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rich farming country. It will be noticed that the route, which is traced on a map presented on page 3, follows a very direct course, and this gives the company a material advantage over competing lines which deviate considerably for the purpose of reaching smaller points.

of its operation may be gathered from consideration of value, character and volume of the industries located in cities and towns which this line reaches. First of all Grand Rapids, the second city in Michigan in populati[illegible] and the largest furniture manufacturing city in the worl[illegible]

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GRAND RAPIDS, GRAND HAVEN & MUSKEGON RAILWAY

One of the most interesting examples of electric interurban railway construction in the United States is presented in the Grand Rapids, Grand Haven & Muskegon Railway system, which has lately been opened for passenger and freight business. This line connects the two most important ports on the east coast of Lake Michigan with Grand Rapids, which is the second largest city of Michigan and a very important manufacturing center. The principal offices of the company are at Grand Rapids, and the railway may be considered one of that city's enterprises, as it is identified very closely with its industries.

The road extends from Grand Rapids in a northwesterly direction to Muskegon, with a branch leading to Spring Lake and Grand Haven from Grand Haven Junction, which is a point on the main line near Fruitport, passing in its course through a number of small towns and villages and a rich farming country. It will be noticed that the route, which is traced on a map presented on page 3, follows a very direct course, and this gives the company a material advantage over competing lines which deviate considerably for the purpose of reaching smaller points.

The road was designed primarily to be operated along the same general lines as a steam railroad, and to engage in general passenger and freight business. It is an innovation in electric railroading in many respects, and the selection of this territory proved exceptionally favorable for carrying out the idea of the builders. It presents an opportunity to operate an electric railway as a factor in a general system of transportation in conjunction with steam and lake traffic under favorable conditions, at the same time competing with steam lines for the business between Grand Rapids, Muskegon, Grand Haven and other important points along the line. The company has already developed a large passenger business, and it is now handling considerable freight, although its terminal facilities have not yet been entirely completed.

An idea of the possibilities of this system and the scope of its operation may be gathered from consideration of the value, character and volume of the industries located in the cities and towns which this line reaches. First of all is Grand Rapids, the second city in Michigan in population and the largest furniture manufacturing city in the world.

ENGINE ROOM IN POWER HOUSE AT FRUITPORT

It also produces more plaster paris than any other city or section of the United States, and the milling and railroad interests are extensive. The city has the additional advantage of being the wholesale distributing center for the northern and western portions of the lower peninsula of Michigan. Next in importance is Muskegon, on Muskegon Lake, one mile from Lake Michigan, which, with Muskegon Heights, comprises a population of upwards of 26,000.

EXTERIOR OF POWER STATION AT FRUITPORT

This section was formerly prominent for its great lumber cut, and while there are still a number of mills cutting lumber, the relative importance of the industry has lessened with the disappearence of the timber, and the industries of the place have been changed so that they are now quite diversified, and include rolling mills, tin plate mills, sulphite and paper mills, knitting factories, furniture and machine shops, which is really a favorable transformation for railroading. Grand Haven, which has 5000 inhabitants, has not made as good progress as Muskegon in rearranging its industries since the disappearance of the timber from the surrounding country, but it has done considerable toward recovery from the depression that followed the completion of its cut. Several large factories have recently been built, and others are contemplated, as the city offers many inducements to manufacturers. Ferrysburg, across the river

WALKER SUB-STATION, SHOWING THIRD RAIL CONSTRUCTION

from Grand Haven, contains a shipyard capable of building the heaviest dredges used by the government on the lakes, and this adds to the general volume of freight for this section.

In the matter of passenger service the road is equally fortunate, as it passes through many points where attractions may be offered that will stimulate patronage, especially during the summer months. Across Spring Lake outlet from Ferrysburg, for instance, is the village of Spring

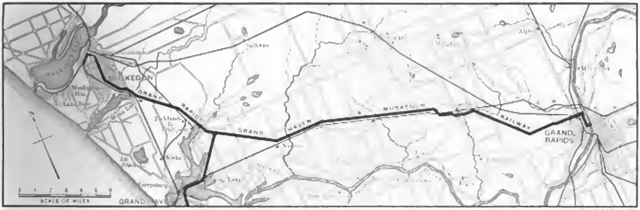
BOILER ROOM IN POWER STATION AT FRUITPORT

Lake, beautifully located on Spring Lake, and containing several summer hotels, making it quite popular as a summer resort. The shores of Spring Lake are well built up with summer cottages owned by Grand Rapids, Chicago,

COOPERSVILLE SUB-STATION, SHOWING OVERHEAD CONSTRUCTION

Milwaukee and Louisville people, and there are several good summer resort hotels at well selected points. The lake is probably the most beautiful sheet of water and presents the finest natural scenery in Michigan. The railroad company operates boats in conjunction with its cars, both for giving access to the several landings along the lake and

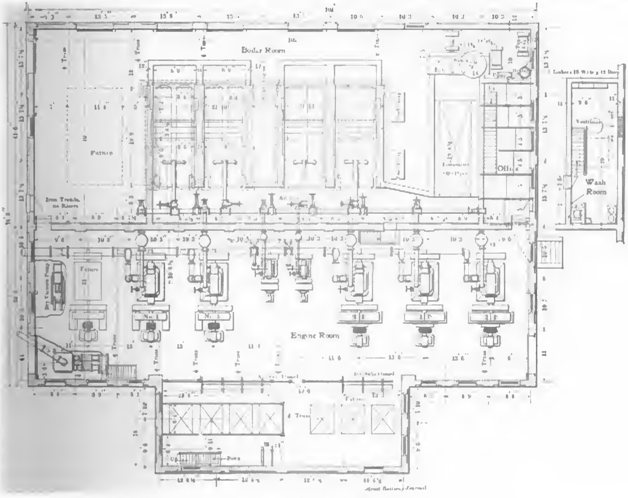
to afford a cool evening boat ride as a part of an excursion trip from Grand Rapids. Spring Lake extends from the village of Spring Lake in a northwesterly direction with jutting arms a distance of seven miles in its longest axis to the main line of the road at Fruitport. At this point the power house and car shop and car storage buildings are located, and from here direct current is transmitted northwest to Muskegon and southwest to Grand Haven and east to Coopersville. Sub-stations, illustrated on page 2, for the distribution of direct surrent are located at Coopersville and in the township of Walker.



MAP SHOWING ROUTE OF GRAND RAPIDS, GRAND HAVEN & MUSKEGON RAILWAY

The construction features of the system are worthy of special attention. The road is a single track line with frequent turnouts, and follows the shortest route rather than the highway in traversing the country. This enables high speed to be made, although stops are frequent, as it tends to localize stopping places. In the small towns combination freight and passenger stations have been constructed. Those at Walker and Coopersville are combined with the sub-stations, containing the rotary converters and other transforming equipment required for the distribution system.

The main line of the railway is 35 miles in length, and the branch to Grand Haven is seven miles long. The distance



PLAN OF POWER STATION

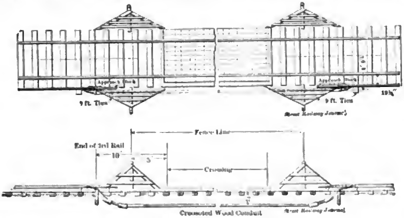
from Grand Rapids to Muskegon is one mile less than the shortest steam road between those points, but the distance to Grand Haven is slightly greater than the steam road. However, the cars leave the center of the city of Grand Rapids, and the actual running time of the electric road is not far from that required to go by steam trains, while the greater prominence of the terminal cities makes it possible to operate a much more frequent service for Grand Haven than would be possible had an effort been made to make the Grand Rapids-Grand Haven route shorter. The line from Muskegon to Grand Haven has been found to be quite popular with the traveling public.

The road is constructed with standard steam railroad ties and 70-lb. T rail, double bonded at the ends for the return circuit.

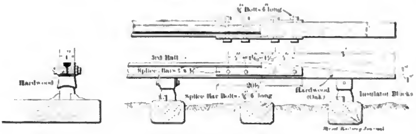
An interesting feature of the equipment is the fact that both overhead and third-rail construction are employed. The road controls its own right of way for the greater part of the distance between the several cities and towns along the line, but in passing through these towns and in entering the cities it uses the lines of the local system. For this reason it has been found necessary to have motor cars equipped with an overhead trolley arm as well as a contact-shoe. The third-rail system is employed on all portions of the line where it is practicable. In the towns and villages, of course, it is not practicable, as there is no difference in the grade at the crossings, and on these portions of the line an overhead trolley is used. Nearly all of the right of way outside the villages and towns is enclosed by wire fences, except at the crossings, which are all provided with cattle guards. The third rail is open at crossings, of course, and at such points the ends of the sections of third rail are connected by large copper conductors, well insulated and embedded in pitch, which is poured into an underground conduit. Details of the construction and insulation of the third rail are illustrated on this page. The rail is of 65-lb. section and standard composition. It is supported upon reconstructed granite insulators, and has been exceptionally free from trouble through the bad washouts and trying months of the spring.

There are no railroad grade crossings on the line, all steam roads being crossed on steel bridges.

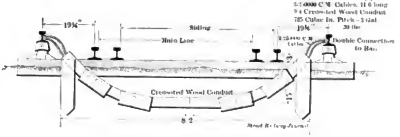
The power house is of brick, iron and tile construction throughout. The carefully laid red brick walls, with red



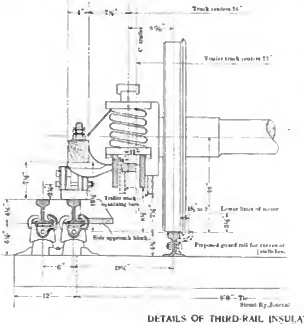
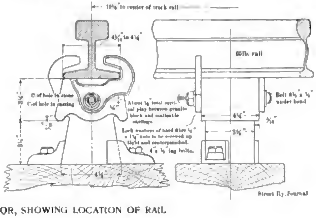
HIGHWAY CROSSING



DETAILS OF APPROACH BLOCK



CROSS CONNECTION FOR THIRD RAIL

DETAILS OF THIRD-RAIL INSULATOR, SHOWING LOCATION OF RAIL

tile roof, present a very neat appearance. Along the boiler room side of the building is the coal bunker, capable of holding 500 tons of coal, which is reached by an elevated track connecting with the steam railroad. This provides for the storage of coal in front of the boilers and protects it from the weather. Coal is handled from the cars into the bunker by gravity and shoveled directly from the bunker into the mechanical stokers, the plant not being large enough to require coal-handling machinery.

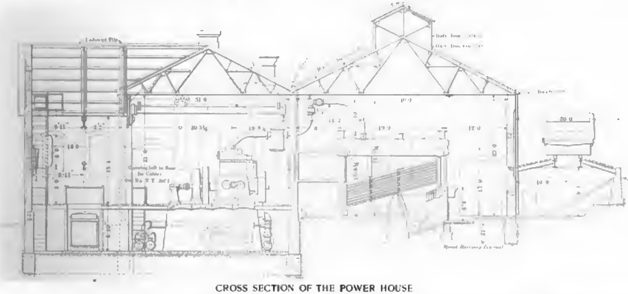
The power plant contains five 250-kw Westinghouse generators, three of which are double-current machines and two regular alternators. They are engine-type machines, and are directly connected to Westinghouse vertical compound engines, having steam cylinders 18 ins. and 30 ins. in diameter, by 16-in. stroke of piston. They are arranged for operation in multiple.

Excitation current is furnished by two 37½-kw Westinghouse engine-type exciter generators, directly connected to Westinghouse vertical compound engines.

Steam is supplied by four 250-hp Babcock & Wilcox boilers equipped with Roney mechanical stokers, and condensation is effected by means of a Worthington elevated jet condenser. Economizer and mechanical draft plant supplies draft and heated feed water for the boilers, and the waste exhaust from auxiliary engines is saved. The economizer is of the circulating type and heats the water nearly to boiler temperature. The feed pumps are of the Henry R. Worthington outside end-packed pressure pattern, and are in duplicate. The piping of the station is on the feeder and main principal, and any section of pipe can be easily isolated and repaired. All valves are of outside screw and yoke pattern, even to the smallest drip valves, and are furnished by the Chapman Valve Manufacturing Company.

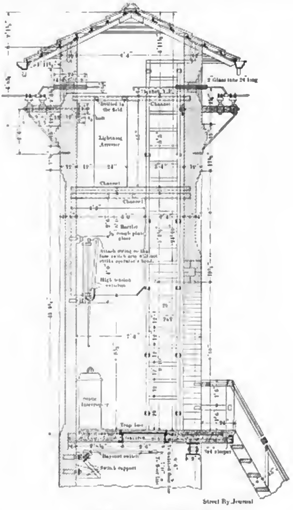
The switchboard is of the regular Westinghouse type, and, as at present installed, appears as two boards, but when the power house is extended the board will be continuous and fill the gap in the alcove shown in the plan of the power station, which will be found on page 3.

Direct current is generated at a pressure of 650 volts, and is fed directly to the third rail through two panels, one connecting with the rail toward Muskegon and the other reaching toward Grand Rapids, the arrangement of feeders being such that if the circuit in one direction is in trouble it may be cut out without interfering with the other section.



CROSS SECTION OF THE POWER HOUSE

Alternating current is taken from the bus bars through a bank of raising transformers. One spare transformer, which was installed for emergencies, has never been used except to test it for assurance that it is ready for service. The transformers raise the voltage from 370 volts to 16,500



TOWER OF A SUB-STATION

volts, and transmit it directly to the sub-stations at Coopersville and Walker, where it is reduced and converted for feeding to the low tension circuits. The standard high tension construction, and also the trolley construction in the public streets in Coopersville and the terminal towns, are

shown in the detail on this page. The standard construction of a farm or highway crossing with third rail is shown on page 4. Connections at each highway crossing are made with two 500,000-cm copper cables. The general arrangement of the circuits is illustrated on this page, together with the schedule and low-tension drop in voltage.

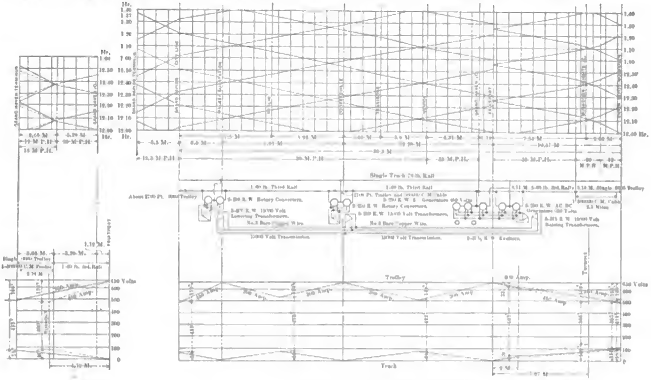
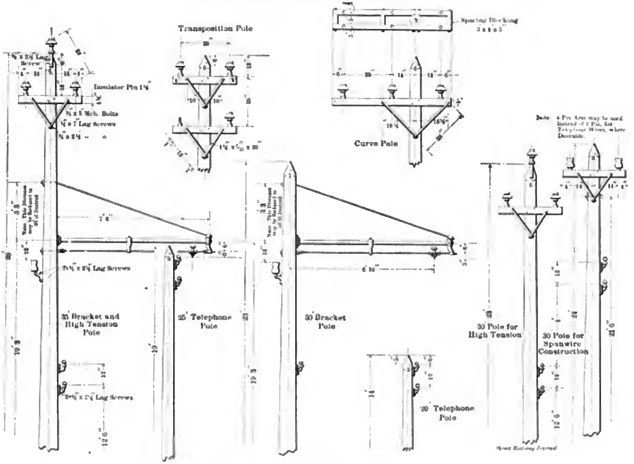


Diagram of Fall of Potential in Feeders and Track.

TRAIN SHEET AND ARRANGEMENT OF CIRCUITS



DETAILS OF OVERHEAD CONSTRUCTION

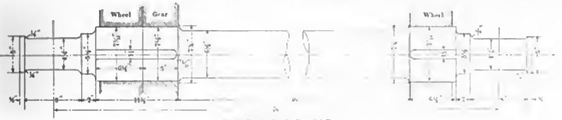
Interior views are shown of the engine and boiler rooms on pages 1 and 2, and an exterior view of the power house

on page 2. The sub-stations are of brick, iron and tile throughout, and have been carefully arranged. General views of the exterior of the Walker and Coopersville sub-

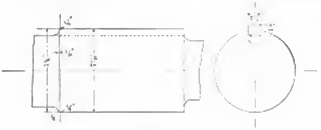
TYPICAL PASSENGER COACH

stations, as they appeared during construction, are shown. The surroundings have been somewhat improved since these pictures were taken.

The details of the arrangement of the apparatus in the

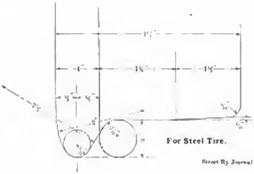


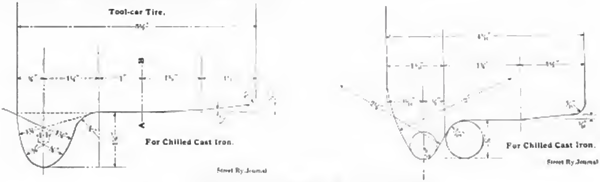
PASSENGER CAR AXLE



WHEEL FIT

towers of the sub-stations are shown, page 5. Each sub-station is provided with sufficient space to accommodate three rotaries, two being placed in the initial installation.



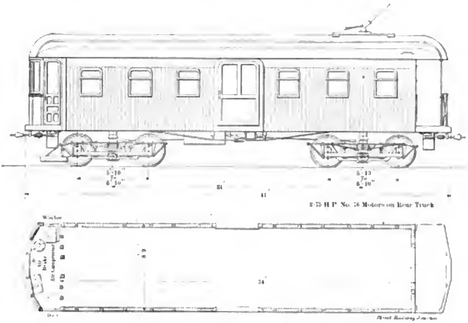


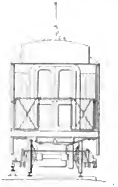
DETAILS OF THREE TIRES FOR TRUCK WHEELS

Combined freight and passenger stations have been provided in all towns and villages except at the terminals, where the patronage has been considered sufficient to warrant the separation of the freight business from the passenger business.

The rolling stock consists of fifteen passenger coaches, three express cars and one work car. The passenger cars are each 52 ft. in length and 8 ft. 9 ins. in width, and the bodies were built by the Barney & Smith Car Company, of Dayton. They are finished in white oak, medium grade, with plate glass windows. Each car contains twenty-eight double seats. The seats are upholstered in red plush and are arranged to be non-reversible. Each car is equipped with a telephone and extension cord which may be plugged into cast-iron telephone jacks at all sidings and important points, while in event of trouble on the line connections can be made promptly to the telephone circuit by means of pole and cords provided. Space is allowed for the accommodation of a considerable amount of hand baggage without crowding. The cars are divided so that the forward twelve seats may be used as a smoking compartment. The smoking compartment is ventilated forward through a transom by a peculiar action of the curved vestibule, inducing a flow of air from the main body of the car through the smoking room and vestibule to the external air. The cars are warmed by electric heaters. The trucks were furnished by the Baldwin Locomotive Works

and represent a high standard of practice for electric railway service. The motor truck wheels are steel tires, while the leading truck wheels are spoked chilled iron wheels.





EXPRESS CAR

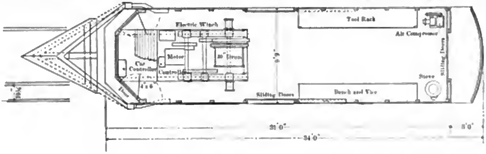
The motor equipment of each passenger car consists of two 50-C Westinghouse, 150 hp capacity. These motors are carried by Gibbs suspension and both motors are applied to the rear truck.

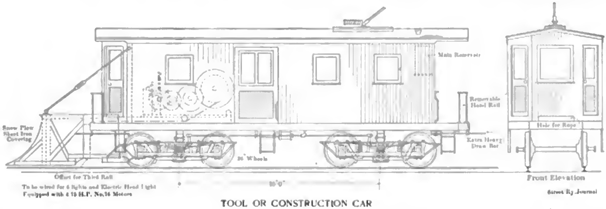
The express cars are 45 ft. in length and 8 ft. 9 ins. in width, and are each equipped with two 75-hp motors. They have electric heaters. The trucks are of the Barney & Smith class F. The cars are provided with large side doors and large double doors in the rear for loading scenery.

The tool, or construction, car is 30 ft. in length and is provided with a detachable snowplow and with a winding drum and motor for use in pile-driving, pulling cars on the track or for other work where great pulling capacity is required. This car is equipped with four Westinghouse No. 76 motors, and is capable of a sustained speed of upward of a mile a minute on the line.

The standard sections of the tire for the three classes of equipment are illustrated on page 7, and details of the express and construction cars are shown on this page. All cars are equipped with Westinghouse air brakes.

A car shop and storage building is situated at Fruitport near the power house, and an exterior view and cross section are given on page 9. Half of the building is devoted to the shop and the balance to storage. A fire wall 18 ins. thick, with heavy pilaster, rises through the building to separate the storage from the shop space. The trusses are of iron and the roof is of 3-in. planking tarred and covered with gravel. The tracks in the shop portion are served by two traveling cranes, each crane having two trolley hoists so arranged that one crane can lift a car body and thus permit the removal of the motor from the truck or the substitution of another truck when desired.





TOOL OR CONSTRUCTION CAR

The shop is equipped with a long skeleton pit, but no heavy lifting is done, the pit being used for purposes of inspection and cleaning only. The shop equipment consists of a 60-in. universal radial drill, 24-in. drill press, a sensitive drill, a lathe with 12-in. swing and 6 ft. between centers and a larger double-spindle lathe 12 ft. between

CAR HOUSE AND SHOPS AT FRUITPORT

centers of a suitable size to handle any machinery on the road. In addition to this, there is a Niles wheel press and an 18-in. shaper.

The blacksmith shop is in the end of the main repair shop, partly separated by a curtain to prevent drifting of sulphurous gases which may escape from the forge. The armature-winding room, stock room, with bins for the supply of salt and sand, are provided, and are served by an overhead traveler and trolley in the front of the building, and in the corner of the shop is the office of the master mechanic. Above this are the men's quarters, provided with lavatory, toilet facilities and with expanded metal lockers.

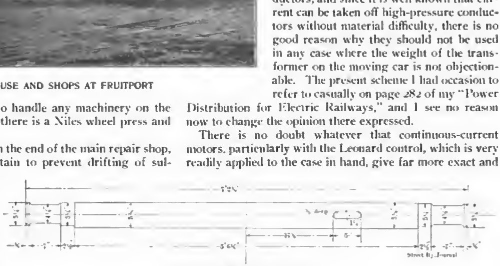
The road began carrying passengers in February, and has been doing a good business from the start. Freight

Methods for Heavy Electric Traction

BY LOUIS BELL, PH. D.

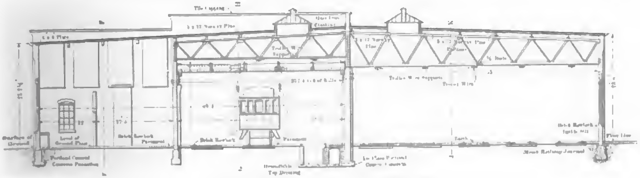
I have read with great interest Huber's proposition for the conversion of trunk lines to electric traction. It is not altogether new, for the essential part of the project was set forth by Leonard in 1894, nor can it be called by any stretch of the imagination simple; but it has been carefully worked out as is Herr Huber's wont, and must receive serious consideration. It differs from Leonard's scheme mainly in the use of a high-voltage working conductor, which has heretofore been many times suggested, and which is obviously necessary to economy. The burden of fixed charges must always be great in any system that uses low-voltage working conductors, and since it is well known that current can be taken off high-pressure conductors without material difficulty, there is no good reason why they should not be used in any case where the weight of the transformer on the moving car is not objectionable. The present scheme I had occasion to refer to casually on page 282 of my "Power Distribution for Electric Railways," and I see no reason now to change the opinion there expressed.

There is no doubt whatever that continuous-current motors, particularly with the Leonard control, which is very readily applied to the case in hand, give far more exact and



STANDARD EXPRESS CAR AXLE

efficient speed regulation than has yet been attained with any form of alternating motor. It may turn out that the Ganz concatenated system will secure ample regulation at a good efficiency, but it certainly cannot do any better than an ordinary series parallel control, which, however, is good enough.



CROSS SECTION OF SHOP AND CAR SHED

service has only been in operation a few weeks, and is still considerably hampered by lack of terminal facilities in Grand Rapids and Muskegon, where unavoidable delays have been encountered.

The road was designed and constructed throughout by Westinghouse, Church, Kerr & Co., who located the line and conducted the negotiations for the right of-way.

The real point of Huber's work lies in the use of a single-phase current and a single-working conductor to avoid the complication of polyphase-working conductor. The price paid for this is (1) inability to use alternating motors, if one wanted them, and (2) the complication and loss of efficiency entailed by a motor generator or rotary converter on the car. That this is a complication there is no doubt,

and it must add materially to the weight and cost and also lower the efficiency by 10 per cent or so. Huber's figures show small apparent extra weight, but, since polyphase motors can be made as light as or lighter than continuous-current motors of similar output and efficiency, it needs no argument to show that the total weight of the motor generator or rotary converter is added dead weight whatever it may be. Of course, if weight is needed to give adhesion, well and good, but a motor generator is an expensive form of ballast.

I hope that Herr Huber will have an opportunity ere long to put his locomotive into regular service and give the scheme a trial. It certainly will give excellent speed regulation and a very simple system of working conductors, but whether this gain is worth the price of admission is, in my opinion, rather open to question. Granted that the speed control is necessary and cannot be obtained with polyphase motors, it still seems to me doubtful whether the single-phase system is advisable for a general system.

Personally, I would rather pin my faith to polyphase-working conductors, for I think the gain in capacity and efficiency of the rotary converters if it were considered desirable to hire continuous current for freight locomotives, the lessened loss in the conductors, and the ability to use polyphase motors for certain classes of service, rather outweigh the objections to a polyphase trolley system. In equipping a road with polyphase-working conductors one would gain the power to use induction motors while improving the conditions for operating continuous current ones. The Zossen experiments seem conclusive on the practicability of polyphase-trolley lines, and experience should secure entire reliability in such service.

However, I trust the Huber plan will be given a good trial, for it is singularly easy to apply, and anything that will improve the chances of electric traction for a fair test on large railway work is worthy of encouragement. At present there is an enormous corporate inertia to overcome, and the art is making painfully slow headway.

Electric Interurban Lines in Northern Illinois

While a map of Northern Illinois showing the electric interurban lines does not by any means present such a network as similar maps of Ohio or Southeastern Michigan, it discloses the beginning of a healthy growth. Perhaps one reason the accompanying map of Northern Illinois does not show a greater network as compared with some maps that have been published of other States is that it shows only the roads actually in operation or under construction, or so far along in organization as to be practically in the beginning of the construction period and hence almost assured. A map of all the proposed electric interurban lines in Indiana, Illinois and Iowa would be almost as complex as a map of the present steam roads in these States, because they have been a most active field of labor for the electric interurban promoter for the last twelve months.

Looking at the accompanying map of Northern Illinois we see that the only region which has anything near approaching a network of electric interurban lines is that just west of Chicago. Strange as it may seem, the building of interurban and suburban lines has never progressed as rapidly in the neighborhood of Chicago as around several much smaller Ohio cities. A number of local conditions have been responsible for this. The companies already in the field in the city of Chicago have not seen fit to extend their operations far outside of the city limits. The steam road suburban service in various directions from Chicago has also been excellent and has tended to discourage electric competition until very recently. Further than this, it is necessary to go about 40 miles in any direction from Chicago before reaching any manufacturing towns large enough to tempt capital into electric interurban railways. Franchises in the neighborhood of such a large city were naturally more difficult to obtain upon reasonable terms than around smaller cities, and purchased rights of way were expensive. Steam roads doing a suburban business, and hence opposing any new lines, and village councils putting excessive values on franchises, have been discouraging elements. Recently, however, the lack of interurban lines near Chicago is being rapidly filled in.

The most notable of these roads, as well as the latest to be constructed, is the Aurora, Elgin & Chicago Railway (No. 10 on the map), a complete map of which was given in the STREET RAILWAY JOURNAL of Feb. 1, 1902. This road, which is almost ready to begin operation, will probably be the finest example of high-speed electric interurban service to be found in the world. Something like 40 miles an hour average schedule speed, including stops, is expected, and the running time from Aurora, 39 miles, to Chicago, using the Metropolitan West Side Elevated Railway for entrance to the city, will probably be one hour and fifteen minutes. This is about the time in which the Chicago, Burlington & Quincy Railroad's fastest trains deliver passengers at the Union Depot, Chicago, which is some distance from the heart of the city. From Wheaton to Chicago this line is double-tracked and will serve a good line of suburban towns, paralleling two steam roads. The Pomeroy-Mandlebaum Syndicate at Cleveland is behind this enterprise, Will Christy, of Akron, Ohio, being general manager, and, with his assistant, W. E. Davis, responsible for the many excellent engineering features incorporated in this road. The population of cities and towns which will be served by this system, according to the census of 1900 (from which all the population figures given in this article are obtained), is as follows: Chicago, 1,698,575; Oak Park, 7500; River Forest, 1539; Maywood, 4532; Melrose Park, 2592; Elmhurst, 1728; Lombard, 590; Glenellyn, 793; Wheaton, 2345. The population of the Fox River towns forming the western terminals of this road is given in the following paragraph under the Elgin, Aurora & Southern Traction Company, which will operate its system in conjunction with the Aurora, Elgin & Chicago Railway, as it is controlled by the same capitalists. The same power house will also supply both systems.

The Elgin, Aurora & Southern Traction Company (11) connects a number of good manufacturing towns located up and down the Fox River Valley for a distance of about 40 miles. The present system is a consolidation of several roads. This populous Fox River Valley was among the first in Illinois to enjoy the benefits of an electric interurban system. Beginning at the northern end of the line there is Carpentersville, with a population of 1002; Dundee, 2765; Elgin, 22,433; St. Charles, 2675; Geneva, 2446; Batavia, 3871; Aurora, 24,147; Oswego, 618; Yorkville, 840, and Bristol, 427. These lines up and down the Fox River have done a good business for a number of years. With such a large population scattered along the river within a comparatively few miles it was natural that the first extensive interurban building in Illinois should be done in this locality.

The first interurbans of any kind in the State were, of course, short. That from Champaign to Urbana (1) was of this class. This could hardly be called a true interurban railway, however, because the cities of Champaign and Urbana were joined so as to make practically one town. This line is operated by the Urbana & Champaign Railway, Gas & Electric Company, of which W. B. McKinley, of

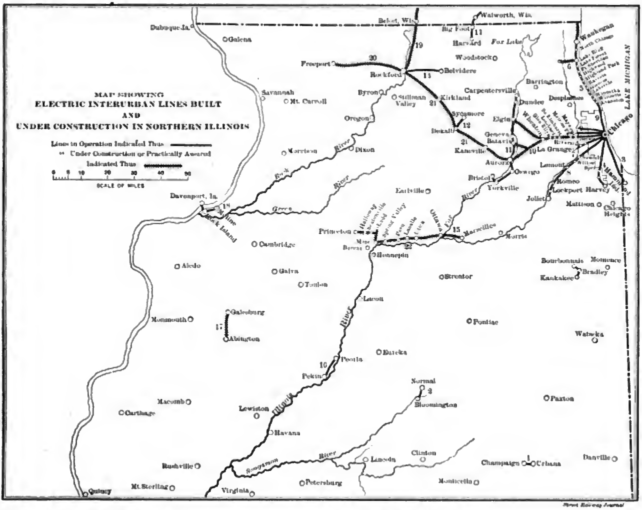
Champaign, is the head. He is also interested in many other street and interurban railway projects. Operation is in charge of H. J. Pepper. The population of Champaign in 1900 was 9098, that of Urbana 5728.

Of a similar nature was the early extension of the Bloomington city lines built between Bloomington and Normal. This company is now known as the Bloomington & Normal Street Railway Company (2), of which John Eddy is the manager. The population of Bloomington is 23,286 and that of Normal 3795. The State Normal Institute at Normal helps to swell the traffic between the two towns.

Rock Island and Moline have been a part of the Tri-City Railway Company system (18) for many years. This company operates in and between Davenport, Ia., Rock Island and Moline, Ill.

These short lines just enumerated were, however, so short that it may be truly said that the first real extensive interurban building in the State was that between Aurora and Elgin, in the Fox River Valley, before mentioned.

After the Fox River roads, the next long line to begin operation was the Chicago & Milwaukee Electric Railway (5), which occupies a magnificent territory along the shore of Lake Michigan north of Chicago between Evanston, the first suburb beyond the Chicago city limits, and Waukegan. The name, Chicago & Milwaukee Electric Railway Company, so far represents only the ambitions of the promoters. An electric line has been built from Milwaukee south as far as Racine, Wis., but the gap between Waukegan, Ill., and Racine, Wis., has not as yet been filled. From Racine to Waukegan progress has been blocked for several years by franchise difficulties in Kenosha, but as this matter has recently been straightened out there is prospect that the connecting link between Waukegan and Racine will soon be built by a company of which B. J. Arnold, of Chicago, is



1. Urbana & Champaign Railway, Gas & Electric Company.
2. Bloomington & Normal Street Railway Company.
3. South Chicago City Railway Company.
4. Chicago Electric Traction Company.
5. Chicago & Milwaukee Electric Railway Company.
6. Chicago & Milwaukee Electric Railroad Company.
7. Suburban Railroad Company.
8. Chicago & Joliet Electric Railway Company.
9. Chicago Consolidated Traction Company.
10. Aurora, Elgin & Chicago Railway Company.
11. Elgin, Aurora & Southern Traction Company.
12. DeKalb-Sycamore Electric Company.
13. Rockford & Belvidere Electric Railway Company.
14. Chicago, Harvard & Geneva Lake Railway Company.
15. Illinois Valley Railroad Company.
16. Peoria & Pekin Terminal Railway Company.
17. People's Traction Company.
18. Tri-City Railway Company.
19. Rockford, Beloit & Janesville Railroad Company.
20. Rockford & Freeport Electric Railway Company.
21. Aurora, DeKalb & Rockford Traction Company.
22. Illinois Valley Traction Company.

DEVELOPMENT OF ELECTRIC INTERURBAN RAILWAY SERVICE IN NORTHERN ILLINOIS

president. One can then ride by electric car the 86 miles from Chicago to Milwaukee. The present lines, however, are not built for very high speed, but are suited only to local travel and passengers from suburban towns to whom time is no great object. The road fills an important place as to local transportation, however, as will be explained later. It is not unlikely that some day a high-speed frequent-service electric railway between Chicago and Milwaukee and the principal intermediate cities will be constructed. The only thing that could prevent such a line being built would

be the adoption of electric traction by the two steam roads which now run several fast trains daily between the two cities, but which would surely have to yield the cream of traffic to an electric road offering fast and more frequent train service and freedom from soot and cinders.

One notable thing about the present electric road from Evanston along the north shore to Waukegan is that while it is not a high-speed line (the maximum speed of cars being 24 miles per hour on the level) it captures not only a large part of the local business between suburbs, but also many of those passengers who are bound for Chicago and who take the electric road to Evanston or some other convenient steam-road station at which the train service is more frequent than at other stations along the line of the steam road. The trouble of changing cars at Evanston is met by the cheaper fare on the electric road and the fact that the cars stop for passengers at any street crossing, while the steam road depot may be a mile or more distant. From Lake Bluff, on this road, a branch road (6) 6 miles long to Libertyville is being built this summer to get the lake-resort traffic from the inland lakes from that region.

The populations of the towns traversed by the Chicago & Milwaukee Electric Railway are as follows: Evanston, 19,259; Winnetka, 1833; Wilmette, 2300; Glencoe, 1020; Ravinia, 75; Highland Park, 2806; Highwood, 750; Fort Sheridan, 1575; Lake Foust, 2215; Lake Bluff, 490; North Chicago, 1150; Waukegan, 9426.

The larger towns in Northern Illinois are found scattered almose entirely along the valleys of certain larger rivers. These towns were originally started because of small water powers to be found along these rivers at the points where the various towns were located. It is therefore natural that some of the important interurbans should follow these river valleys, not for civil engineering reasons, but because the population of the towns justify the location of the interurbans. Next after the Fox River Valley in importance as an interurban center the present prospects are that the Rock and Illinois Rivers will come next. Rockford is destined to be the most important interurban town in the northern central part of Illinois.

The Rockford & Belvidere Railway (13) has been built by the same interests that control the Rockford Railway Light & Power Company, of which R. N. Baylies, of Chicago, is president, and T. M. Ellis, of Rockford, is manager. The same people have surveyed a line from Rockford to Freeport (20). The population of Rockford, which is called the "Lowell of the West" on account of its extensive factories, is 31,051, and that of Belvidere is 6937.

Running north from Rockford is the Rockford, Beloit & Janesville Railway (19) soon to be in operation from Beloit, Wis., to Rockford, Ill. Its northern terminus is to be Janesville, Wis. This is a road in which the Pomeroy-Mandelbaum Syndicate, of Cleveland, is interested, and of which Will Christy is president. The construction is under the immediate charge of G. W. Knox, consulting engineer, of Chicago.

It is likely that before many years there will be a continuous chain of electric interurban lines from Chicago to Joliet, and thence through Morris, Marseilles, Ottawa, La-Salle, Peru to Princeton, thus joining Chicago with an important set of towns along the Illinois River.

From Chicago to Joliet, the Joliet Electric Railway (8) has now been giving service for over a year. This road in the main follows the highway, and the route of the famous Chicago drainage canal. Unfortunately this company's terminal connections in Chicago at present are such that a large part of the time between Chicago and Joliet is taken up within the city limits of Chicago. This company is controlled by the American Railways Company, of Philadelphia, F. E. Fisher, of Joliet, being general manager. The population of Joliet is 29,353. The population of the intermediate towns is as follows: Lockport, 2659; Romeo, 113; Lemont 2449; Willow Springs, 163; Summit, 547.

The Illinois Valley Railroad Company (15) of Ottawa is building a line 6 miles between Ottawa (population 10,588) and Marseilles (population 2559). Weston Bros., of Chicago, are engineering and supervising this work. The officers of this company are men interested in the Ottawa Railway, Light & Power Company, of which L. W. Hess is general manager.

Further down the Illinois Valley is the Peoria & Pekin Terminal Railway (16), giving an electric service between Peoria and Pekin, and also operating a number of miles of steam road around these two cities. L. E. Myers, of Chicago, is the general manager of the road. The population of Peoria is 56,100; that of Pekin 8420.

The People's Traction Company (17), of Galesburg, is considering a line from Galesburg south to Abington. Galesburg has a population of 18,607, and Abington 2022. The Chicago, Harvard & Lake Geneva Lake Railway (14) has a line 10½ miles long from Harvard, Ill., north to Lake Geneva, Wis. Further details of this road were given in the STREET RAILWAY JOURNAL of June 7, 1902. H. T. Windsor, of Walworth, Wis., is general manager. Its chief business is that of taking passengers from Harvard on the Chicago & Northwestern road to the southern shore of Lake Geneva, in Wisconsin, and a freight business in which it exchanges cars with steam roads.

The Chicago Consolidated Traction Company (9) reaches as far north as Evanston, and as far west as Melrose Park, with its regular street railway service, which covers all the outlying parts of the north and west sides of the city.

On the south side of Chicago, the South Chicago City Railway (3) operates the Hammond, Whiting & East Chicago Railway, which reaches down just across the State line to Hammond, Ind.

The Chicago Electric Traction Company (4) is another line operating in the city of Chicago which reaches Morgan Park (population 2329), Blue Island (6114) and Harvey (5395), to the southwest.

The Suburban Railroad Company (7), in connection with the West Side Elevated roads of Chicago, gives electric service to LaGrange and intermediate points along the Chicago, Burlington & Quincy Railroad. This, together with the competition of elevated and surface lines, has caused the taking off of quite a number of the Chicago, Bulington & Quincy suburban trains.

A short line is under construction, 6 miles, from DeKalb to Sycamore. This is the DeKalb, Sycamore Electric Company (12), of which W. B. Ullmann is president; L. Chaldecott, secretary and treasurer; John W. Glidden, superintendent. The population of DeKalb is 5904, and that of Sycamore 3653.

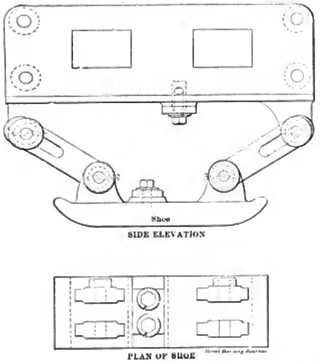
The Aurora, DeKalb & Rockford Traction Company (21) is preparing to build from Aurora, northwest through Kaneville, DeKalb and Kirkland to Rockford. That between Aurora and DeKalb will be built first. W. D. Ball, of Chicago, is consulting engineer. The company is backed by a syndicate composed of V. A. Watkins and William George, of Aurora; R. S. Vivian and G. B Shaw, of the American Trust & Savings Bank, of Chicago.

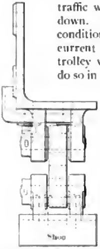
An important road joining the Illinois valley chain of cities is the Illinois Valley Traction Company (22), which is building from Ottawa (population 10,588) west, through Utica (1150), LaSalle (10,446), Peru (6863), Spring Valley (6214), Ladd (1324), Seatonville (909), and Holloway (207), to Princeton (4023). This is one of the Portland Syndicate roads, of which W. B. McKinley, of Champaign, Ill., is president.

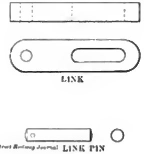
Collectors for Heavy Traction

BY GEORGE T. HANCHETT

When an electric car or system of cars requires more than 200 amps. for its propulsion, heating and lighting, the problem of collecting this current by means of a movable contact begins to become interesting, and the



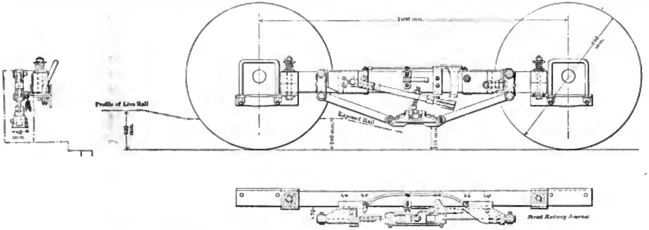




DETAILS OF CONSTRUCTION OF BOSTON ELEVATED CONTACT SHOE

necessity for its careful consideration increases with the amount of current to be collected.

The heaviest instances of electric traction usually comprise situations which have been previously handled by means of steam, but where the latter form of motive power



DETAILS OF CONTACT SHOE ON BERLIN ELEVATED AND UNDERGROUND ELECTRIC RAILWAY

has become inadequate, either by reason of its inability to accelerate the trains sufficiently to make a rapid schedule possible in congested sections or because the noise, smoke and steam have become objectionable to the tenants of the rapidly increasing number of buildings along the line of travel, or positively unendurable to employees and passengers on account of tunnels which cannot be adequately ventilated for numerous reasons. The entrance of great railway systems into the large cities present most formidable problems which usually involve all of these objections with reference to steam. The increasing traffic has aggravated the conditions to such an extent as to compel the adoption of electricity in several notable cases, and experience gained in these cases will serve as a precedent for future enterprises. It is, therefore, not inappropriate to consider the problem of collecting current and discussing its possibilities, for it constitutes one of the problems, and perhaps not the least, which will require satisfactory solution before electric traction can be adopted for any of these purposes.

The overhead trolley is of course inadequate. Its limit has been reached in suburban and interurban traffic with heavy equipments of from 300 hp down. Even with two trolleys under favorable conditions it becomes difficult to collect all of the current that can be supplied through a 0000 trolley wire, and it is practically impossible to do so in case of a sleet storm. Beyond this point the heavy overhead contacts and correspondingly heavy overhead structure become items of such great expense that recourse must be had to the third rail.

The third rail in the open air on an elevated structure is a proved success, and no difficulty is found in collecting current from 300 amps. to 500 amps. with a shoe weighing from 15 lbs. to 25 lbs., and dependent for its contact upon its weight. These shoes are usually suspended by two links and carry a flexible connection bolted fast to the shoe itself. Such shoes usually operate on third rails having a clearance above the tread rail of from 1½ ins. to

3 ins. A shoe of this class is illustrated herewith, a side elevation plan, end elevation and link and linkpin details being included.

An interesting modification of the shoe commonly used on German railways is illustrated on the preceding page. In this case the shoe is supported in toggle arms, which are somewhat longer than those in common use in the United States, and the shoe itself is provided with a switch which drops to an open position whenever for any reason the shoe drops below any predetermined level. This is a valuable feature, for it can be so set as to make the shoe itself dead whenever it leaves the live rail, even if other shoes on the same car are in contact. In work of this kind the shoe, having cleared the live rail and traveling by simply hanging from the truck, is likely to encounter grounded metal or to be touched by an individual, and by this simple device serious arcs or shocks are avoided. It is a device which might be profitably adopted in this country.

It must be appreciated that shoe clearance is a most important matter to consider. It is plain that if the shoe strikes any grounded metal the result is a formidable short circuit, which, besides throwing circuit breakers and possibly setting woodwork on fire, has a very damaging effect if it occurs in full view of a station full of passengers. It must not be forgotten that the public regard electricity as an exceedingly powerful and destructive agency, and that there is still considerable mystery about its manifestations, so far as the majority of people are concerned; they look upon it as being chained and brought into useful service by the strongest means and requiring the utmost ingenuity of man, and under the circumstances it is not to be wondered if pyrotechnic exhibitions of this character are regarded as a frantic attempt of a caged monster to break loose and sweep the locality with devastation. Any such occurrence is therefore not calculated to inspire confidence and increase traffic. The writer may be charged with indulging in a little romance in the foregoing paragraph, but the words are based upon actual experience, under circumstances favorable for learning public opinion of such demonstrations.

In any event short circuits must be avoided, and due regard to shoe clearance must therefore be had. The shoe must evidently clear the tread rail by a reasonable margin. It must also clear interlocking mechanisms, not only in their final but in their intermediate positions. Of course it is easy to comply with these requirements in the case of elevated work or light interurban work by raising the third rail about 3 ins. or 4 ins. above the tread rail, but when a trunk line problem arises an inspection of clearance sheets from the mechanical department will show that the margin is very narrow indeed, and opportunities for raising the third rail are very limited.

The bulky cylinders of large compound freight engines, the projecting doors of steel coal cars, which must, by the way, be considered in an open position, and numerous other things which might be mentioned, make it necessary to keep the height of the third rail down; the clearance underneath the cars is always so limited that it is impossible to have a section of third rail between the tread rails.

With a margin of from 2 ins. to 2½ ins.—and the third-rail engineer must consider himself fortunate if he secures as much as this—it is plain that the shoe cannot be allowed to drop more than 1 in. below the level of the third rail, and this rail must, therefore, be set so that in no place shall it be lower than ⅜ in. from the level its surface was designed to occupy. If this is not heeded the shoe will arc on the low place very formidably if heavy current is carried, and this will result in burning both the rail and the shoe so badly that the conditions will be aggravated when the next shoe traverses the low place. In heavy locomotive work these arcs are very noisy and brilliant, and if they occur in front of a station and, perhaps, set the platform on fire the performance is not reassuring to passengers.

From the foregoing it will be easily seen that in a third-rail installation among other requirements the following are necessary:

The third rail must not be so high that there will be any possibility of the ironwork of the moving trains striking it, and on the other hand it must not be so low that there will be any danger of the shoe on the motor car striking projecting ironwork in the trackway. This height is one of the most difficult problems to be determined and requires special consideration.

Closely related to the height is what is known as the third-rail gage, that is to say, the distance between the centers of the third rail and the nearest tread rail. If very near the tread rail the third rail must be set low in order to clear the cars, and if set too far from the tread rail the overhanging shoe structure extends so far from the track it is likely to strike switch lamps, signals and even the wall of tunnels or the girders of bridges. There is just one spot on the clearance diagram where the center line of the head of the third rail should come, which is locatable, according to the conditions, with as much accuracy and precision as is the center of a circle.

On the elevated roads clear of mud, dirt or dust the third-rail surface can be kept clean, and the collection of sufficient current with a shoe of moderate weight and dimensions is not troublesome, but where large currents are to be collected from third rails placed on the ground on roads traversed by steam trains passing through damp tunnels the problem is by no means as easy. In the case of electric locomotives taking from 1200 amps. to 1500 amps maximum in such locations, the least dirt or rust on the third rail causes terrific arcs at the shoe and corresponding heating; and, if such performances continue across long stretches of track, the shoe may become red hot, although weighing from 50 lbs. to 60 lbs. In damp tunnels this is particularly the case, and it is noticeable that if the rail is left untraversed by the shoe for a single day the first few runs will be marked by excessive arcing, after which, when the surface of the rail has been cleaned by the friction, this trouble will disappear. The deposit from steam locomotives on the third rail, mixed with water, seem to form a peculiarly suitable substance for the promotion of arcs. It covers the third rail with a crust and is a partial conductor, and when vaporized by the intense heat seems to lend itself to the propagation and intensification of the arc that is formed. Clay or earth, on the other hand, such as accumulates on the rail in cuts and places where excavations have been going on, does not act in this way, as its refractory powers seem to be greater, and while it undoubtedly does not improve the contact of the rail and shoes it does not vaporize and lend fuel to the flame; in fact, it is very striking to note how a shoe carrying a heavy current will sputter savagely on traversing a little moist crust of deposited cinders in a tunnel, and, emerging therefrom, will ride over a third rail covered with a mass of earth and produce scarcely a scintillation.

A glance at the accompanying half-tones will show how serious arcs and consequent shoe-heating enter into the problem. The photographs from which the cuts were made represent pieces of slag taken from a shoe carrying from 800 to 1000 amps. and traversing a dirty third rail. These pieces of slag are found either under the surface of the shoe, thereby spoiling its contact with the third rail, or attached to the shoe as trailers, and consist of melted iron particles and impurities found on the third rail. They

usually get white hot, throwing off scintillations like iron at welding heat. If proper attention is not paid to shoe contact and clean surface the third-rail shoe becomes little more than an arc furnace.

The conductivity may of course be somewhat increased by making the shoe of copper or some of its alloys. From what follows, however, it will be seen that copper or brass will not stand the wear, its surface tearing to pieces very rapidly under the heavy friction from the rough surface, and what is still more important it does not grind through the film of rust and dirt and secure complete contact with the rail itself.

In one case with which the writer is familiar this problem has been satisfactorily solved by the use of a heavy brass shoe with a renewable steel face, held thereto by a dove-tailed joint, the conductivity of its contacts being reinforced by a large number of heavy copper rivets. This combination has the wearing qualities of the steel and the conductivity of the copper combined, and it seems to be the best arrangement that has yet been used.

In the case of heavy currents it is necessary to have the shoe bear heavily on the rail so that it will grind itself down to a metal to metal contact in spite of all dirt and obstruction. If the shoe is too light it will ride over the particles of dirt, ironing them down on to the third rail. If the foreign substances are semi-conducting, as in the case of cinders, they will be deflagrated, and if practically insulating and refractory, as in the case of clay, they will either lift the shoe clear of the rail, causing an arc, or increase the resistance in the other parts of the contact, causing those places to overheat. In a case where much current is to be collected pressure on the shoe surface must be increased almost to the point where mechanical pressure becomes a serious source of heat; 125 to 150 lbs. is not too much.

The shoe-holding mechanism must be designed so as to allow the shoe great flexibility of motion, but still the shoe must not be abandoned and given universal motion in every direction. It should move freely up and down in order that it may rise and fall with the irregularities of the surface of the rail. Its downward motion should extend to a point where it will be absolutely certain to bear with its entire weight on lowest portion of the rail at all times. It should have as much margin beyond this point as will insure its safely clearing grounded metal. Its upward motion in case of a simple third rail need not be limited except as the convenient arrangement of the mechanism shall dictate. If the rail is hooded in places for protection it should not be allowed to rise so as to create danger of its striking the protectors above the rail.

The shoe must be capable of tilting, that is to say, to enable one end to be raised so that the face of the shoe comes on an angle with the horizontal, in order that it may smoothly take the approaches to the third-rail sections. If the third-rail section is such that the shoe has to traverse through slots or between guard boards it must be capable of horizontal motion in the direction of the axle to allow for irregularities in the gage and flange play of the wheels. Finally, it must occupy a normal position to which it will always be restored by springs or other equalizing devices.

The insulation of the shoe must be exceptionally secure. The breaking down of the insulation between the shoe and the support constitutes a permanent short circuit as the current traverses the third rail through the shoe hanger to the truck frame. This short circuit cannot be removed until the shoe itself has been removed or the car has been drawn off the third rail so that the shoe hangers clear.

With the large current the question of the order of contact becomes important. If two plane surfaces are pressed together two points only may be all the mechanical contact that obtains. It may possibly be a line or may be several points, but it never is a contact throughout the entire surface. As such surfaces ride one upon the other these points of contact are continually changing. Such a point of contact constitutes a little isthmus through which the current must pass, and if this current is large the isthmus will get hot, and if very large it will be vaporized, when another point of contact will obtain with similar phenomena, the result being a sparking and sputtering shoe.

In the writer's opinion it is doubtful whether the rounded head of the third rail and the plane surface of the shoe are best adapted to deal with the case of heavy current collecting. It is true that an enormous amount of current can be collected through very inferior contacts, especially if this contact is a rubbing one, bringing cool metal continually into play. A flat shoe obviously contacts with a curved rail-head only on a line, but as the shoe wears it conforms in a measure to the shape of the rail-head and the order of contact becomes higher; but it must not be forgotten that it is impossible to set third rails truly to gage, and that therefore the curved surface which the rail-head was intended to fit may be shifted laterally by the irregularities of the gage or flange play of the wheel, and even though compensating motions have been provided in the shoe mechanism the contact may become inferior. The writer therefore does not hesitate to recommend a truly plane third-rail surface for heavy traction work. This not only improves the order of contact, but takes a great deal of responsibility from the means which it is ordinarily necessary to provide to permit the shoe to compensate for lateral motions.

SPECIMENS OF METALLIC FORMATION ON CONTACT SHOE

As the traction problem becomes heavier a new system of power distribution will become necessary, for it will not be feasible to transmit or collect large currents by conventional methods, and recourse must therefore be had to the device of supplying the power by means of collecting lesser current at higher pressure.

Five hundred and fifty volts is the present practical pressure limit for railway commutators, but that trouble can be readily obviated by the use of motors in series, and the pressure can be advanced to 750 volts or even 1000 volts. When pressures of 800 volts to 1000 volts are reached the support and insulation of the third rail becomes a much more difficult problem than has heretofore been presented, and one which has very little precedent. Even at 600 volts and 750 volts leakages which were unimportant at the lower

voltages become very formidable, and it is therefore necessary to provide means to circumvent them. Serious short circuits are also much more likely to occur. It is absolutely necessary, in the first place, to protect the third rail by surrounding it with guard boards, which make it impossible to lay a straight bar between the third rail and tread rail.

It is unwise to place dependence on the third-rail insulator of the common type, and it should be reinforced by a filled wood block. It is possible for a third-rail section only 300 ft. to 400 ft. long to leak 4 amps. or 5 amps. at these high voltages, and the simple device of cleaning the few insulators on which such a section is supported may make this leak entirely disappear. Usually the leak is due to moisture film, supplemented by dirt, and oftentimes under continued voltage will disappear itself by reason of the moisture drying out. Occasionally, however, and particularly in tunnels where much carbonaceous matter from steam locomotives accumulate, the leakage will increase instead of diminish, and finally establish a fairly good circuit between the third rail and tread rail or between the third rail and adjacent piping, the line of flow being marked by incandescent scintillating earth and the flaming of any combustible matter in the vicinity. Such a leak is usually accompanied by arcs over the non-conducting gaps, and in many cases it is impossible to extinguish it by any means other than cutting off the current, the application of sand and kindred common methods being futile. As cutting off the current means suspension of traffic these matters are important.

That the leak on a section of third rail is a very evanescent quantity is a matter of common knowledge. With ordinary voltage it is usually small. The writer has seen lengths of 3 miles of rail show a leak of 150 amps., which reduced after twenty-four hours' application of pressure of 10 amps. or 15 amps., but immediately increased when the pressure was taken off for a few hours and then reapplied. This is undoubtedly due to the drying out of moisture. If, however, high voltages are used it is almost certain that the heavier currents which will flow through the leaks will not only dry out the moisture, but will tend to carbonize any material capable of such decomposition which lies in their path, increasing rather than reducing the leak, possibly to the extent of short circuit.

It behooves the profession, therefore, in view of the heavy third-rail problems which are shortly to come, to make a particular study of third-rail and shoe construction with all of these points taken into consideration.

Interesting Temporary Installations

The Hudson Valley Railway Company, which is a consolidation of the Stillwater & Mechanicville, Greenwich & Schuylerville, Glens Falls, Sandy Hill & Fort Edward, and Warren County Railroads and the Saratoga Traction Company, has now in operation over 100 miles of electric road, running north from Albany and Troy to Saratoga, Lake George and the Adirondacks. At the present time power for operating the road is derived from several independent power stations located at Stillwater, Saratoga, Middle Falls, Glens Falls and Caldwell. Ultimately power for operating the entire system will be developed on the Hudson River near Waterford.

For the operation of the road until this Hudson River power station is completed a somewhat unusual and interesting method will be used. The company has increased the capacity of the direct-current power station at Glens Falls by installing a 250-kw direct-connected engine-type generator, and has increased the capacity of the Caldwell station by installing a 170-kw direct-current, belted generator. In the power station at Glens Falls there will be installed a 250-kw rotary converter, changing direct current to alternating current with raising transformers. Power will be transmitted by a three-phase, 11,000-volt transmission line to Caldwell, where lowering transformers and a second 250-kw rotary converter will be installed to supplement the power of the Caldwell direct-current generating plant.

At the company's power station in Saratoga there is to be installed a 400-hp engine and 250-kw, 2200-volt, belted, alternating-current generator with raising transformers. From this plant power will be transmitted by a three-phase, 11,000-volt transmission line to a sub-station at Round Lake, where lowering transformers and a 250-kw rotary converter are to be installed. This sub-station will supply power to the recently-completed Saratoga division of the system, connecting the main line at Mechanicville with the Saratoga-Balston line at Balston Spa. After the alternating-current generating plant is installed next year on the Hudson River the generating and sub-station apparatus, now in use and in course of installation, will be displaced by eight 300-kw, 600-volt rotary converters. All of the electrical apparatus for the temporary installations and also for the permanent equipment of sub-stations is to be built and furnished by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.

Pennsylvania Railroad Tunnel

It is intimated that the Board of Aldermen will hold up the Pennsylvania Railroad contract and thus delay work upon this improvement for several months. The contract between the Rapid Transit Commissioners and the Pennsylvania Railroad Company for a franchise for the tunnels which the company wishes to construct for the purpose of providing an entrance into Manhattan Island, has been signed by the Commissioners and railway officials and transmitted to the Board of Aldermen for approval. The delay will probably be explained on the part of the aldermen by a desire to secure better terms for the city, but the real ground for objection is said to be jealousy on the part of the aldermen because of the powers vested in the Rapid Transit Commission. When the latter body was formed it deprived the aldermen of some of their most important powers, and the Board not only resented this invasion of its rights and privileges, but it has frequently gone outside its usual course to show antagonism by blocking measures recommended by the Rapid Transit Commission. In the present case it is said that the aldermen planned to refer the contract to a committee and then adjourn for the summer. This, of course, would postpone definite action until the fall, and then if the aldermen returned in the same mood further delay might be caused by insisting upon having public hearings, which might be strung out indefinitely.

Much pressure is being brought to bear upon the aldermen, and it is hoped that they may be induced to reconsider this plan and act upon the measure at once. The Pennsylvania Railroad Company is prepared to begin the work of construction immediately upon the approval of the contract, and it is particularly anxious to get the work under way during the summer, as it hopes to makes sufficient progress in the work of excavations before the cold weather sets in to enable it to continue the work throughout the winter. If the contractors are delayed now, however, it will be impossible for them to do this, as they would scarcely get the ground broken before they would be compelled to suspend operations during the winter months.

The System of the Elmira Water, Light and Railroad Company

The city of Elmira is the field of operation of a monopoly of municipal undertakings which if not run upon the most approved lines and able to give to the citizens an excellent service would result in a most unsatisfactory arrangement. It speaks, therefore, very well for the management of the Elmira Water, Light & Railroad Company, which controls the electric lighting, gas lighting and water supply of the town, as well as the street railway, that it has as pleasant relations with the city authorities and its patrons as if the various departments were run by separate companies in competition. The consolidation, which was arranged some years ago, has proved eminently satisfactorily to all concerned, and a description of the portion of the combination which is of particular interest to street railway men will prove of value in showing the possibilities which exist for the advantageous union of public enterprises by a private company.

The town of Elmira, as seen by the accompanying map, is considerably longer than it is wide, and this fact gives the railroad company an opportunity to develop a system of practically parallel lines running from one end of the town to the other without necessitating the building of many transverse connections. The railway receives considerable revenue yearly from its park traffic, and the line which connects the center of the town with the cemetery is also a good payer. The traffic to the Interstate Fair Grounds and Eldridge Park, at opposite ends of the town, requires a large amount of accommodation, and the system also operates a park of its own, known as Rorick's Glen, some two and one-half miles from the center of the town, which, during the summer season, keeps this line very busy. In order to accommodate the extra loads the company has adopted a train system, and runs two or three trailers with very good success. This is only done, however, during the summer, the winter service being operated entirely with single cars.

The Elmira waterworks consist of a pumping station and an extensive filtering plant and are located a short distance away from the town. The system of distribution is similar to that employed in most towns having private water companies, each consumer having a meter and paying for the amount used. The gas works are situated adjacent to the power station, which supplies both the electric lights and power for the railway. This location is near the railway track and affords every facility for easily obtaining its supply of coal for both the gas works and power station.

EXTERIOR OF POWER HOUSE

POWER STATION

The equipment of the power station is being at present considerably enlarged and the boiler room is having an addition built on it for the accommodation of a new battery of boilers. At present the capacity of the power station is about 2500 kw, including power for lighting and individual motors throughout the city and for the railway circuits. There are two tandem compound McIntosh & Seymour en-

GENERAL VIEW OF ENGINE AND DYNAMOS

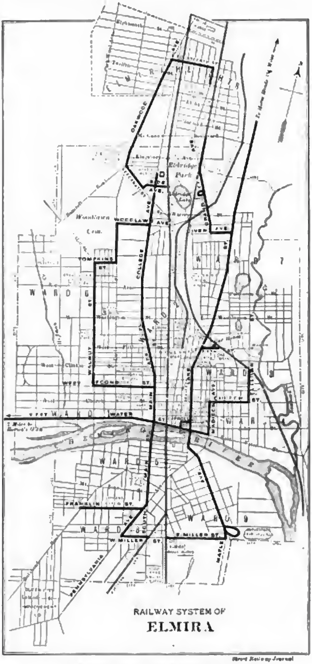
gines of from 400 hp to 450 hp. One of these is belted to a 200-kw Stanley three-phase generator and a 75-kw, 250-volt Westinghouse power generator. The other is belted to three 165-light Brush arc machines for street lighting The third engine is a McIntosh & Seymour triple-expansion 700-hp to 800-hp marine type vertical engine and the fourth is a cross-compound 500-hp to 600-hp engine made by the Payne Engineering Company. These two engines are belted to a countershaft which runs lengthwise in the center of the building and to which are belted five Westinghouse railway generators. One of these is 100 kw in capacity, two are 150 kw and two are 200 kw. The fifth engine is a tandem compound McIntosh & Seymour 400 hp and is belted to a

ONE OF THE LARGER ENGINES

200-kw Stanley three-phase alternator and 150-kw, 250-volt Westinghouse power generator. The Stanley alternator is excited by a 3 1-3-hp Crocker-Wheeler generator belted to its shaft. The equipment is completed by a sixth engine of 650 hp to 700 hp, direct-connected to a General Electric three-phase alternator having a capacity of 400 kw at 80 per cent power factor. The engine was made by the Ball & Wood Company and is of the vertical-compound type, a good view being shown of it in the illustration of the power station.

It will be seen from this resumé of the equipment that four distinct classes of service are given by this power station. The alternating current is generated at 2000 volts and distributed by means of a three-phase system. There is a three-wire system of 250 volts and 500 volts which supplies direct current to the power circuits connected to the various individual motors which are operated on the lines. This three-wire system is connected to the two 250-volt generators mentioned above, the loads being so distributed that the larger generator takes approximately twice as much as the smaller. The town street lighting is at present done by engine-driven Brush machines, but it is not unlikely that within a short time alternating-current synchronous motors will be substituted to drive the direct-current machines now in service. The commercial arc lighting is done by alternating current in parallel with the incandescent lamps. A total of 550 commercial alternating-current arcs, 23,000 incandescents, 387 direct-current arcs, 2040 hp in motors and 545 sixty candle-power incandescents are connected to the company's circuits.

The boilers are of a total capacity of 1325 hp and were supplied by the Babcock & Wilcox Company. After the extension of the plant which is under construction the capacity of the boilers will be 2000 hp at nominal rating.



RAILWAY MAP OF ELMIRA, N. Y.

Forced draft is used, the fan, made by the Buffalo Forge Company, being placed at the base of the chimney and regulated by a Burke & Parker regulator. The water for the boilers is obtained from the city mains and is chemically treated by a compound prescribed by the Dearborn Drug & Chemical Company, of Chicago. The engines are run condensing, and some 700,000 gallons of water are used daily for this purpose, the water being piped for a distance of about 1 mile. Near the shore a small house has been built on piles. This house contains a 500-volt Ft. Wayne motor

connected to a centrifugal double-suction pump made by the Lawrence Machine Company, which pumps the water through a pipe placed some three or four feet underground to the power station a mile distant.

Blake feed pumps of the duplex-compound type are used. The water enters the boilers at a temperature of 275 degs. F. There are three heaters, the first, or main heater, being a Wainwright, made by the Taunton Locomotive Manufacturing Company, which heats the water to 140 degs., the auxiliary heater, which is a Berryman, heating it to 190 degs., and a Wainwright even-flow heater using live steam brings it to the final temperature of 275 degs. The pressure in the steam headers is 165 lbs. Compressed air is used to clean generators and cars.

The switchboard is equipped with oil switches and oil-cooled feeder regulators, and until recently was on the main floor of the engine room. It has now been raised to a gallery, so that the attendants are away from the machinery and have a complete view of the room. The various classes of service given by the station necessitate a somewhat complex array of instruments and switches, but each department is kept entirely distinct on each division of the board. A complete oiling system has been installed, which is connected to a 200-gallon tank in the roof. The oil is delivered at the bearings, etc., by gravity at a pressure of 10 lbs. per square inch and then returned to the filters in the oil house and used over and over.


SOME VIEWS IN RORICK'S GLEN

CARS.

The electrical equipment of the rolling stock was furnished almost entirely by the General Electric Company, of Schenectady. The total number of cars is thirty-six closed cars and thirty-nine open cars. There are eighteen 16-ft. vestibuled box cars built by the John Stephenson Company, seven 18-ft. closed cars built by the J. G. Brill Company, four 20-ft. cars most of which were furnished by the Brill Company and some by the American Car Company, six eight-wheeled closed cars (42-ft. over all) built by both the John Stephenson Company and the American Car Company and one closed trailer, which is sometimes used as a smoking car. The open-car equipment consists of six double-truck 12-bench cars made by the Brill Company and Jackson & Sharp Company, five 10-bench cars made by the Jackson & Sharp Company, sixteen 9-bench cars made by the Brill Company and the American Car Company, three 8-

bench cars made by the Brill Company and five 8-bench trailers made by the Jackson & Sharp Company and the John Stephenson Company. Eight 9-bench open cars which were in service last year have been condemned and will be placed around the loop at the end of the line which runs to Rorick's Glen to be used as waiting rooms by the company's patrons. Air brakes made by the Christensen Engineering Company, of Milwaukee, Wis., are installed on all of the heavier cars. These brakes are operated by motor compressors. The company has installed on its trailers axle-driven compressors, using an ingenious system of multiple-unit control. This enables the trains containing two or more trailers to be operated at a very high rate of speed with safety, and a much more efficient service can be given. A view of a train consisting of one of the large double-truck cars and two open trailers is given in the accompanying illustration.

TRAIN OF THREE CARS USED FOR PLEASURE TRAFFIC

RORICK'S GLEN.

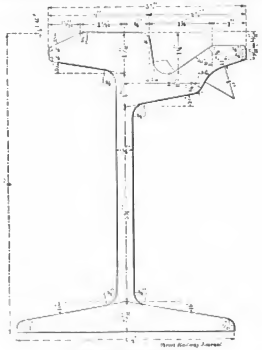
This park is one of the handsomest pleasure grounds in New York State, and a number of views taken therein are given in the group shown. As stated above, Rorick's Glen is placed at a most advantageous distance from the center of the town, about two and one-half miles, making it too long to walk and yet short enough for a profitable haul at 5 cents per passenger. The park contains a casino, at which during the summer entertainments of a light nature are given. These consist of both high-class vaudeville and regular performances of light opera, and are very well patronized. Last year there were few pleasant evenings when a seat could be obtained at any of the performances after commencing. Both afternoon and evening performances are given. Ten cents is charged for admission to the park to those who do not come on the cars, this price including the checking of bicycles. The park is entirely under the management of Henry F. Dixie, a retired actor and manager, who thoroughly understands the theatrical and amusement business and takes a personal pride in the performances which he superintends at the park.

ORGANIZATION.

A large portion of the street railway work is, of course, done by officers of the company, who are also in charge of the other departments, such as gas and water; thus the general manager, W. W. Cole, devotes only a portion of his time to the problems of the street railway, but is obliged to give his attention to the operation of the other works in which his company is interested. There are, however, a number of officers, such as superintendents and engineers in charge of the power station, who are entirely distinct from the other divisions of the organization. The president of the company is Ray Tompkins; vice-president and general manager, W. W. Cole, and secretary and treasurer, J. M. Diven. The superintendent of the street railway, who is in charge of all matters relating to operation, is Francis G. Maloney, and the chief engineer and electrician, who has charge of both the lighting and railway, A. E. Walden. The master mechanic is J. Creighton.

New Grooved Rail for Philadelphia

The accompanying engraving shows a new type of rail which is being rolled by the Lorain Steel Company for the Union Traction Company, of Philadelphia. The rail is to



A NEW RAIL SECTION

be used on those streets where the traffic is the heaviest, and contains several features of novelty. There will be in all about five miles of single track laid on Chestnut, Walnut,

Front, Twenty-second and Arch Streets. The standard flange used on the wheels of the Union Traction Company is 11-16 ins., although there are a few ⅝-in. flanges in service. The groove on the new rail, therefore, which is 1¼ ins. deep, will, when new, accommodate a wheel having a flange considerably larger. In order that the groove may be kept clean the lip is made much lower than the head of the rail and the slope of the groove on the inside is very considerable. A peculiarity of the rail is the sloping edge on the outside of the tread. With this construction, as the rail wears down, it is expected that it will retain its form much better than if the tread were made flat throughout its entire width. In order to accommodate this sloping edge the outside dimensions of the head of the rail are made a little greater than ordinary.

Before adopting this section of rail the subject was very carefully investigated by the company, and it is thought that a type has been found which will have as long and efficient a life as is possible under the heavy traffic conditions found on the routes where it is to be laid. There are many localities in city streets where the wear on rails is necessarily very severe, and in the rail illustrated this fact has been given the greatest attention, so that until the rail is worn sufficiently to be unfit for service it will continue to offer to the wheels the most desirable form of head and groove. In laying these rails the zinc joint described some months ago in these pages will be used, and when the track work is finished it will be one of the finest examples of permanent-way construction in city streets in the country.

Train Resistance

BY A. H. ARMSTRONG.

The keen interest taken in the subject of train friction, especially at the higher speeds, insures a warm welcome for the first experimental curves obtained from the Zossen experiments published in the STREET RAILWAY JOURNAL While these curves do not in any way afford data for a complete study of high-speed car work, they are the first authentic published data of the kind carried up to speeds beyond 60 miles per hour.

The data is especialy welcome at this time owing to the wide divergence in opinion on the subject of high-speed car friction and the amount chargeable to wind resistance at speeds approaching 100 miles an hour. Some tests taken upon the Buffalo & Lockport tracks by the General Electric Company were published by W. J. Davis, Jr., in the STREET RAILWAY JOURNAL, together with his reply to criticisms upon his original article. This last contribution has also been criticised and the Zossen tests quoted as disqualifying the results obtained. Before comparing the data from the different tests let us briefly cover the question of train friction and see what constitutes the different elements making up the total friction to be overcome at constant speeds.

Repeated tests upon stationary apparatus have shown that the friction loss of rotating bodies may be taken as directly proportioned to the speed, or, in other words, the torque is approximately constant at varying speeds. The journal friction of cars will vary from 4 lbs. per ton for heavy units to as high as 8 lbs. per ton, or even more, for very light cars. Added to this journal loss there is a certain amount of flange friction which may be considerably increased by a transverse wind. As the roadbed is not perfect or rigid there is a further loss in bending rails, riding joints, etc., which is a function of the speed and could very well constitute a second factor in a train friction formula. By far the largest loss at speeds approaching 100 miles per hour occurs in pushing the car or train through the air, and it is this factor upon which we have the least experimental data and consequently the greatest disagreement of authorities.

It is unfortunate that so many train friction formulæ are based upon pounds per ton, as it is evident that the wind resistance is not measured by the weight of the car, but rather by its cross-section and length, and such formulæ are especially misleading when applied to trains composed of a different number of units from that pertaining to the test from which the formula was derived. This fact largely accounts for the conflicting results obtained by comparing different formulæ where these are of a general character. This is especially true when an attempt is made to apply general formulæ of different authorities to the operation of single cars at speeds approaching 100 miles per hour, as no experimental data has hitherto been published for single cars operating at this speed.

The total amount of data available for comparison consists of some laboratory tests made by the Siemens & Halske Company, the results of which were published Sept. 7, 1901, in the Electrical World and Engineer, wind pressure being obtained by revolving different shaped surfaces. These tests, together with the results given by Mr. Davis from the Buffalo & Lockport experiments, and the Zossen tests published in the STREET RAILWAY JOURNAL, constitute the available data for comparing the performance of single-car trains.

The results obtained by revolving different shaped surfaces gave a constant of $.001V^2$ for parabolic surfaces and $.004V^2$ for flat surfaces where "V" is velocity in miles per hour. The Zossen tests gave $.0028V^2$ and $.003V^2$, depending upon the shape of the car end, and the Buffalo & Lockport tests $.004V^2$. These results are tabulated below.

Parabolic rotating surfaces	$.0010V^2$
Zossen tests, Siemens & Halske car	$.0028V^2$
Zossen tests, Allgemeine car	$.0030V^2$
Buffalo & Lockport tests	$.0040V^2$
Flat revolving surface	$.0040V^2$

There is a considerable discrepancy between these results, and the difference between parabolic and flat surface shows that the shape of the end of a car has a very marked effect upon the friction. These values are, moreover, taken by three different methods, which in itself is enough to produce considerable variation.

The revolving surfaces must necessarily give too low a pressure to the square foot when applied to straight-line work, as they do not rotate in still air, but carry a considerable volume of air with them. We would look upon the Siemens & Halske experiment, therefore, as giving results somewhat too low, and, in fact, they serve only as an indication of what would be expected for actual friction of a car at high speeds. Moreover, they would consider only the head-on friction of the car and neglect the side and rear friction, which must amount to considerable, as is evidenced by the increased total wind friction when extra cars are added to a train. These tests point out, however, one fact very strongly, and that is that the wind friction increases as the square of the speed and that the third member of our train-friction formula should contain the second power of velocity.

The Zossen tests determine the wind friction by pressure tubes at the front end of the car and include only the head-on friction, neglecting the side and rear friction. The constants obtained ($.0028V^2$ and $.003V^2$) cannot therefore be used directly, but must be increased to take care of the additional friction of the sides and end of the car. The pressure in pounds per square foot given by the barometer tubes cannot be used directly either, as it does not necessarily obtain over the total cross-section area of the car.

The only correct method of securing the actual wind friction of the car is by means of power readings at different speeds checked by a coasting curve on a straight, level track.

The Buffalo & Lockport tests, on the other hand, measured the power to drive the train as a whole, deducted the rolling and journal friction and arrived at the constant of $.004V^2$ by including not only the head-on friction but the total wind friction of the train. This method of obtaining the power required to drive a car at high speeds is undoubtedly more accurate and more complete than either of the two methods given above. Further publication of the results of the Zossen tests will undoubtedly contain values of train friction depending upon the actual power required to drive the car, and hence will be directly comparable with the Buffalo & Lockport tests.

In his formula, Mr. Davis considers the constant of .004 as too high, it being obtained with a flat-end surface, and he assumes that it will be reduced to .0035 with a car having its ends adapted for such high-speed work, a figure not much higher than the Zossen constants obtained and not too high for conservative preliminary calculations.

The power required to drive the Siemens & Halske experimental car at a speed of 100 miles an hour has been given as 950 hp output of the motors. The car weighed approximately 104 tons of 2000 lbs. and had an effective cross-sectional area of about 119 sq. ft., which was determined by including the projecting starting resistances on the sides and current-collecting devices on top of the car. Using the constant obtained in the Zossen tests (.0028) the tractive effort due to wind friction alone at 100 miles an hour would be 3330 lbs., or 32 lbs. per ton of 2000 lbs. It is necessary to add a certain amount for journal and rolling friction of the car, and this latter item could be made somewhat larger than the figure given by Mr. Davis, as the rail used in the Zossen experiments was stated to be too light for the heavy cars and high speeds used. The Davis formula gives a constant of 5 for journal friction of a 45-ton car, and we may perhaps reduce this to 4 for such a heavy car as those used in the Zossen tests. The second factor of the Davis formula (.13V) could well be increased in this case, owing to insufficient weight of track for the high speeds maintained. Using, however, the same factor for the second member of the Davis formula and 4 for the first member we arrive at 17 lbs. per ton additional, which, added to our 32 lbs., brings the total up to 49 lbs. per ton total friction of the Zossen car. At a speed of 100 miles per hour this corresponds to 1368 hp output of the motors, or 44 per cent more than the 950 hp given as the experimental value for this speed.

Although it would seem that the constants of the first two members of the Davis formula are conservative, and they are below those given by some authorities, it may be that they are too high. Taking the wind friction of the Zossen experiments as being correct, 32 lbs. per ton at 100 miles per hour for the Siemens & Halske car, we arrive at an output of the motors of 877 hp for a speed of 100 miles an hour due to wind friction alone. This leaves 73 hp, or .83 lb. per ton, for journal and track friction, an amount which is obviously absurd. The data given as wind friction from the Zossen tests, therefore, seems to discredit what figures have been published regarding the horse-power required to drive the car.

Returning again to the Davis formula, we do not find any grounds for discrediting it due to the results of the Zossen experiments. The previous laboratory experiments made by the Siemens & Halske Company showed a variation between .001 and .004, depending upon whether a parabolic or flat surface was opposed to the wind. The Buffalo & Lockport test gives a constant of .004 with surfaces that are nearly flat, being reduced by Mr. Davis to .0035 for rounded-end cars, while Zossen shows a constant of .0028 as obtained from the car ends approaching a parabolic surface and .003 for the rounded-end car of the Allgemeine Company. In other words, the difference between the Davis constant and that obtained from the Zossen experiments is not as great as previously obtained with the same shaped surfaces in the Siemens & Halske laboratory experiments.

It is unfortunate that the Buffalo & Lockport tests could not be carried to much higher speeds in order that there might be no question concerning the elimination of track and journal friction from wind friction. As far as they went, however, they indicated that the wind pressure increased as the square of the speed, which has since been verified by the Zossen experiments, thus justifying the use of the second power of velocity in his formula. The constant of .0035, however, includes the total wind friction of the car or train, while the Zossen constants of .0028 and .0030 include only the end friction of the car and entirely exclude the side friction and whatever rear-end friction may obtain. Taking the Zossen constant as it is given, however, it does not agree with the horse-power required to drive the Siemens & Halske car so far as these figures are published as yet, and, furthermore, does not discredit the Buffalo & Lockport tests, but rather confirms the conclusions arrived at from these experiments.

It is obvious that any formula based upon pounds per ton must be used with considerable discretion for cars presenting different cross-sections, different shaped ends and different irregularities along their surfaces. Considerable error may also be made in selecting the effective cross-section of the car even after proper constants are found by exhaustive experiments.

Opposing a wind at a velocity of 100 miles an hour is a serious matter, as evidenced by applying the results of the Zossen tests directly to the operation of a 45-ton car at this speed, using the same constants of 5 and .13V, as given by Davis, but substituting .0028 for .0035. Assuming a cross-section of 110 sq. ft. we arrive at a total tractive effort of 86.5 lbs. per ton, corresponding to 1040 hp output required to propel a 45-ton car at 100 miles an hour. The same constants applied to the Zossen car gave a total of 1368 hp, but this car was over double the weight and practically the same cross-section as the 45-ton car, while it does not require so very much more energy to propel it at the same speed Davis found that each trailing car added approximately 10 per cent to the wind friction value, and, assuming this to be correct, and using the Zossen wind friction curves, we obtain an output of 1390 hp for a train of two 45-ton cars, a figure which is practically the same as that required for the propulsion of the Zossen car, but carrying with it a greater seating capacity.

Very high-speed lines, 100 miles per hour or above, will probably use trains consisting of more than one car, as it is a question if it is not advisable to operate two 50-ton cars rather than a single 100-ton car, thus securing the advantages of distributing the load over a greater wheel base and the steadying action secured by trains at high speeds. The published results of Zossen experiments giving horse-power required to drive the car at different speeds and the subdivision of car friction into track, journal and wind friction, will be looked forward to with very great interest as giving much better working data than the results of wind pressure as measured by pressure tubes. It is to be hoped in the interest of future high-speed railroading that wind friction will show a constant not greater than .0028 even when total wind friction of the train is included. In the

meantime, however, the constant of .0035 for total wind friction deduced by Davis from the Buffalo & Lockport tests seems justified for conservative estimate, and, in fact, checks up remarkably well with the results of the Zossen barometer tests if these should be increased to include as well the side friction of the train.

Train Resistance Formulae

BY JOHN BALCH BLOOD

In the May number of the STREET RAILWAY JOURNAL, Mr. Davis had an article based on a series of tests on the Buffalo & Lockport Railway. He does not give the test, but gives formulae which he deduced therefrom.

In determining his formula he starts with the principle that the different items going to make up the total resistance should be properly segregated, but falls down on the rock where most every one has before him, namely, in attempting to have the variables of the formula with integral exponents.

A formula for train resistance can be made with two distinct objects in view, one for the easy and approximate calculation of the resistance and the other the accurate determination of the resistance. In the first, simplicity is the desideratum, while in the second, functional accuracy is important as well as conformity to the conditions of the case.

The accuracy of experiment and observation has much to do with the form of the formula, as also has the limiting values of the speed. For instance, if the accuracy of the observation were measured by a probable error of one pound per ton, it would be useless to introduce a term whose total value in a given case was much less than one pound per ton. Again, if the range of the formula were very limited, it is useless to increase the complexity by multiplicity of factors of different exponents, as within a short range a single factor or two factors can be made to represent given observations within the accuracy of the observations.

Mr. Davis has attempted to get accurate results. He has introduced terms to increase accuracy, but at the same time has made assumptions which introduce larger errors than the accuracy of the terms he introduced.

The formula he uses is essentially the same as proposed by Mr. Armstrong, and is similar to the formula proposed by the engineers of the Eastern Railway of France, with the addition of a term giving the wind friction on the sides of the cars.

Mr. Davis gives the elements in train resistance as three: (A) Journal friction, (B) rail friction, (C) wind resistance. He mentions that the gear and bearing friction of the motors together with the motor losses should be calculated as a function of the motors rather than of the train resistance, and with this proposition I agree.

Mr. Davis in making this division assumes that the wind resistance is all of the same function. It would seem from reason and experiment that such is not the case.

It is pretty well established that there is a portion of the resistance which varies as the zero power of the velocity, which is independent of the velocity. This can be deduced by experiment and also on theoretical grounds, and represents as a basis the journal friction, but contains probably other portions of friction of less moment than the journal friction.

Again, it is pretty well established that a portion of the friction varies according to the first power of the velocity. This portion is the rail-rolling friction, and from a theoretical standpoint it seems that this should vary as the first power of the velocity, as it is practically the bending of a beam.

Mr. Davis's third function, wind resistance, he has taken as varying with the second power of the velocity. He does this because the wind pressure on a normal plain from tests varies approximately as the second power. He assumes that the friction resistance on the side of the train also varies as the second power. This last assumption is purely an assumption, and it is not borne out by tests or theory.

In ship resistance the head resistance or resistance through a fluid is found by experiment to vary as the third power of the velocity or some higher power, whereas the skin resistance or side resistance of the water is taken as the 1.83 power. This has been demonstrated, and this exponential figure, 1.83, is almost universally accepted as the proper exponent for the skin friction. If the side friction is deemed of sufficient importance to be put in the formula it should have its proper exponent to the velocity factor.

As to the second power being the result of Mr. Davis's curves, I would mention that from Fig. 2 the 1.9 power would represent the results equally as well as the second power. It will be noted that between 6 lbs. and 13 lbs. per square foot all of the points are above the line, and in no case is there a point below the line.

Taking the case up from experience it seems to me pretty well demonstrated that with the third term of the formula a second power term, the results by such formula give much too high resistance above 60 miles or 70 miles per hour. At the same time, with no term higher than the first power resistance above 50 miles per hour is lower than would be experienced.

At 60 miles an hour, with from three to five cars, the head wind resistance is probably less than 4 lbs. per ton. The side wind resistance is also much less than one pound per ton. The rail resistance is about nine pounds per ton, at 60 miles, and the bearing resistance about 4 lbs.

It will be seen then that up to 60 miles per hour the exponent of the third term will not vary the total resistance to a very great extent, but when we get to 100 miles per hour, we have the bearing friction 4 lbs., the rail friction 15 lbs., and the wind friction something like 30 lbs. Here it will be seen that the higher exponential factor is of larger importance, as a difference in exponent from one to two would make a total in the resistance of from 30 per cent to 40 per cent.

This matter of exponents for terms has been one which has troubled everyone who has endeavored to make formulae. D. K. Clark, in 1854, used a formula with two terms, the first independent of the velocity, and the second varying as the square of the velocity. This formula was in all probability deduced from theoretical reasoning, assuming that the bulk of the resistance was of the nature of wind resistance, or that it varied according to the same law.

With proper constants this formula would give reasonably satisfactory results within a small range, but it was found that when the range was increased the formula was wide of the mark. On this account we find a reaction, and several persons made formulae, using first power of the velocity as the only variable. This gave much better results at speeds less than 40 miles per hour, and was used in large measure in practice for many years.

Rankine's formula is of this form as is the one of Baldwin Locomotive Works. Engineering News, in 1893, gave a formula of this nature as did also D. L. Barnes, who had given great study to this matter of train resistance.

The engineers of the Eastern Railway of France, in 1885, made some very careful experiments to determine train resistance, at speeds varying from 12 km up to 80 km. They found that neither the formula with single first

power or single second power term was applicable, and their formulae contains three terms, one with the zero power term, another with the first power term, and the third with the second power term, which has the weight factor in the denominator. This is theoretically as one would expect in determining the resistance in pounds per ton of train, as the head resistance would naturally be constant independent of the train wherein the resistance per ton of train would vary inversely as the weight of the train.

The Eastern Railway of France experimenters found that even with this formula satisfactory results could not be obtained, and in order to make it applicable were forced to change the constants of the first and second power term, giving different formulae for the different speeds. In all they have four formulae, one according to their statement for freight trains, with speed from 12 km to 30 km per hour. This formula has no second power term in it. The second formula is for passenger and mixed trains of speeds 32 km to 50 km per hour. The third is for passenger trains with speed from 50 km to 65 km per hour, and the fourth for express trains with speed from 70 km to 80 km per hour. This fact, namely, that the constants have to be changed with the speed, shows that the exponent of variable is not correct.

It seems to me that there is overwhelming evidence that a resistance formula with three terms, with the third term and second power term, will always give a much too high resistance above 60 miles per hour if the formula is correct for speeds below that.

In the STREET RAILWAY JOURNAL for March, 1899, I gave an article on "Train Resistance," mentioning this fact and giving as most reasonable general formula where three terms were the limit, the formula as follows:

$$R = 4 + .15M + .30 \frac{M^{1.8}}{T}$$

Where

R = resistance in lbs. per ton.
M = speed in miles per hour.
T = weight of train in tons.

I believe this formula, as it stands, would give reasonable results, but in all cases where extreme accuracy must be obtained, as in cases of single cars, the importance of each factor must be considered and proper co-efficient used accordingly. For instance, a 10-ton car with four wheels would have less bearing friction per ton than a 10-ton car with eight wheels, and again, a single car running on a 100-lb. well-laid rail would have much less rail friction than if it were running on a 50-lb. rail in bad condition.

Again, for extreme accuracy, I believe that we need four terms, one representing the head resistance, and another representing the side resistance of the train. For single cars I believe that the side resistance term should be eliminated, and here we would need three terms only, but for trains of from five to ten cars two terms of different exponential value are necessary.

In conclusion I would say, that I do not think it possible to develop a formula for accurate work to take in speeds from zero to 100 miles per hour without introducing one factor with the exponent of the velocity fractional between one and two.

Again, I think that without doubt the wind-side friction varies with the different power of the velocity and the head friction. Further, I believe that it is useless to introduce complications into the formula for the side friction until the proper exponents for side friction and head terms are determined.

It seems to me that while the engineering work in this branch has not produced satisfactory data at high speeds, with exponential factor for the third term of 1.8, it will give as accurate results between 60 miles and 100 miles per hour, as we have had with other formulae of only two terms up to 60 miles per hour.

With reference to experiment I think that the effort should be to show the exponents of the wind factor both as regards head friction and side friction.

Argument on Subway Injunction

The application of Charles T. Barney for an injunction to prevent the completion of the Rapid Transit subway along its present line in the section which passes his residence, at Park Avenue and Thirty-eighth Street, New York, was argued before Justice Giegerich in the Supreme Court of the City of New York, on June 26, by A. H. Masten, who appeared for Mr. Barney, and Edward M. Shepard, who represented the Rapid Transit Commissioners. Corporation Counsel Rives also appeared as the representative of the Mayor and Comptroller.

Mr. Barney contends that the original plans of the Subway Commission have been modified, and that these changes are of such a radical nature as to really endanger the safety of the residents along the line; consequently he asks that the excavations, which he claims were unauthorized, be filled in. He also says that the plans upon which the contractors are now working call for four tracks, where only two were authorized, and that the wall of the tunnel instead of being 35 ft. from his house is only 7 ft. Mr. Masten, his attorney, says that while it may be wise to enlarge this part of the tunnel so as to provide for connection with the tracks at the Grand Central, it is not lawful to do so on the decision of the chief engineer alone, that when the modification of the original plans was contemplated, the change should have been announced publicly, and the matter should have been submitted to the Rapid Transit Commissioners for consideration and approval.

Mr. Shepard, opposing the petition of Mr. Barney, said that the interests involved in the construction of the subway were of such magnitude that an individual's loss or annoyance ought not to be considered, as there could be no comparison between these losses and the benefits which would accrue to the general public. He declared that the change in the plans was considered and ratified by the Board, and that these modifications were absolutely necessary in order to carry out the mandate of the appellate division, which had directed the Rapid Transit Commissioners to make some provision for the accommodation of the East Side and interurban traffic. Mr. Shepard said that if the section of which Mr. Barney complained had to be refilled, in accordance with his wishes, it would mean a delay of at least eighteen months in the completion of this portion of the work. In summing up the case Mr. Shepard said:

> We insist that Mr. Barney can never maintain this action, or, indeed, be greatly listened to. He is a large stockholder and a director of the Rapid Transit Subway Construction Company, which has constructed this section. If the work has been done without the route and general plan it has been done under his direction and he is without redress. This change was advised and concurred in by the engineers of the company of which he is a director. If he was ignorant of the location of the tunnel that was simply because he refrained from knowing what his company was doing.

The corporation counsel, who appeared for the Mayor and Comptroller, corroborated the statement of Mr. Shepard that the modifications in the line of the tunnel had been made in strict conformity to law, and he urged that the action of the Commission be supported by the court. He declared that much harm would come from any protracted delay in the completion of the tunnel work at this time.

Decision was reserved.

STREET RAILWAY ACCOUNTING

CONDUCTED BY J. F. CALDERWOOD, ASSISTANT TO THE PRESIDENT, BROOKLYN RAPID TRANSIT COMPANY, AND MEMBER INSTITUTE OF SECRETARIES OF LONDON

Creation of Reserve Funds

BY JAMES MANNING.
Member of the Institute of Accountants and Actuaries of Scotland and Fellow of the Institute of Secretaries of London.

I have read with interest the article by H. C. Mackay, president of the Street Railway Accountants' Association of America, entitled "Creation of Reserve Funds." The suggestions expressed by Mr. Mackay are so thoroughly in accord with my personal opinions that I should be at a loss to find a point on which to take issue with him but for the title, which affords me a pretext for writing a few words.

In my experience as an accountant in railroading I invariably raise the point so effectively treated by Mr. Mackay, that provision should be made for the proper maintenance of track and also of equipment, machinery and buildings. Without doubt ample provision should be made each year for the wear and tear on these and for their renewal. Once the average life of the different material in the track is settled by the engineer and the approximate cost of labor required in making repairs and renewals is ascertained, the accountant can make his calculations as to the appropriation that should be made on each account, so as to provide for renewals as they become necessary. In so far as the ascertained amount is not expended in renewing the track, a charge should be made to operating expense and a corresponding credit to a track renewal fund. This fund may be subdivided so as to show the funds available for rail renewals and other items separately. In practice it is well to make these adjustments monthly. Similarly a regular charge "per car mile" may be established for repairs and renewals of cars and motors, regulated according to class of car, and any expended balance charged to operating expenses and credited to a car renewal fund. Renewal funds for buildings and machinery may be similarly established. But these funds must not be regarded as reserve funds, for they differ materially from the reserve fund proper. The renewal fund represents definite depreciation. It is ear-marked for all time, so that it will only be used for the specific purpose for which the charge was made. Essentially it forms a primary charge to the operating account, one that must be made before any surplus can be shown. Now, it is only from the surplus that the reserve fund proper can be voted, and therein lies the difference.

To emphasize this point, I might call attention to the paragraph in which Mr. Mackay refers to making provision for the liability on unpresented or unsettled claims for injuries and damages. Where one has to deal with accidents that have occurred and involve unsettled claims, the charge is one which should strictly be made against operating expenses. But where it is desired to form a reserve fund in view of the possibility of serious accidents occurring in the future, the case is different. Here no actual liability exists. Therefore, any provision voted from the surplus may be regarded as a reserve fund in the strict sense of the term.

In estimating the charge that should be made to provide for the wear and tear of electrical equipment it might be well to allow some margin for replacing equipment that may have become obsolete before it is actually worn out. This, too, might be provided for in a general reserve.

It is certainly most important that a proper sinking fund should be created to replace capital invested in plant and machinery that may have to be abandoned on the expiration of a lease or franchise. In this case the payment of an annual premium to some well-established and substantial trust company commends itself to me. A premium can be adjusted that will be based on a reasonable rate of interest. When the premium is so adjusted and regularly paid the investor can rest satisfied that the repayments of the amount of his investment is assured. As an example of what may be done in this direction, I might state that you could insure the payment of $650,000 on the expiring of a lease or franchise in 40 years by the payment of thirty-nine annual premiums of $9,250 to the trust company. Such an arrangement precludes any possibility of trouble in the adjustment of sinking funds.

I fully agree with Mr. Mackay that, as a general rule, it is well to have all renewal funds especially set aside, so that the actual cash be available at any time that it may be required. There is, however, a special occasion for setting aside the amounts appropriated to general reserve funds. Where amounts are voted from the surplus to form a reserve fund that may be used for equalizing dividends or any other purpose affecting the general welfare of the stockholders, it may be found to be more to the advantage of the business to use the fund in the ordinary course of business as working capital. By so doing the fund may earn several times the amount that would be derived from it if invested in high-class securities. It would appear poor financing to set aside a fund that would only return say 2 per cent. interest, if, on the other hand, you were borrowing money at 6 or 8 per cent. to purchase supplies or carry a floating debt.

The Auditor and the Stockholders

The auditor of a public company or corporation is in theory and by right an agent of the shareholders. In Great Britain, by "the Companies Act, 1900," he is made directly responsible to the general body of shareholders, and it is made compulsory upon him to report to them as well as state on the balance sheet whether the requirements of a full and free auditing of accounts have been strictly complied with in letter and spirit. He is made a watch dog upon the financial operations of the officers and directors. He is to report errors, misleading bookkeeping and malfeasance. He is to report to the stockholders the concealment of essential facts, the payment of unearned dividends, the wasting, misdirection or overvaluation of assets, the covering up of liabilities and the performance of official acts not authorized by the stockholders or by the articles of incorporation. In short, the function of the auditor is to safeguard the interests of the stockholders and protect them from official error and malfeasance.

In order to perform the function of an independent and fearless auditing of accounts so as thus to safeguard shareholder interests, the first essential, of course, is that the auditor's official position comes not from the managing director whose financial acts he is appointed to examine, but from the stockholders themselves whose interests he represents; and right here is the fundamental error of the American practice and the danger to the professional standing of the American auditor.

The appointment of the auditor or comptroller of the average American corporation comes directly from the managing director. The appointee, therefore, is absurdly supposed to act as a watch dog upon the acts of his manager, to report to a miscellaneous investing public the errors and malfeasance of the official upon whom he de-

pends for both his salary and his job. Is it to be supposed for an instant that where crookedness existed an honest and independent audit under such conditions could be accomplished? If the report of a fearless audit exposing the management were prepared, would it be allowed to go to the stockholders? How long would it take the manager in such a case to discharge his appointee and substitute another who would do his bidding? In short, under the current American system, the auditor of the average corporation is nothing more or less than the manager's financial clerk. He is not an independent official. He is not the fiduciary agent of the stockholders. He is not the financial watch dog of the corporation. He can report to the stockholders neither the errors, the deceits nor the frauds of the official management. On the other hand, he is made the cloak for errors, the servile agent of deceits and oftentimes the helpless scapegoat of frauds

The duties of the auditor of the average corporation are:

1. To ascertain the correctness of the accounts.

2. To ascertain and verify the liabilities.

3. To examine and verify the values of the assets.

4. To present to the stockholders properly constructed accounts and balance sheets.

5. To certify that these accounts and balance sheets strictly accord with the facts.

6. To report to the stockholders any discrepancies that may exist between the books and the facts and the discovery of official errors or malfeasance.

But, suppose that the auditor is appointed to his position by the manager of the corporation, and that the accounts to be audited, the liability and asset reports to be verified and the discrepancies to be reported represent the will and acts of the manager. What, under such conditions, is the audit worth? Will it be an audit at all, or simply a false pretense aimed to cover up the missteps of the management and gull the stockholders and investing public?

The well-known Scottish accountant, Ebenezer Carr, explains the correct position of an auditor thus: "Certainly he should not undertake an audit unless he has a free hand to do all that is necessary for presenting a fair and full representation of the position of the concern under audit; anything short of this is worthless." But what auditor can have a free hand in examining and reporting the financial acts of the manager who controls his job? How large a proportion of the auditors and comptrollers of American industrial and public service corporations can boast that they have such free hand?

The auditor is supposed to ascertain if there are liabilities incurred bythe manager other than those shown in the books; to write off the proper proportion on all wasting assets and see that the assets are down for present bedrock values and not at inflated estimates; to reduce the estimates on the stock in hand to net values, and thereby guard the stockholders against the dangers of a false and fictitious balance sheet. But if the official management is the beneficiary of the misrepresentation, and, at the same time, has absolute control of the position of auditor, can the audit be anything else than a cover of falsification?

The audit is to ascertain if there is a voucher for every disbursement, an invoice for each item of the purchase book, a dollar in cash for each dollar in the cash book and a deed and abstract of title for each piece of real estate. The auditor is to ascertain that the bad debts have been marked down as such; that the depreciation in value of plant and fixtures has been properly written off; that there is no inflation in the value of the stock; that no liabilities are concealed; that dividends and cost of maintenance are not paid out of the capital; that the bank account is supported by the certificate of the banker; that all investments are verified at present market values; that contingent liabilities are given full showing; that the reserve fund reported is real and not fictitious; that the balance sheet is a faithful photograph of the books, and that the books give a true and complete record of the facts and of the company's condition. All this the auditor is to examine, ascertain and verify; and for what purpose? In order that the mistakes and malfeasance of the official management may not jeopard the investment interests of the stockholders. But when the official management controls the audit by controlling the auditor, what mistakes and malfeasances of official management are the stockholders going to ascertain from the audit? It is only too plain that, in fact, there is no audit at all. It is pure buncombe, a farce, so much advertising, and that is all.

Under such conditions the auditor might just as well be dispensed with. What is the use of an audit that does not audit, or an investigation that is never made, or, if made, is never reported, or if reported conceals the errors and malfeasance investigated. It is worse than no audit; it is a fraud to conceal a fraud.

It is perfectly clear that if the profession of auditor is to obtain in this country a high professional standing the auditor must be a free moral and financial agent. He must be beyond the control of the officials whose official acts he is to review. His position must come from the stockholders whose interests he is supposed to safeguard. He should report only to the stockholders and be responsible only to them. In that way, and in that way only, will the interests of the stockholders of American corporations be strictly safeguarded, and in that way only will the standing of the American auditor be worthy of the name.

Necessity for Audits

In keeping with the position which we have taken on the value of examination of accounts by independent auditors, the Wall Street Journal recently called attention to several special cases, particularly that of the Evansville & Terre Haute Railway, in which this necessity was emphasized. The increase in the number of industrial companies seeking investment demands that some provision be made for the protection of the general public. The writer of the article in question points out that an audit is one thing and an expert examination is another, the vital fact being the integrity of profits. While this is in one sense a bookkeeping matter, it is entirely different in another sense, for while the books may be kept with irreproachable correctness, so far as balance sheets and income statements may be concerned, the results disclosed thereby and the deductions drawn therefrom may be entirely incorrect in a larger sense. The ordinary audit means very little more than the verification of entries, as it does not go into the broader question of their original correctness, nor does it verify the accuracy of the books as a complete record of the transactions and the condition of the property. Those who are familiar with the situation will agree that the necessity for such independent audits of a thorough and comprehensive character is much greater in the case of street railway properties than in any other class. The difference between the work of the bookkeeper and auditor is very clearly illustrated in the following summary:

Profits mainly depend upon two things, the first of which is the valuation of inventories at the end of the year, and the second, the allowances for depreciation of plant. If a company chooses to over-value the inventories, the bookkeeper simply takes the statement as given to him and puts it on his ledger. The ledger balances agree all right with the profit and loss statement, but if the profit and loss statement is made on this basis, the profit as

written is in excess of the real profit, and the excess will sooner or later have to be dealt with by writing off. Again, if proper allowances are not made for depreciation the profits are over-rated by the amount to which the allowances are short of the facts, and if dividends are made on the basis of the book profits trouble results sooner or later.

The ordinary audit, as far as our experience goes, does not sufficiently canvass the inventory value or the depreciation allowances—neither of which are subject to ordinary check by voucher—and as has been said, it is entirely conceivable that a merely bookkeeping audit might certify a set of accounts in which inventory values were wholly out of proportion with the facts, and in which depreciation allowances were altogether too small.

We think that every industrial company in making its report to stockholders should call in independent auditors, who should be instructed not merely to certify to the accounting, but should also be requested to certify to the profits. The auditor would in such case employ experts satisfactory to themselves on whose judgment they would be willing to issue their certificates. With such a certificate, stockholders could fairly feel that they had something on which they could rely besides the statement of the company's officers. The officers, moreover, could feel that a considerable part of the responsibility had been lifted from their shoulders, and we should imagine that this would be a strong inducement to all who were desirous of doing their duties conscientiously.

An insufficient audit is worse than none at all, because from the nature of things it induces the stockholder to believe that he has a guarantee when he has none. The principle of independent audit is good only in its complete application. We think, however, that such complete application of the principle ought to be practically universal henceforth. There is so much uncertainty involved in industrial corporation finance under the best conditions that whatever can be done to remove or diminish this uncertainty ought to be done. At the present time conditions in this respect are very unsatisfactory.

Corporate Dividends

BY CHARLES COLEBY RECKITT, C. P. A.

In the present age, when nearly 50 per cent of the title to property in the United States is vested in stock companies, it naturally follows that a large percentage of the incomes of the country are derived through the medium of dividends. Notwithstanding, however, the immense revenues derived through this source, there are, comparatively speaking, few court decisions bearing on the subject. What cases there are seem to be chiefly of a prohibitive nature given for the protection of creditors of insolvent companies. The court seldom intervenes to regulate the internal management of the company or to protect the rights of one class of stockholders as against another, the only exception to this case being where fraud actually exists. Upon the accountant of a corporation, therefore, devolves the responsibility of protecting the rights of all classes of stockholders' interests; and although in such matters his services are only advisory, whilst the decision of the directors is almost supreme, his efforts should always be directed to establish the rightful interests of each class of stockholders, to exhibit to the directors a full report on the condition of the affairs of the company and a correct statement in regard to profits of the current and previous years, as well as the condition of all reserve funds and contingent funds which are maintained for specific purposes. It is obvious that where a company is solvent and the capital stock is owned by only one class of stockholders, his task is comparatively an easy one; but where the business is of such a nature as to involve large contingent liabilities, or where the assets are of an exhausting nature, or where stockholders are divided into preferred, ordinary or deferred, or where the company is in the course of liquidation, the auditor has a complex problem to solve.

For the purpose of more intelligently dealing with the subject of dividends and its relation to the duties of auditors, I have divided the subject under the following headings:

1. Different classes of stock and dividends.
2. In what cases may or may not a dividend be declared and paid?
3. What redress have stockholders and creditors as against directors and auditors for improperly declaring dividends?

The most common forms of stock are:

1. Preferred stock.
2. Common or ordinary.
3. Deferred and founders' shares.

A corporation may, in general, make four different kinds of dividends, viz.:

1. A dividend payable in cash.
2. In certificates of stock.
3. In scrip.
4. In property.

In the absence of a special provision to the contrary, dividends will be presumed to be payable in cash and in lawful or current money.

DISCRETION OF DIRECTORS AS TO DECLARING DIVIDENDS

In general, it is for the directors and not the shareholders to determine whether or not a dividend is to be declared. When, therefore, the directors have exercised this discretion and declared or refused to declare a dividend, there will be no interference by the courts with their decision unless they are guilty of a wilful abuse of their discretionary powers or of bad faith or of a neglect of duty. Accordingly, the directors may, in the fair exercise of their discretion, reserve profits to extend and develop the business or for the purpose of meeting contingent liabilities. The free exercise of their discretion cannot be interfered with by the contracts of promoters or original incorporators as to the disposition of corporate profits.

Nevertheless, the discretion of the directors in the matter of declaring or refusing to declare a dividend is not absolute. The courts exercise a supervisory power in this matter, and where there is a clear abuse of power in refusing to declare the dividend a court of equity will, at the instance of any shareholder, compel the proper authorities to declare and pay the dividend. (Stevens vs. South Devon Railway.) Delay on the part of the shareholders in failing to commence their suit to compel the payment of a dividend until the corporation becomes insolvent is fatal. If the plaintiff shareholders are in the majority, and can reelect directors at the next annual meeting, the court will not intervene.

The discretion of the directors is not only governed by the courts, but by the statute and by the articles of association of the company, provided the latter do not conflict with any statute. It has already been stated that the courts will sometimes interfere with the discretion of directors in regard to dividends. The most common causes for intervention are as follows:

1. When the act of the directors in declaring a dividend is ultra vires.
2. When such dividend would jeopard outside creditors.
3. When the dividend is declared out of capital.

Numerous English and American jurists have decided that it is illegal to pay dividends out of capital, or have stated the same fact in reversed form "that dividends can be made only from net profits."

The relationship of the accountant's profession to the subject of dividends and profits naturally differs from the legal, his opinion being advisory only, whilst court decisions are compulsory. The former, however, is much broader and far-reaching, because it applies to individual cases, whilst the latter is given to control the actions of

the general public. It is not enough that a declaration of a dividend is legal; it must conform to sound judgment and conservative financing. Moreover, it is especially within the accountant's province to regulate such questions as to profit which often form contentions between different classes and generations of stockholders, where the courts seldom interfere.

In the case of Lee vs. The Neuchatel Asphalt Company, the court refused to intervene between two different classes of stockholders, preferred and ordinary, to enjoin the declaration of a dividend on the ground that the dividend was paid out of capital. The common stockholders took the view that a reserve should be created for the purpose of making good the capital, as the company dealt in assets of an exhausting nature, consisting of asphalt, and their concessions were merely leasehold interests.

The court held that it could not interfere with the internal arrangements of the stockholders, and said that "it has been very judiciously and properly left to the commercial world to settle how accounts were to be kept." The court took the view that immediately the capital account was invested it was sunk, and if the receipts exceeded the current expenses it was a return of revenue and not of capital. This decision makes it necessary for investors to be careful how they invest in companies dealing in "wasting assets." They should either see that the articles provide for a special reserve for the maintenance of the capital assets or should only take stock that is preferred unless the capital of the company consists solely of common stock. Otherwise they might find that dividends were being declared out of capital, which the preferred stockholders would participate in, to the exclusion of the common stockholders, and they could obtain no remedy under these circumstances unless in case of actual fraud.

TO WHOM MAY CORPORATIONS PAY DIVIDENDS

Registration of stockholders is required by the articles of many corporations and a transfer fee payable upon registration. The company is not bound to deal with any but the registered stockholder, but the registered stockholder is regarded by a court of equity to be a trustee for a bona fide purchaser or mortgagee so far as the ownership of stock and receipt of dividends is concerned, and the latter, as well as the legal representative and judgment creditor, may enforce their rights against the company for unpaid dividends upon the presentation of proper proof and the payment of necessary transfer fees.

As a general rule, however, the party having possession of the stock certificate, and in whose name the stock stands, is the proper party to whom the dividend should be paid.

With respect to dividends of a married woman, the corporation must pay them to the husband or not, according to the domicile of the corporation and not according to the law of domicile of the married woman.

The heirs of a deceased stockholder must, in order to entitle them to dividends, procure a transfer of their ancestor's shares, but if the corporation should, without notice, pay over the same to the administrator, they will be protected in so doing.

TO WHOM THE DIVIDEND BELONGS

The purchaser of shares is entitled to all dividends declared after a sale to him, and the dividends are not apportionable unless by agreement. The same rule applies to a purchaser at a tax sale. A legatee takes all dividends declared after the testator's death. The administrators all declared previously. An offer to sell shares, which is subsequently accepted, entitles the purchaser to dividends declared by the corporation whilst the offer remained open; but a contract to sell on demand entitles the vendors to dividends declared before the demand was made.

The general rule in all such cases is that the time of declaration of such dividends governs, not the time of payment nor the time the profits were earned out of which they were paid. Profits have been likened by one writer to fruit on a growing tree, which would pass with the sale of such tree. Fallen fruit, however, would not pass with a sale of the tree; so dividends already declared would not be included in a sale of stock, although the purchaser has the benefit of all undivided profits.

LIABILITY OF DIRECTORS AND AUDITORS WHERE DIVIDENDS ARE ILLEGALLY DECLARED

The directors of a corporation may be sued for the recovery of dividends declared out of capital and for all directors' fees paid after the corporation has become insolvent. Such suit may be brought either by a creditor or a stockholder.

It is not sufficient defense for the directors to state that they relied entirely on the reports and statements of the auditors; they must satisfy themselves personally in regard to the conditions of the corporation's finances. (London and General Bank, Ltd.) Nor does it relieve the directors from liability, even though the dividend is declared with the acquiescence of all stockholders.

An action for fraud lies where the condition of the business is wilfully misrepresented for the purpose of declaring a dividend.

It is held that auditors are liable only for negligence in regard to statements and reports given in their professional capacity. They are not insurers, therefore they are only responsible for misstatements wilfully made or made through error, when, with proper diligence, they might have ascertained the true facts.

It is not sufficient for the auditor to prove the arithmetical accuracy of the books; they must ascertain that the assets on the balance sheet to which they certify represent something of substantial value; that all actual liabilities are included; that all the expenses of the fiscal period are taken into account, and that all profits stated in their certificate have been earned.

When an auditor relies on certain figures or statements of a previous auditor he should cover himself by stating so. An auditor is responsible for the valuations placed on inventories unless he especially exempts himself. His certificate covers every item on the balance sheet unless he makes exceptions in his certificate.

In this country, especially in the West, where the auditor has not received the same official recognition from the courts, it is doubtful whether his responsibility or liability is so great as in the East.

CONCLUSION

Corporations being of comparatively modern creation, this branch of the law usually designated corporation law is almost in its infancy. It has not become the science that real estate law became many hundreds of years ago, and has scarcely kept pace with the rapid strides which corporations have made during the last century and the development of trusts during the last decade.

As in medical jurisprudence, the lawyers have frequent occasion to consult the medical profession; so in corporation law the accountants will often be called into conference.

It is a comparatively easy matter to lay down a series of rules governing a subject like dividends, but it is the application of those rules which requires constant vigilance and labor; and this is the accountant's duty, for which he is specially adapted and trained.

Profession of Public Accountant

BY J. F. CALDERWOOD.

It belonged to the latter half of the Nineteenth Century to produce the modern profession of public accountant. It remains for the Twentieth Century to develop and give this profession the standing to which it is entitled.

An age of commercial and industrial expansion, an era of joint-stock companies and industrial corporations makes the profession of public accountant as necessary to the public weal as that of law, medicine, teaching or engineering. The duties of public accountant call for a high order of intellect, integrity and technical skill, second to that of no other profession; and certainly no other profession calls for heavier responsibilities.

It was in 1856 that the profession received its first public recognition, that being the date of the royal charter to the Scottish Institute of Accountants. It was not until 1880 that a similar charter was granted to the Institute of Chartered Accountants in England and Wales. Conditions for admission to these institutions were severe and strict, but the growth of the profession has been, nevertheless, rapid, until the membership and list of associates and fellows of the two societies has spread world-wide. Following the British example, the United States has such well-known institutions as the New York Society of Certified Public Accountants, the Incorporated Accountants of Massachusetts, the Illinois Association of Public Accountants, the American Association of Public Accountants, and other societies representing special industrial and commercial interests, of which the Street Railway Accountants' Association of America is an example. The laws of New York, Pennsylvania, California and Maryland recognize the profession by providing for examinations for the degree of "Certified Public Accountants." In the University of New York a School of Commerce and Accounts has been organized to prepare applicants for the degree, the course including bookkeeping and accounts, law and economics. The time will come when every well-equipped university will place accountancy in its course.

Probably the greatest step in the establishment of the profession of public accountant is the act of Parliament, Jan. 1, 1900, the first day of the Twentieth Century, providing not only the forms of the report and certificate by auditors, but furthermore that the accounts of every corporation must be examined and certified by an independent auditor appointed by the stockholders. This act at once stamps the profession of public accountant with legal standing. Every British corporation henceforth must submit its books to the examination of an independent accountant, and no corporation accounts in Great Britain can pass muster without the certificate of such independent accountant. This accountant is not an employee of the corporation, not a subordinate of the manager, but an independent official selected by and responsible to the stockholders. He is the watchdog who safeguards the investor. Consequently, wherever there is a British corporation, or a stockholder of a British corporation, or investment in British corporation securities, there is legal necessity for the duties of an independent accountant, and this profession has standing in law.

Without doubt, American law will soon follow English practice in this respect. Already British investors in American securities are demanding, and in many cases securing, the same protection of an independent audit directed by the investors. A number of prominent American corporations have anticipated legislation by already inaugurating the custom of an independent audit. The United States Steel Corporation is a notable example which is bound to be followed by others. Thus the profession of independent, disinterested, skilled public accountancy is assured of a wide and steadily enlarging field of usefulness, with high standing and responsibility.

The duties of public accountant are so patent as scarcely to require capitulation. Briefly summarized, these duties include:

1. The audit of accounts, which may be continuous, daily or weekly or monthly, or quarterly, half-early or annually, according to the necessities of the case and the nature and size of the business.

2. The preparation of a balance sheet and profit and loss account, based on the facts of the business.

3. The investigation of suspected frauds and the provision of bookkeeping checks against fraudulent manipulation.

4. The establishment of systems of bookkeeping based on the nature of the business, with a view not only to saving of labor, but clearness and thoroughness of account keeping.

5. The inauguration of a system of cost accounts, covering first cost and the various stages of cost through the manufacturing, mercantile or other business processes.

6. To provide for a corps of trained assistants equal to the special demands of widely varied business enterprises.

7. The investigation of the accounts and likewise of the detailed business facts for the purposes of sale, or of incorporation, or of bond and stock issues.

8. The preparation of a case in bankruptcy for the assignee, that the latter, as well as the creditor and the debtor, may begin to settle their affairs by the best system.

9. The similar handling of a trust estate for the executors.

10. Special investigation into the subject of personal injury cases, in a measure acting as a referee.

11. Expert calculation of interest installments to provide for sinking funds, bond redemptions and the arrangement of payments over a series of years.

12. Expert advice in a thousand of business lines for the investor, the promoter, the manager, where special training is required to unearth the earning probabilities of a given enterprise or investment.

The paper presented elsewhere in this department on "Corporation Dividends" was prepared by Charles Colby Reckitt, C. P. A., for the information of street railway investors, managers and accountants. It is an elaboration of the features relating to this special work that were embodied in the author's address before the Illinois Association of Public Accountants, which attracted so much favorable comment.

Ebenezer Carr, the well-known Scottish accountant, in a very able article on "The Duties and Responsibilities of Auditors," published in a recent issue of the Commerce Accounts and Finance, has this to say regarding reserve fund: "A real, as distinguished from a more or less fictitious, reserve must be invested outside the business for which it is created, and the auditor should have the nature of such investment set forth on the balance sheet."

Beginning with an early issue, we will publish a series of articles on important practical subjects, under the headings: First, "A Successful Manager and What He Requires;" second, "How to Analyze a Street Railway Proposition from an Investor's Point of View."

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Papers and correspondence on all subjects of practical interest to our readers are cordially invited. Our columns are always open for the discussion of problems of operation, construction, engineering, accounting, finance and invention.

Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the JOURNAL *when of general interest, otherwise by letter.*

Street Railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our news columns.

All matters intended for publication in the current issues must be received at our office not later than Wednesday of each week.

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Fewer horses and stables are now maintained in New York than formerly, and the number is decreasing every year. The Department of Health has just completed a census of the horses and stables in the city, and the result shows a surprising decrease in the last five years, the number of horses reported this year being only 65,086, against 73,746 five years ago, showing a falling off of 8660. There are now 3326 stables in New York, whereas five years ago there were 4640. This condition is attributed principally to the substitution of electricity upon street railway lines, although the introduction of the automobile has contributed somewhat to this result. In view of the increase in population in the periods mentioned and the consequent increase in the city's haulage requirements, this decrease in the number of horses is convincing evidence of the important part that electric traction is playing in every large and prosperous community.

Street railway companies and contractors who build public works will be interested in the opinion submitted by Corporation Counsel Rives, of New York, upon the question of the validity of municipalities inserting clauses in public contracts restricting contractors to the employment of union labor. The labor unions of New York have been trying to get the City Council to insert a clause in contracts and specifications for work and supplies providing that only union labor and union-made material shall be used. The corporation counsel holds that such action would constitute discrimination and prevent competition, and therefore would be illegal. In support of this position he cites a case in Chicago in which the Illinois courts pronounced legislation of this character unconstitutional.

In the controversy over the misdeeds of automobile operators the disputants seem to be inclined to lose sight of a very important fact, which, however, cannot be overlooked in the final settlement, namely, that streets are dedicated to the use of the people, and cannot be converted into racetracks. The automobile of to-day is built for higher speeds than is safe under ordinary conditions upon the public thoroughfares of any large city, and the tendency of the operators is to send them along at the top notch, without regard for the safety, convenience and comfort of those who cling to the old-fashioned carriages drawn by horses, thus positively endangering the lives of pedestrians, especially children. The daily newspapers have been printing a lot of rubbish in the form of communications from owners of these vehicles, who attempt to defend their practices. They emphasize the advancement that has been made in the development of these equipments, and the mechanical perfection attained which will enable an expert operator to attain a wonderful control over the machine. But all this is foreign to the subject. The numerous accidents recorded show that there is a wide difference between theory and practice in automobile operation. Objection is not made against the machine itself, but against the practice of driving it along at a dangerous speed.

A satisfactory explanation is sought for the falling off in the new mileage which is added from year to year to the country's steam railroads. So marked has been this decline that it has come to be regarded as a serious problem by the builder, the engineer and the investor interested in properties of this class. Statistics have been compiled which show that, while this diminution is general, it is particularly noticeable throughout this country and Canada, the growth in the whole of North America between 1890 and 1900 being only 40 per cent of that reported between 1880 and 1890. This condition is viewed with apprehension by many, although some capitalists console themselves with the reflection that their investments will increase in value in keeping with the decline in building opertions, but they must realize that this will be true only within certain well defined limits. It is but natural to offer in explanation of the constant decrease in new mileage the fact that during the period of greatest activity more roads were built than were really needed and that many years of industrial development must elapse before the capacity of the great systems of transportation already established will be reached. There is unquestionably considerable merit in this explanation, but it is a significant fact that the

threatened stagnation in steam railroad building does not extend to the electrical field. On the contrary, in this new department there is now greater activity than ever before in its history, and the magnitude of the undertakings of to-day surpass anything seriously considered a few years ago. Besides, it is recognized and admitted that electricity is supplanting steam in much of the new work and in service that was formerly considered safe from invasion. The real significance of the tendency to adopt electricity upon interurban and suburban lines and employ it in operating feeders and branches of important steam lines is that it points to the inevitable extension of the electric equipment to the working of the entire system. The suburban and interurban field is being given over gradually, but surely, to electrical operation, just as the street railways have been, and in many districts this has naturally resulted in the development of freight and express service in connection with the passenger traffic. Of course, these changes involve radical departures from street railway methods of construction and operation. New conditions have to be met and the special requirements of the new field must be carefully studied. How sucessfully the problems have been solved is shown by the equipments of numerous roads for heavy service in various parts of the country. The development of this department is now uppermost in the minds of electrical engineers, and while it may be said that the progress thus far made has been mostly in timid, faltering steps, the experience gained has indicated such vast possibilities that we may confidently expect to see further advancement made in sturdy strides. This may result in a still greater diminution in new mileage of steam roads, and in the transformation of many of the present lines into complete electrical systems. Of course, this is not the task of a day, but its ultimate accomplishment is confidently expected by every electrical engineer.

Steam and Electric Suburban Service

The suburban passenger business of steam roads is just now at a critical point, and the same might be said regarding local passenger business where it is of sufficient volume to be of any importance. It has been evident to observers of the passenger traffic situation throughout the country that the electric railway is gradually developing to a point where it is securing a larger and larger proportion of the local passenger business, and that instead of meeting the issue and providing some permanent policy for relief the steam roads are relying upon an impracticable and unpopular plan of opposition to all advancement.

The first electric railways for city or interurban service were comparatively short and made slow time, according to the present standards. Therefore they affected steam road business only between a few points, and these were located only short distances apart. But the length of electric interurban roads is increasing, as is also their schedule speed. They are, it is true, creating new business to a large extent, but they are also taking away profitable business from steam roads, as is clearly shown by the changes in the suburban train time-tables in many localities. We do not presume to say that steam railroad companies have been entirely to blame in allowing their suburban and local traffic to go to electric suburban and interurban lines; that is a question for them to decide. It is for them to say, also, whether their through freight and passenger business is of such importance, and their track and terminal facilities are so limited, that it is impossible to cater to local and suburban passenger and express business. The steam railroad companies have, to be sure, obstructed efforts to build parallel electric lines in many cases, and it is manifest that at best such efforts can only afford them temporary relief. It is too evident to require further argument that the only way in which local and suburban passenger and express business can be retained by the steam railroads is by giving the public as good service, if not better, than can any electric road operating in the same territory. In the present state of the art this can only be done by the adoption of electricity for handling such business and by introducing radical changes in methods of operation.

Steam roads do not seem to have made any serious effort to get out of the rut of steam operation, and the building of high-speed electric roads goes merrily on, invading more and more sacred steam territory every year. In Chicago, the Aurora, Elgin & Chicago Railway is about to offer a suburban service superior in every way to that of the established steam railroads with which it competes, and these roads, too, have been noted for the excellence of their suburban service. In New York the New York & Port Chester Railway is preparing to put up a similar competition against established steam roads, and the result will doubtless be the same. These are only the two latest and most notable instances of the electric railway entering steam suburban fields. The day is surely coming when the present so-called competition between electric railways giving a local service and roads adapted to high-speed service with infrequent stops will be changed into a co-operation which will be beneficial to all parties concerned. Both classes of service are absolutely necessary, and unless the steam roads meet the exigencies of the situation soon they are lost.

When a passenger patronizes a high-speed line with infrequent stops and then consumes a large amount of time in walking from a station to his ultimate destination there is a waste of time which is as unjustifiable as if he had boarded a car on a line giving local service and stayed on that car until such time as it arrived at a distant point. In other words, there is room in every populous community for two classes of service, a high-speed express service and the local service, whether these be given on the same tracks or whether they be given by two distinct companies. It does not require any great reasoning power to recognize the fact that the passenger traffic can only be developed to its highest perfection when the local and through services are operated in harmony. We have in mind a certain magnificent suburban territory through which an electric line operates side by side with an excellent steam road. Such an arrangement would be almost ideal were the two roads to co-operate. The suburban territory in question, like many others, is scattered along the entire length of the line rather than concentrated at particular points. The electric road being built to land passengers at any street crossing is a great convenience to those living at a distance from the stations of the steam road, while the location of the electric line alongside the right of way of the railroad is very satisfactory from a suburban property-holder's standpoint who does not like to have his village cut up with many railway lines. In the case under consideration, the unfortunate thing about the arrangement for the steam road is that when passengers once board the electric car near their respective homes they are inclined to remain on

the car until it has proceeded a considerable distance toward the city before changing to the steam railroad, and no small numbers escape to other lines of transportation, although many take the steam trains at some of the more important stations where the fastest steam trains stop. If the two roads were worked more in harmony as to time-tables and rates of fare it would profit both, provided, however, the service on the high-speed or steam railroad was as frequent as that on the local lines. In other words, in order to make such a plan most profitable and best suited to the needs of the public the steam road should adopt electric traction, which would allow it to give a more frequent service at a profit. The only obstacle at present in the way of profitable co-operation between electric and steam railways which are parallel is the lack of frequent service on the steam roads and the lack of terminal facilities acceptable to suburban passengers in the largest cities. To overcome this latter difficulty, co-operation with the local surface and elevated lines should prevail at the downtown terminus as well as out in the suburban territory; and this, too, would be feasible with electricity, but not with steam.

Whether steam roads will awaken to the situation soon and save their suburban and local traffic by adopting electricity for that purpose is a matter of speculation. From their conservatism in this respect in the past, and the willingness of capital to go into the building of new electric interurban roads for such traffic, it is reasonable to assume that before steam roads make the necessary radical changes parallel electric lines will have covered the field. It is but natural that steam railroads should place their through freight and passenger business above anything else. They would be foolish to jeopard it for the sake of local business, if one would have to be sacrificed. The steam roads, however, should realize that they must either prepare to adopt a frequent service for local traffic, such as electric traction makes possible, or step aside and let others handle it. We have a firm belief that such a supplementary electric service could advantageously be given in connection with through steam service in very many cases in spite of the present indications that it will not be done.

Electric Railroading Before the Institute

This year's convention of the Institute at Great Barrington will be remembered because of the prominence given the subject of electric railroading and the special interest attached to the papers in this field. A day was devoted to consideration of these contributions, and it is not too much to claim for it the distinction of being the most interesting and instructive session of the entire meeting. Mr. Arnold's paper upon the New York Central work has already received attention, as has also his announcement of the completion of his preliminary experiments in the development of a system of heavy electric railroading employing a single-phase motor. Two other papers of great practical value and scientific merit were contributed by Messrs. Arnold and Potter and Mr. Mailloux.

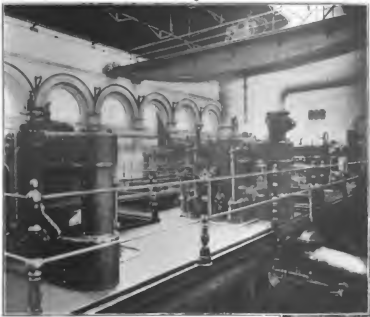
The paper by Messrs. Arnold and Potter should really be read in conjunction with Mr. Arnold's paper on the New York Central plans, as the investigations which it records were primarily made to secure special data upon which to base recommendations in connection with the Central's plans. In this paper a careful study is made of the relative merits of steam locomotives and electric motor cars for acceleration in fast suburban service, and what might properly be called heavy trunk line traffic. The comparison was made with a powerful consolidated engine designed especially for this work, and the results are consequently of greater value than they would be had the test been made with an ordinary locomotive not especially selected because of its adaptability to this work. The result was entirely satisfactory from the standpoint of the electrical engineer. The electric cars were equipped with motors of ample power, and their weight was concentrated upon the driving wheels. They made a much better showing than the locomotive in accelerating trains of equal weight, giving a greater maximum draw-bar pull, keeping up the work and giving quicker acceleration and lower maximum speed for the same schedule than in the case of the locomotive. Some very interesting data is presented upon the energy consumed, and the cost of steam locomotive service is included in this paper. Not the least important feature is the fact that the locomotive showed a marked tendency to lose steam pressure rapidly under continued effort. Every result of the investigation in this particular is favorable to electric traction, although the conditions under which the investigation was conducted were far from ideal. Under the circumstances, this showing is, of course, particularly gratifying, as it justifies electrical engineers in anticipating greater victories under conditions better suited to electric service.

Mr. Mailloux, in his paper on "Plotting Speed—Time Curves," called attention to the fact that the advent of electrical engineers in this department was marked by a substitution of rational for empiracal methods and standards. The author's purpose is to facilitate the use of speed-time curves as a method of precision by simplifying their application to practical work, and he has gone into a very careful and comprehensive investigation of the subject. It is shown in the course of the discussion that any force concerned in the movement of a train may be expressed in terms of an equivalent acceleration, and the theorem is developed that the effective acceleration in any concrete case is equal to the algebraical sum of the accelerations which will be produced by each of the forces acting independently and alone, and is consequently equal to the algebraical sum of the differential co-efficients due to these forces. The first subdivision of the subject in the body of the paper is on the analysis of train motion, followed by the specific analysis of the different forms of variable motion, including positive acceleration, and the two forms of negative acceleration, corresponding to the motion of trains while drifting and braking. The second subdivision of the subject is on the plotting of speed-time curves, beginning with certain preliminary considerations, and then discussing separately the plotting of acceleration curves, drifting curves and braking curves. In this portion of the paper the author, after briefly referring to two other methods of plotting these curves, describes a new simple graphical method of plotting speed-time curves of all kinds, based upon the theorem referred to, and also upon a formula for the time values corresponding to speed values. The first installment of this paper is presented in this issue, and the brief outline here given of the salient features will show that it is really a very valuable contribution to the literature of the subject, and is worthy of careful study.

The Cardiff Corporation Tramways

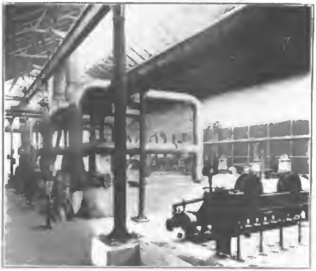
The county borough of Cardiff, the metropolis of the Principality of Wales, had a population at the last census of 164,315. The value of taxable property is about $5,000,000, and the area of the municipal borough is 8408 acres or 13.13 square miles. That Cardiff is a growing town is shown by the fact that during the last twenty years the population has just doubled, the population in 1881 being 82,671, while at the same time the taxable values have nearly trebled.

The corporation in 1898 promoted a bill in Parliament seeking powers to borrow money for various purposes, including the purchase of Cathays Park, consisting of 60 acres of land from the Marquis of Bute, the erection of a new town hall and law courts, street improvements and the construction of tramways, and the purchase of land for buildings in connection therewith. This bill in due course received the royal assent, which enabled the corporation to proceed with the various works. The amount of money sanctioned in the bill to be borrowed by the corporation for tramway purposes was about $800,000 for permanent way construction and for the purchase of lands for power station and car houses. The period for repayment was fixed by the act at sixty years for lands and thirty years for buildings.



All other monies to be borrowed for tramway purposes, such as plant and equipment, cars, etc., was to be such as might be sanctioned by the Board of Trade. W. Harpur, Esq., M. I. C. E., the borough engineer of Cardiff, acted as engineer to the scheme during this important period.

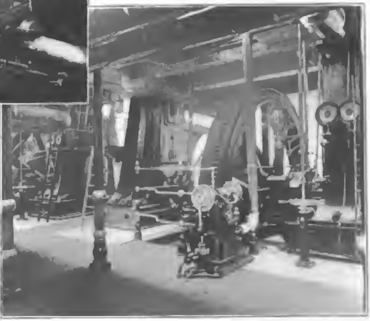
During 1899 the chairman and deputy chairman of the tramways committee and the borough engineer, acting on instructions from the Council, visited all the important tramway systems in the kingdom, and presented a lengthy and detailed report thereon, with the result that the Council finally decided to adopt the overhead system of electrical traction in preference to any other, although at one time the conduit system was suggested, and, in fact, the estimates placed before Parliament in the corporation bill were based on this system. The first important matter to be dealt with by the corporation was the purchase of lands for power station and car houses. Four sites were purchased for these



STEAM PIPING OVER BOILERS

purposes. Two are at the eastern end of the borough and are occupied by the power station and main car house, one is at the western end, and used by the district car house already constructed there, and the fourth at the southern part is held for the building, when needed, of another district house.

In June, 1900, Arthur Ellis was appointed electrical engineer to the tramways department and took up his duties in September of the same year. In the month of December following he was appointed borough electrical engineer and manager of the electric lighting and tramways undertakings of the corporation. Immediately after taking up his duties in connection with

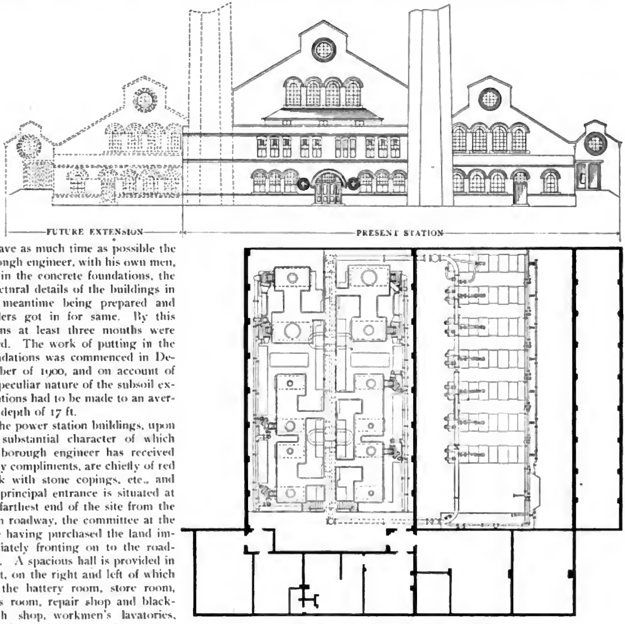


THE ENGINE ROOM ABOVE AND BELOW

the tramways he prepared details of his requirements in connection with the power station, in order that the

work might be proceeded with without delay, this being the most important matter to be dealt with. Upon receiving these details of requirements Mr. Harpur, the borough engineer, who has acted as architect for all buildings in connection with the undertaking, immediately proceeded to prepare the plans of the building, Mr. Irwin acting as clerk of the works.

As soon as the foundation plans were ready and in order to save as much time as possible the borough engineer, with his own men, put in the concrete foundations, the structural details of the buildings in the meantime being prepared and tenders got in for same. By this means at least three months were saved. The work of putting in the foundations was commenced in December of 1900, and on account of the peculiar nature of the subsoil excavations had to be made to an average depth of 17 ft.



PLAN AND ELEVATION OF POWER STATION

The power station buildings, upon the substantial character of which the borough engineer has received many compliments, are chiefly of red brick with stone copings, etc., and the principal entrance is situated at the farthest end of the site from the main roadway, the committee at the time having purchased the land immediately fronting on to the roadway. A spacious hall is provided in front, on the right and left of which are the battery room, store room, mess room, repair shop and blacksmith shop, workmen's lavatories, etc. Immediately over these rooms are the offices of the station staff, comprising in all five large rooms complete with lavatories, a bath room, etc. The offices are reached by means of a staircase leading from the main entrance hall, as well as from the switchboard gallery in the engine room.

The engine room and boiler house are situated immediately behind the offices. The former is a fine, large room, provided with excellent ventilation. It is 104 ft. long, 60 ft. wide and 56 ft. high and is lined throughout with cream-colored glazed brick. At intervals along the side walls substantial piers with semi-circular arches are provided, upon which the rails for the traveling crane are fixed. On one side is the boiler house, of the same length as the engine room, and 46 ft. wide and 48 ft. high. The walls of the boiler house fronting the boilers are lined with cream-colored glazed bricks, which give a very clean appearance. The front portions of the boiler settings are also lined with glazed bricks. Immediately to the side of and adjoining the boiler house is provided a building running its full length, into which the coal trucks are brought directly from the railroad siding. From this building the coal can be tipped either into the bunkers above the boilers or into the coal storage below the level of the tracks.

The roofs throughout are supported by mild steel principals and framing of neat design, composed of angles and flat tie-bars. The buildings have been erected by W. Symonds & Co., the whole of the steel work being provided by A. D. Dawnay & Sons, Ltd., of Cardiff, as sub-contractors. The stack is situated at the front end of the building, and is 160 ft. high, it is built of red brick and is octagonal in shape. It is surmounted by a very heavy granite capping, made up of eight stones, each weighing a ton and a half, and the hoisting and fixing of these heavy stones was a matter of great difficulty. The stack was erected by Clark & Co., of Cardiff.

Mr. Ellis, in arranging these buildings, fixed their position in such a way as to leave room on the other side of the engine room for an exact duplicate of the boiler house and coal bunkers. When this addition is completed, therefore, the engine room will be between two boiler houses. These extensions he expects will be required at an early date, and the present buildings are all finished off with temporary brick ends, awaiting this enlargement of the capacity. The dotted lines in the accompanying engraving indicate the proposed extension. There is sufficient room also on the present site to extend the buildings a further 300 ft., with two additional stacks at the ends.

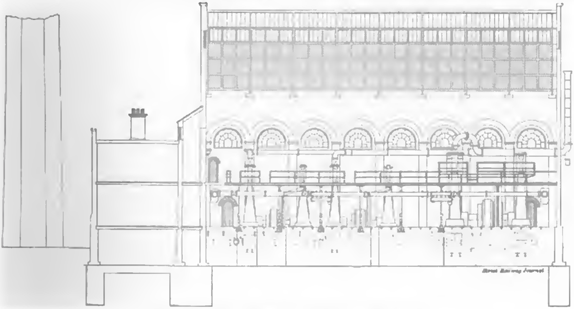
At the end of the building and in front of the offices a large cooling pond is being provided for condensing purposes. The water in the pond is drawn from a fresh water brook running along one side of the main building and dividing the power station site from that of the main car house. Mr. Ellis intends, when necessary, to erect cooling towers over the pond, which has been built with this end in view. The construction of the pond is very substantial, and has been carried out by the Department of Public Works, under the direction and supervision of the borough engineer, who prepared the detailed drawings to meet the requirements supplied to him by Mr. Ellis.

POWER STATION EQUIPMENT

The present power-station buildings, it is expected, will be fully equipped during the present year. At the present time there are in the engine room four engines each of 500 hp, and two more on order of 1600 hp each. The engines are supplied by John Musgrave & Sons, Ltd., of Bolton, Lancashire. They are all of the inverted vertical cross-compound condensing type and of heavy design. They work under a steam pressure of 140 lbs. per square inch, and run at a speed of 100 revolutions per minute. Each engine is fitted with its own condenser, driven by side levers from the crossheads. The air pumps of the smaller sets are are fitted with Corliss-valve gear on both cylinders, worked by means of eccentrics fixed to the crankshafts. Each engine is provided with Musgrave's patent automatic cut-off motion, connected direct to the governor. The engine is entirely closed, and forced lubrication is applied to the

THE POWER STATION

crank shaft necks, crank pins, crosshead pins, slide blocks and eccentrics by means of two ram pumps, fixed on each side of the engine. The governors are of the quick speed type, driven by ropes from the crankshafts. Means are also provided so that the speed can be altered by hand whilst



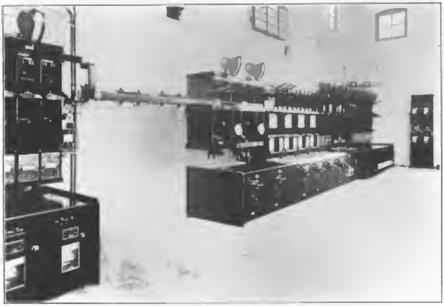
CROSS SECTION OF ENGINE AND DYNAMO ROOM

25 ins. in diameter, 12-in. stroke, and the condensers are all of the injector type, with suitable water regulators. On the large sets there are two air pumps, each of 30-in. diameter. The condensers are placed below the engine room floor level, and immediately at the rear of each engine.

Each engine is provided with steam-driven barring gear. They are capable of withstanding an overload of 25 per cent for two hours, and 50 per cent for short periods. They the engines are running, the governing variation from no load to full load being 2½ per cent. The cylinders are of hard, sound metal, the high-pressure cylinder being 17½ ins. in diameter and the low-pressure cylinder being 35 ins. in diameter, both having a stroke of 3 ft. The piston rods are 4 ins. in diameter and are fitted with United States metallic packing. The crankshafts are made of hollow Siemens-Martin steel, 12½ ins. in diameter and 15 ins. at the wheel

boss. The flywheels are 16 ft. in diameter, made in halves. They have a weight of 14 tons in the rims alone, the total weight of each wheel being 35 tons.

The larger engines, which are to come, have cylinders of 38 in. and 58 in., with a stroke of 42 ins.; piston rods 6 in. diameter and 6½ in. diameter, and crankshafts 18 ins. in diameter and 23 ins. at wheel boss. The flywheels are 19 ft. in diameter, built up in sections, with a weight of 38 tons in the rims and total weight of 75 tons each.



SWITCHBOARD FOR BOTH LIGHTING AND TRACTION CIRCUITS

Each engine is fitted with a neat and substantial packing stage, with ornamental hand rails and pillars. Every facility is therefore furnished for getting at cylinders, valve gear, etc., and the platforms are all coupled together so that the attendants can get from one engine to any other with ease.

The four generators at present installed were supplied by the British Westinghouse Electric & Manufacturing Company, Ltd. They each have an output of 300 kw, and are capable of withstanding overloads of 25 per cent for two hours, and 50 per cent for short periods, without sparking and without movement of the brushes. The generators are of the multipolar type and mounted directly on the shafts of the engines, in between the high and low pressure sides. The armatures were forced on to the shafts under pressure of 70 tons. The generators work as compound machines on tramway loads at pressure of 500-550 volts, and as shunt machines on lighting loads at a pressure of 460-500 volts.

The two large generators on order are being supplied by Dick, Kerr & Co., Ltd., of London. They each have a capacity of 900 kw, and are being made to meet the same conditions as those already installed, and will be mounted on to shafts in a similar manner.

There is also in the engine room an 80-kw motor-generator, which works in conjunction with a battery of accumulators and serves several purposes. It receives current from the main tramway bus-bars at 500 volts, and gives out current at a pressure of 100-140 volts for charging the battery or supplying the works lighting independently. The lighting circuits can also be supplied directly from the battery when the motor generator is not working.

When worked in the reverse order the motor-generator can receive current directly from the battery at 100 volts, and give off current at a pressure of 500-550 volts. By this means it is possible to switch the cars in the car houses when the main plant is shut down, and to work the various motors in the power station in connection with the mechanical stokers, etc., when raising steam in the boilers previous to starting up the plant. It is also used for running any specially early cars or repair cars for night work on the overhead equipment. The motor generator was supplied by Bruce, Peebles & Co., of Edinburgh, and consists of two generators coupled together with a flywheel weighing one ton between, and mounted on a common bedplate. The

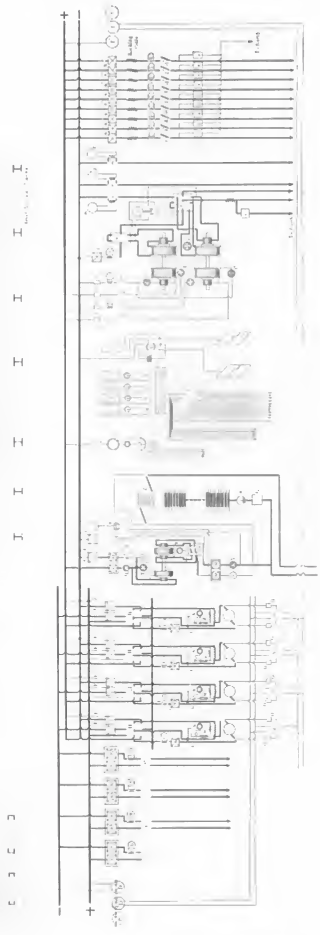
		Amperes	Volts
A	Automatic circuit breaker	600-1,000	500
B	Ammeter (Weston type)	1,000	.
C	D. P.—S. T.—Q. B. switch	1,000	...
D	Voltmeter (illuminated dial)	....	0 & 600, 0—600
E	Watt meter (recording)	1,000	....
F	Tumbler switch	5	200
G	Fuse with magnetic blow out	5	500
H	Q. B.—D. T. switches	1,000	...
I	Ammeter illuminated dial	1,000	....
J	Automatic circuit breaker	1,200-800	600
K	Field switch	25	.
L	8 c. p. lamp	...	
M	Non-inductive resistance 1,333 ohms	5	500
N	D.P.—D. T. voltmeter switch	5	500
O	Recording Watt meter	400	
P	Single pole circuit breakers	200-400	600
Q	Starting resistance	......	...
R	Ammeter	0-400	
S	Voltmeter	......	600
T	Shunt regulating resistance (field)	...	......
U	Field regulating resistance	.....	....
V	Series parallel switch	1,000	100
W	Single pole. Auto circuit breakers	500-1,000	100
X	Ammeter	1,000	
Y	Starting rheostat	......	......
Z	Charge and discharge switch (10 way)	1,000	

		Amperes	Volts
a	Ammeter (polarised)	1,000-0, 1,000	
b	Automatic cut-out	1,000	
c	Magnetic blow out fuse	10	
d	Ammeter. Two scales	0-10, 0-5	
e	H. T. switch	10	
f	12 way contact switch	10	
g	Recording voltmeter		10
h	Plug connections	5	
i	Bus bars with plug connections	5	
j	4 volt accumulator	10	4
k	Recording ammeter	0-50	
l	Two way d. p. switch	30	
m	Magnetic blow out fuse	75-100	
n	Ammeter	0-100	
o	Starting resistance (for motor)		
p	Field regulating resistance		
q	Auto circuit breaker	600	...
r	Ammeter		
s	D. P. throw over switch	600	
t	Triple pole throw over switch	600	
u	Booster field regulating resistance	...	...
v	Voltmeter		135
w	Ammeter	800	
x	S. P. switch	600	
y	Ammeter	1,500	
z	Ammeter	1,500	

		Amperes	Volts
a'	Automatic circuit breaker	400-800	
b'	Kicking coil	600	..
c'	Ammeter	600	
d'	S. P.—Q. B. switch	600	
e'	Thomson-Houston lightning arrester		
f'	Voltmeter		0-600
g'	S. P.—Q. B. switch	100	....
h'	Recording voltmeter	.	400-500
i'	H. V.—S. P. switch	5	
j'	D. P.—Q. B. switch	200	.....
k'	Magnet blow out fuses	200	
l'	Magnetic blow out fuses	100	....
m'	S. P.—Q. B. switch	100	....
n'	Starting resistance	.....	....
o'	Field regulating resistance	.....	......
p'	Magnetic blow out fuses	25	....
q'	D. P.—Q. B. switches	25	
r'	Ammeter	600	..
s'	D. P.—4 way switch	5	.....
t'	D. P.—2 way switch	5	.....
u'	Voltmeter	....	0-800
v'	Recording voltmeter	.....	400 to 480
w'	S. P. switch	1,500	...

REFERENCES TO LETTERS ON DIAGRAM ON OPPOSITE PAGE

ELEVATION AND DIAGRAM OF SWITCHBOARD



low-tension has a double-wound armature and is furnished with the commutator at each end. The reason for the double-wound armature on this side of the apparatus is to get the maximum output of the machine and to run the set at a constant speed.

To enable the low-tension side to generate an output of 600 amps., at 140 volts or 84 kw, the high-tension side requires an output of 100 kw, at 500 volts running at 500 r. p. m. With double-wound armature and a pressure of 100 volts supplied to the low-pressure side of the two armatures in parallel the set is driven from the battery at a speed of 600 r. p. m., and the high-tension side generates its full output of 170 amps. at 500 volts or approximately 84 kw. The motor-generator can by this arrangement always be worked at its highest efficiency without any weakening of the fields except the small amount necessary to reduce the voltage on the low-tension side, as a dynamo, from 140-100 volts.

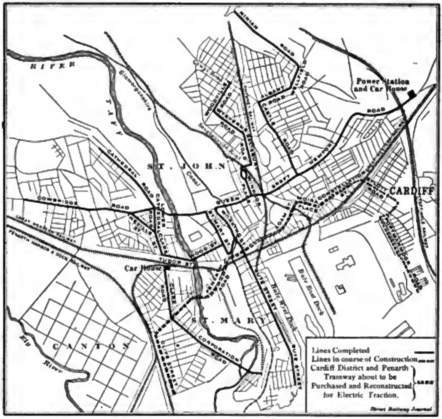
The battery of accumulators, which is placed in a room adjoining the engine room, was supplied by the Tudor Accumulator Company, and consists of fifty-six cells with thirty-one plates in each. The cells themselves consist of lead-lined wooden boxes, supported on oil insulators. The capacity of the battery, at different rates of discharge, is as follows:

2100 ampere-hours when discharged at 210 amps.
1800 ampere-hours when discharged at 360 amps.
1620 ampere-hours when discharged at 540 amps.

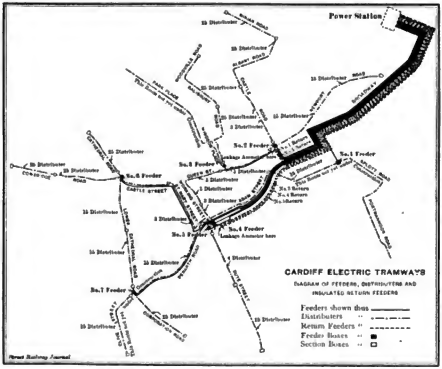
The normal rate of charge is 300 amps., and the maximum rate of charge 375 amps. The duties of the battery, as previously mentioned, are the lighting of the power station and car house and the supply of current to the works generally.

In the engine room there is a 20-ton traveling crane, supplied by Joseph Booth & Bros., of Leeds, which can operate the whole length of the building. It is intended to eventually equip the crane electrically, but at present it is operated by hand. The span is 60 ft. and the lift 35 ft. The crane is fitted with platforms and handrailing on either side, running its full length.

Down the center of the engine room, between the two rows of engines and generators, there is a gangway supported by means of ornamental columns, the gangway being 12 ft. above the engine room floor level. This gangway is coupled up to the stagings around the various engines and also leads on to the switchboard gallery at one end of the



MAP OF CARDIFF TRAMWAY SYSTEM



ELECTRICAL DISTRIBUTION SYSTEM

room. It is approached at the switchboard and by means of a double staircase from the engine room floor and a staircase at one side of the gangway at the opposite end of the engine room. The whole of the upper gangway is protected by means of ornamental columns and handrailing of similar design to those on the stagings of the engines mentioned above. This central gangway serves two purposes, the easy access to the cylinders and valve gear and the carrying of the main steam pipes running down the center of the room, which are supported by carriers on the underside of the gangway.

The main switchboard is built direct into the main wall at one end of the engine room, and stands back in a recess, taking up 42 ft. of the total width of the room. Immediately in front of the board there is a clear space 10 ft. in width. The gallery is carried right through into the boiler house and to the coal bunkers beyond, so that the engineers in charge can control the whole station with the smallest amount of trouble.

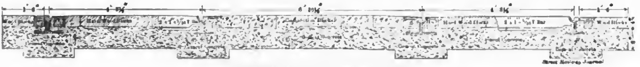
The switchboard is of the standard Ferranti pattern, and consists of ten feeder panels, each of 600 amps capacity; two return feeder panels, each 1500 amps capacity; one positive booster panel, one negative booster panel, three panels for motor generator and battery, one Board of Trade panel, four 300-kw generator panels, two 900-kw generator panels, four panels for controlling supply of current for private and public lighting and power purposes, each of these panels having a capacity of 1000 amps.

On the front there is a table standing out from the board 2 ft. 6 ins., upon which the field-regulating and motor-starting switches are placed, the resistances being below the board. There are also four panels on the front of the table for controlling the works motor, battery, regulating cells, etc. There are two independent sets of main bus bars for controlling the traction and lighting loads, each of the bars having a cross section of 6 sq. ins.

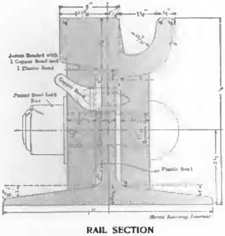
All the switches are designed for a current density of 60 amps per square inch of contact area. Each panel is fitted with an automatic circuit breaker of the Ferranti pattern, and the various indicating instruments are of the edgewise type. The recording instruments were supplied by Elliott Bros., the wattmeters being of the Thomson type. There are three Weston-type illuminated dial voltmeters at each end of the board for lighting and traction purposes. An independent switchboard has been installed for controlling the lighting circuits of the station.

In the boiler house there are at present fixed four Lancashire boilers, 30 ft. x 8 ft., with provision for three more of similar sizes, which are being erected. The boilers were supplied by John Musgrave & Sons, Ltd., and are made for a daily working pressure of 150 lbs. per square inch. Each boiler has two flues with five cross tubes in each. The fittings were supplied by Messrs. Hopkinson, and are of their latest type. At the rear end of each boiler there is a superheater of the Musgrave type, so arranged that it can be easily removed for inspection, the steam in the meantime going directly to the main steam header. At one end of the boiler house there is a Green economizer, consisting of 288 pipes, built into a by-pass from the main flue.

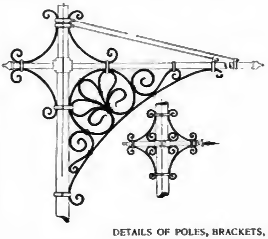
The mechanical stokers, which, together with the metal coal bunkers, ash conveyor and elevator, were supplied by T. & T. Vicars, are of the coking type, and hoppers are taken to each from the coal bunkers above. The ash conveyor is of the screw type, working in a trench in front of the boilers and independent of the blow-off trench. The elevator is fixed at one end of the boiler house. The general arrangement is such that a minimum amount of fuel handling is necessary. The coal is brought directly from the colliery and passes over the railway siding from the main line. It is weighed on a weighbridge at the entrance to the power station yard, and the trucks are delivered into the boiler room annex, where the coal is either put into the coal bunkers over the boilers or into the storage room below, which runs the full length of the building and is connected to the boiler house by sliding doors fixed opposite each boiler. The fuel is only used from this store when

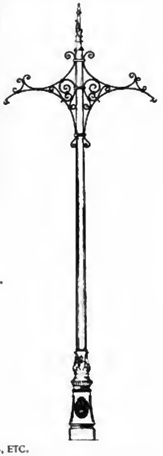


CONSTRUCTION OF PERMANENT WAY



RAIL SECTION





DETAILS OF POLES, BRACKETS, ETC.

hand firing is necessary. The ashes are withdrawn from the fires, dropped through grids in the floor of the boiler house to the conveyor, and delivered into a hopper at one end, where they are taken up by the elevator and delivered either into railway trucks or carts.

There is room for twelve feed pumps in the pump room, which is at one end of the boiler house and immediately under the repair shops. At present there are but two in-

engine room consist of two 14-in. pipes, supported by the central gangway.

There are separators at either end between the boiler house piping and engine room piping.

There are also expansion bends and separators in the center house. The steam branches to the engines are 6 ins. in diameter.

All of the separators are drained through Geipel steam

STREETS BEFORE PAVING, SHOWING HANDSOME SPECIAL WORK

stalled and one on order. The pumps were supplied by G. & J. Weir, of Glasgow, and are of the vertical direct-acting type, capable of delivering each 6000 gallons of water per hour against a pressure of 160 lbs. per square inch.

The whole of the steam, exhaust, injection and overflow pipes, and also the auxiliary and feed pipes, were supplied by the Sir Hiram Maxim Electrical & Engineering Com-

traps and delivered into a main drain pipe, which runs back to the cooling pond. All of the valves were supplied by Messrs. Hopkinson, of Huddersfield. A duplicate system of 4-in. auxiliary steam pipes is provided for the pumps with separators and drains. The steam pipes as well as the engine cylinders are covered with non-conducting cement and finished off with planished steel with bright steel bands

VIEWS IN CARDIFF AFTER OPENING TRAMWAY SYSTEM

pany, Ltd., of London, which has also on order the pipe extensions for the two large engines and three boilers. This firm also supplied the central gangway and switchboard gallery in the engine house. The steam pipes are made of best wrought steel and other pipes of cast iron. The main steam pipes in the boiler house are 18 in. and 14-in. diameter, and are coupled to each boiler by means of a 7-in. branch, from which there is also a 7-in. by-pass to the superheaters. The main pipes are coupled up to separators at each end of the boiler house. There is a large expansion bend in the center of the boiler house, and the leaders in the

at the joints. The cast-iron exhaust pipes are carried the full length on each side of the engine room, and are supported by means of brackets and hangers and fixed immediately below the crane gantry. The pipes at one end of the room are 12-in. diameter, increasing to 22-in., with 12-in. branches to each engine; 18-in. branches are provided for the large engines not yet installed. There is an automatic valve between the main exhaust and each engine. The injection and overflow pipes are fixed below the engine room floor level and coupled up to the condensers, and there is a duplicate system of feed-water pipes of cast-iron,

which deliver to the boilers either directly or through the economizers. The blow-off pipes for the boilers are fixed in a trench in front of the boilers and deliver into a tank at one end, from whence the water is pumped up into the brook, the boiler house being below water level. A complete system of drain pipes from all parts of the station is provided, and the water delivered into the cooling pond.

The engine room floor is chiefly constructed of cast-iron plates, which can be easily removed for getting at the pipes, etc., with mosaic work around each engine and at one end of the room. The cooling pond, mentioned above, has a capacity of over one million gallons, and is being made by the Public Works Department of the corporation, under the direction of the borough engineer. The whole construction is of concrete. The water from the condensers is delivered into a hot well at one side of the pond, and the injection

At one end there will be an electrically-driven transfer table or "traverser," operating the full width of the shed, for taking cars either from one track to another or into the repair shops beyond. The pit in which it runs is 25 ft. wide. The repair shops consist of a machine shop 120 ft. x 60 ft., painting shop 90 ft. x 33 ft., blacksmith shop 29 ft. x 25 ft., and carpenters' shop 29 ft. x 25 ft., together with rooms for the men, oil storage, sand storage, etc. The foreman in charge of this part of the shed has an office between the paint and machine shops, with glass windows on all four sides, so that he has a complete view of the whole building from his office. The contractor for this building was D. W. Davies, who also built the car house at present in use at the opposite end of the town, which has accommodations for thirty-two cars. The lighting arrangements and tool equipment of both sheds is being carried out by the staff of the

SOME TYPES OF OVERHEAD CONSTRUCTION

water is taken from a point where the water is coolest. The pond is so constructed into two sections by means of a substantial wall that one-half can be shut off for cleaning purposes at any time. If, at some future date, cooling towers are necessary they can be built over the pond as stated.

The lighting of the power station, which has been carried out on a large scale, was done by the men of the electric lighting department, under Mr. Ellis. A complete set of engine room signalling apparatus is fixed and controlled from the switchboard gallery, there being three illuminated signal boards at different points of the room, one at each end and one below the central gangway.

MAIN CAR HOUSE

Adjoining the power station and on a site of two acres, which is divided from it by the Roath Brook, is the main car house, which, when completed, will accommodate 100 cars. The main portion of the building consists of four bays, each 320 ft. long, with three tracks in each. The total width is 136 ft. At the side of the shed there are offices for the shed foreman and timekeeper, together with men's lavatories, etc. The foreman's office is on the first floor and overlooks the interior from the large bay windows, standing out into the storage room. On this floor are also offices for clerks, engineers, etc. The whole of the shed flooring and tracks are supported on columns, leaving a clear space under the cars 4 ft. deep.

tramways department under Mr. Ellis, while the borough engineer has acted as architect in both cases.

PERMANENT WAY

Cardiff is an ideal town for tramways, being practically flat and having only four gradients in the whole system, the worst of which is one in twenty. On the other hand the tramways are handicapped to some extent by very low railway bridges, which necessitate the reduction of headroom inside the cars, and on two routes the use of single deck cars. Fortunately on the main line, that going to the docks, where most of the cars run, it has been possible to lower the roadway 15 ins., giving sufficient headroom under the bridge on this route for the use of double deck cars. The sharpest curve on the system is of 40-ft. radius.

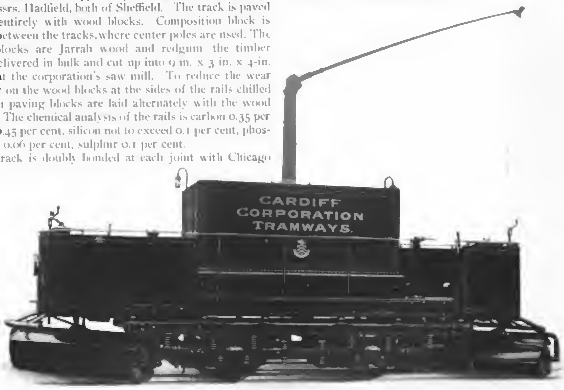
Girder rails have been used 45 ft. long, having a weight of 100 lbs. per yard. The rails are 6½ in. in depth with a 7-in. flange, the groove of the rail being 1¼ ins. wide by 1¼ ins. deep. The rails are laid in a concrete bed 11 ins. deep and 1¾ ins. wide, the depth of concrete under the other portions of the track being 8 ins. The rail joints are made by fishplates, weighing 64 lbs. per pair, with six 1-in. bolts and patent lock nuts. The joints are further secured by sole plates, 2 ft. x 11 ins. and ⅝ in. thick, secured by four single and two double clips by ¾-in. bolts and nuts. The tie-bars used were especially designed by Mr. Harpur, the borough engineer. The rails being 6½ ins. deep and the paving bricks only 4 ins., enables the rails to be buried in concrete to a

depth of 2½ ins. The accompanying cross section view of the track shows the various details of construction.

The rails were supplied by Dick, Kerr & Co., and Bolckow, Vaughan & Co., of Middlesborough. The points and crossings have been supplied by Askham Bros. & Wilson, and Messrs. Hadfield, both of Sheffield. The track is paved almost entirely with wood blocks. Composition block is placed between the tracks, where center poles are used. The wood blocks are Jarrah wood and redgum the timber being delivered in bulk and cut up into 9 in. x 3 in. x 4-in. blocks at the corporation's saw mill. To reduce the wear and tear on the wood blocks at the sides of the rails chilled cast-iron paving blocks are laid alternately with the wood blocks. The chemical analysis of the rails is carbon 0.35 per cent to 0.45 per cent, silicon not to exceed 0.1 per cent, phosphorous 0.06 per cent, sulphur 0.1 per cent.

The track is doubly bonded at each joint with Chicago and plastic bonds. Neptune bonds are also used. It is cross-bonded every 80 yards.

The track construction was commenced in one of the new routes in December, 1900, and a portion opened for horse tramway traffic in June of the next year, when the Royal Agricultural Show was held in Cardiff. Several other new routes were completed during this year, the work being done for the tramways department by the public works department of the corporation. On December 12, 1901, after long negotiations with the Cardiff Tramways Company, Ltd., terms were arranged whereby the company agreed to hand over its lines to the corporation at 12 p. m. on December 31, 1901, the sum paid for the lines being £50,000. The corporation also took over fifty-two cars and 342 horses, for which it paid £15,644, and there still remains to be paid to the company the sum to be agreed upon for the purchase of three car houses.



TRACK SWEEPER AND SPRINKLER

In the meantime the borough engineer had prepared plans for the reconstruction of the whole of the company's lines, representing 12 miles of single track. Long discussions took place as to whether the work should be done by contract or by the corporation's own men. One firm offered to do the whole of the work for a stated sum and to complete the work in six months with the usual allowance for bad weather, traffic, etc. The borough engineer stated that he could not only do the work in the same length of time but for less money, and the work was taken over by the corporation. It is greatly to Mr. Harpur's credit, therefore, that on May 1 eleven out of the twelve miles were opened for traffic,

PLAN OF CAR HOUSE

whilst the rest of the twelve miles was completed on May 16, or one month less than the time guaranteed.

The cables are of the single-conductor, plain lead-covered type, drawn into Doulton's earthenware conduits. There are seven main feeding points on the system, the feeders varying in section from .6 sq. in. to .4 sq. in., there being five .6 sq. in., one .5 sq. in. and one .4 sq. in. feeders. These feeders run direct from the power station to feeder pillars and are not tapped at all between these terminals. The feeder pillars are of special design made by Mr. Ellis and contain one main feeder switch of 600 amp. capacity and four switches of 300 amp. each, as well as a lightning arrester. From these pillars cables are taken to the section pillars from which each route is fed. The section pillars contain two main switches for cutting the distributors into sections and four line switches.

The use of these feeder pillars does away with the necessity of tapping the main feeders when necessary to feed into more than one distributor. The feeders are so arranged that each one feeds a star, or, in other words, in three or four directions. There are two return points on the system from which insulated cables are taken back to the power station, and from one of these three .3-sq. in. cables are taken, and from the other two .6-sq. in. cables. These cables are coupled to the rails by means of special clamps and copper bonds. The distributors running along the several routes vary in size from .4 sq. ins. down to .15 sq. ins.

Test wires consisting of three core cables are taken to the various points of the system, one conductor being used for testing purposes and the other two for telephones. Special telephone pillars are fixed every half mile along each route and at different points in the center of the town and are in communication with the power station, central offices, depots, etc. The entire cable installation was supplied by the British Insulated Wire Company, Ltd., of Prescot, Lancashire. The conduits are laid solid in concrete, and from the power station to the center of the town there are thirty ducts. At this point the conduits radiate in all directions along the several routes. At the power station end the main line of conduits is coupled up to the power station by a subway 300 ft. x 10 ft. x 4 ft., this subway being in direct communication with the main switchboard.

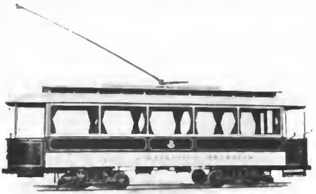
OVERHEAD EQUIPMENT

The whole of the overhead construction has been carried out by the men of the tramways department under Mr. Ellis, the poles, brackets, bases, etc., being designed by him. The equipment is very solid and substantial, flexible suspension being used throughout. Center poles are used chiefly, although side poles and bracket arms, as well as span wire constructions, are used on some of the routes where the streets are narrow and not sufficiently wide for center poles, although double track is laid. Specially heavy materials have been used, including 000 trolley wire, supplied by Back & Manson, the agents for Roebling & Sons.

The engravings give an idea of the handsomeness of the overhead work. The hangers are made of best gun metal, with ⅜-in. insulated bolts. None of the ears are less than 18 ins. long, and they were specially designed by Mr. Ellis to give great strength. The ears vary in length up to 36 ins. The insulation is of the Ætna type, the line materials being supplied by R. W. Blackwell & Company, of London. The span wire consists of seven strands of No. 12 gage steel wire, galvanized, while the guard wires are of twelve No. 16 strands. Steel taper poles in one section have been used, with heavy cast-iron bases 6 ft. high. While heavy materials have been used, they do not in any way detract from the appearance of the construction, which, as can be seen, is light and elegant.

ROLLING STOCK

Three types of cars are used, all of which are extremely well built, having steel underframing and a handsome appearance. They are double-deck four-wheel cars with a fixed wheel base of 6 ft., double-deck double-truck cars with maximum traction trucks and single-deck double-truck cars with maximum traction trucks. The wheel



SINGLE-DECK CAR

base of the maximum traction trucks is 4 ft. The four-wheel cars carry fifty-two passengers, twenty-two inside and thirty outside. The staircases are the double or broken type, with a platform half way up. The over-all length of these cars is 28 ft. 6 ins. over the bumpers, with platforms 5 ft. 9 ins. On account of low bridges the over-all height of the cars from the rails to the trolley plank is 9 ft. in order to leave 6 ft. clearance from the trolley plank or upper deck to the under side of the bridges, and on this account it has only been possible to get an internal head-room of 6 ft. The internal length of the car body is 16 ft.

DOUBLE-DECK CAR

The double-deck double-truck cars are similar in every way except in length, the length over all being 34 ft. 6 ins., and inside the car body 21 ft. 4 ins. The roof seats are in both cases of the "garden" type. The cars carry sixty-eight passengers, thirty inside and thirty-eight outside. The single-deck cars carry thirty-four passengers, and the length over bumpers is 33 ft. 6 ins. The interior length of car body is 24 ft. 4 ins., the platforms at either end being 3 ft. 9 ins. The internal finish of the three types of cars is

very handsome, the double-deck cars having flat roofs, while the single-deck cars have monitor roofs. The woodwork is chiefly light and dark oak and the ceilings three-ply bird's-eye maple divided into panels by oak mouldings. All the inside seats are lathe and space, no cushions being used. The windows are draped with neat red blinds with "C. C. T." worked on each.

The larger double-deck cars have eight 16-cp lamps inside, with two roof lights and the usual dash and canopy lights, the four-wheel cars being similarly lighted with the exception of there being only six internal lights of 16 cp. The single-deck cars have eight inside lights. All the cars are provided with illuminated destination or route indicators made by the British Electric Car Company, of Manchester. Each car has also a Ruby leakage lamp at either end. It might here be added that all cars have steel underframing.

STANDARD CARWHEEL

The four-wheel trucks are the Brill No. 21-E type with 30-in. wheels. The spring base measures 14 ft. 6 ins., and the extreme length of top-plate 15 ft. 7 ins. The wheels have tires with wrought-iron centers and were made by John Baker & Company. They are forced on to the axles under a pressure of not less than 25 tons or more than 30 tons. The axles are 3¼ ins. in diameter and the journal boxes are fitted with spring caps. The brakes are the ordinary link-suspended type with Corning brake-shoes. The cars are fitted with life guards and fenders of the Tidswell type. The maximum traction trucks were also supplied by J. G. Brill & Company, of London. The diameter of the driving wheels is 30 ins. and that of the pony wheels 20 ins., and the wheels all have steel tires and wrought-iron centers. The flanges are all ⅞ ins. deep and the wheel treads 1¾ ins. wide. A view of one of the wheels is given.

The cars are fitted with a controller at each end having four series and three parallel notches, as well as four notches for the electric brake. The electric braking is effected by connecting the motors as series generators in parallel with each other and in series with the same resistance as used ordinarily. Each car is fitted with an automatic circuit-breaker, main motor switch and main fuse, with magnetic blow-out, lightning arrester and kicking coil. The trolley standards are of the inclosed spring type, a single spring under compression being used. The standard is in one piece, made of malleable cast-iron. A super-elevation stop is provided to limit the vertical motion of the trolley pole. The trolley standards are fitted with hand-holes for getting at the cable connections between the car and standard. Wood's trolley-heads are used.

The motor equipment consists of two series-wound motors, each capable of a draw-bar pull of 1400 lbs. on 500 volts, propelling the car at a speed of 8 miles an hour at this load. They are capable of doing this for one hour with 100 per cent overload for short periods. The motors are of the four-pole type, with the armatures geared to the car axles by single-reduction spur gearing. The armatures are of the slot-wound drum type and so wound that only two sets of brushes are necessary. The commutators have a wearing depth of 1 in. The insulation of the armatures and field coils from the frames are tested to withstand a pressure of 3000 volts.

Each car is provided with a complete set of tools, including a traversing and lifting jack, a set of adjusted spanners, screwdrivers and cutting pliers, hammer, chisel, rubber gloves and four feet of steel rope, with a hook at each end, for hauling purposes. All of the cars have been supplied complete with equipments, etc., by Dick, Kerr & Co., Ltd., of London, whose first contract was for the supply of twenty double-deck double-truck, twenty double-deck four-wheel and fourteen single-deck bogie cars. They have recently received an extension order for twenty double-deck double-truck cars and twenty double-deck, four-wheel cars, making ninety-four cars in all. It is expected that there will be at least 150 cars required.

GENERAL REMARKS

The general arrangement of the plant, etc., at the power station, together with the cables, overhead equipment and cars has all been carried out in accordance with the plans and specifications prepared by the borough electrical engineer and manager, Arthur Ellis, M. I. M. E., M. I. E. E., who, from the commencement, has been ably assisted by his chief assistant, C. E. Davies, who is a man well versed in tramway work. The tramway system was officially opened on the first of May, and since that time has been running smoothly, no accidents of any consequence having taken place.

Mr. Ellis, in addition to his duties in connection with the electric lighting and tramways department, has, since January, had to manage the horse tramways system as taken over from the old tramways company. This consisted of fifty-two cars and 342 horses, together with the various depots. The horse tramways will, of course, be gradually done away with as the electric cars put into service increase.

Since the opening, the traffic on the electric cars has been enormous, and they have already become very popular in the district, the public realizing the greater facilities offered by them for getting about. Cheap fares have been adopted with a quick service and stopping places have been fixed along the various routes. It is interesting to note that from the new power station, which is now in operation, it is intended to supply current for electric lighting purposes in addition to the supply of power other than that for tramways, and it is mainly for this reason that the two large generator sets of 900 kw are being installed. It is expected that by next winter there will be a demand in motors alone amounting to nearly 1500 hp, the corporation having recently entered into a contract with one of the largest shipbuilding and repairing firms in Cardiff for the supply of current for the driving of the whole of its machinery, which eventually will mean 500 hp for this customer alone. In addition to this company there are applications in from several other very large firms for large amounts of power.

The whole of the current for lighting and power purposes generated at the main power station will be transmitted to a large sub-station in the basement of the electric lighting and tramways department's central offices, and it is intended to put in a main switchboard at this point, together with balancers, boosters, battery, etc., and to transmit the current from this central sub-station to the various sub-stations in the district. For a commencement, 2-sq.-in. feeders are being laid from the power station to the sub-

station, and for the docks district alone two .5-in. triple concentric cables are being laid. It is intended to change over the central area to continuous current during the present summer, as the existing lighting station is practically working up to its fullest capacity. It is also intended to light up the whole of the tramway routes electrically, which will be done from the trolley poles, but the lamps will not be supplied from the tramway feeders or trolley wires, independent cables being laid for the purpose.

In closing, a few words should be said about the handsome Ferranti switchboard. It consists of a number of massive slates fixed in a horizontal position and grouted into the station wall. These slates are divided off by vertical partition slates and insulating material into a number of separate compartments. Each of these compartments contains, separately, the apparatus making up the board. There are in all about twenty panels, occupying a wall space of some 40 ft. Of these panels, commencing at the left hand facing the board, there are four lighting feeders, each feeder containing a quick-carbon-break switch and automatic device to release same on maximum current. The edgewise ammeter placed on the top of the slate reads the current passing through the circuit. The bus-bar voltmeters are mounted on a swivel bracket so that they can be seen from any position on the switchboard platform. Next to these lighting feeders, continuing toward the left of the board, is a wattmeter, arranged in the bus-bars to read the total energy distributed to the feeders.

Each dynamo panel consists of double set of bus-bars, one for traction the other for lighting, and a change-over switch by which the machine can be used on either system. The other parts comprising the dynamo panel are the quick-break switch with automatic reverse-current release, edgewise ammeter, field regulating resistance and the usual field and voltmeter switches. Two of these dynamo panels are suitable for dealing with a maximum current of 2000 amps., and the remaining four are rated at 750 amps. In order of arrangement come the panels required for motor generators and boosters containing the switches and instruments for these panels, designed so as to be in conformity with the remainder of the gear To the extreme right are the traction and feeder panels, comprising chopper switches, quick-break switches with automatic maximum release, ammeters, kicking coils, lightning arresters, etc. A set of illuminated dial voltmeters is arranged for these panels to correspond with those fitted over the lighting feeders. The regulating table has been extended under the traction feeder-panels and contains small fuses and switches required for the station power circuits. The design is very efficient and substantial, and great care has been taken with the workmanship and finish. A striking advantage of this system is the simplicity in the general arrangement of parts which render it possible to read the connections from the front of the board without the aid of a diagram, thus reducing the responsibility of the attendant and the possibilities of mistakes.

Boston Subway Legislation

The Massachusetts Legislature, in its closing days, enacted a bill providing for the construction in Boston of a subway through the business center and along the general line of Washington Street, and this was signed by Governor Crane. As a result of long negotiations between the Governor, the Mayor of Boston, representatives of the mercantile organizations and the Boston Elevated Railway Company, the bill was drafted and was referred to the committee on metropolitan affairs of the Legislature a week ago, and was reported unanimously to the Legislature by that committee, but with certain amendments, two of which were eventually struck out.

The compromise bill agreed to by the representative of the interested parties provided that the Boston Transit Commission may construct a tunnel for elevated trains and later a subway for surface cars extending from a point near the junction of Broadway and Washington Street and a point near Adams Square, Haymarket Square, or Causeway Street, and follow the general line of Washington Street. Much latitude is allowed in the fixing of the precise route, since the tunnel may be built anywhere between the existing subway and a line 750 ft. easterly from Washington Street.

This tunnel will contain two tracks, and will be adapted to elevated cars or trains, and its construction will begin immediately after the acceptance of the act by a majority of the voters of the city. A further provision is made for the construction of another two-track subway for the use of the surface cars along the same general line, any time after one year after the completion of the tunnel just mentioned. This second subway will be built if the Transit Commission and the Elevated Railway Company agree that it is necessary, or, in case of disagreement, if the Board of Railroad Commissioners decide that it is necessary.

The Transit Commission shall, within ninety days after the passage of the act, execute a lease of the tunnel and subway for a period of twenty-five years from the beginning of the use of the tunnel, at an annual rental of 4½ per cent of the net cost of construction. The Elevated Road is authorized to connect its elevated lines with the tunnel in such manner as the Board of Railroad Commissioners may approve.

Upon the completion of the tunnel the company must remove its elevated trains from the existing Tremont Street Subway and readapt that subway to the use of surface cars, as formerly. At any time after one year from the completion of the second subway the Railroad Commissioners may order the removal of surface tracks from Washington Street between Broadway and Adams Square, and such order shall be deemed a revocation of all locations and rights to occupy the street.

The cost of construction is to be met by an issue of fifty-year bonds by the city of Boston, and the rental derived from the use of the subway will be used for the purpose of paying the interest and providing a sinking fund for the retirement of these bonds. The act will not become operative unless approved by a majority vote in the next municipal election, or some special election called for the purpose, except, of course, the provisions that apply to preliminary work take effect at once.

The provisions of the act become a part of the terms of the contract between the city and the company, and likewise constitute a contract between the Commonwealth and the city, under which the city will own in its private and proprietary capacity as an irrevocable grant from the Commonwealth, all subways heretofore authorized, as well as those authorized in the bill.

The committee having the bill in charge made several changes, two of which were not approved. One of them provided that Pleasant Street should be widened for surface cars to provide a connection between the Tremont Street Subway and South Boston. This amendment, however, was rejected by the House, and is not now a part of the bill. The second change was the insertion of a section providing that none but American citizens should be employed as laborers or mechanics in the work of construction, and that such laborers shall be paid not less than the rate of wages paid to laborers employed by the city of

Comparative Acceleration Tests with Steam Locomotive and Electric Motor Cars*

BY B. J. ARNOLD AND W. B. POTTER.

In connection with the preparation of a report on the use of electricity for the propulsion of trains of the New York Central Railroad in the tunnel entrance and terminal in New York City, an invitation was extended by the General Electric Company to W. J. Wilgus, chief engineer of the railroad company, to use its experimental track (Fig. 1) and apparatus at Schenectady, and a series of tests were accordingly carried out under the direction of the authors of this paper. The tests were principally for the purpose of determining the comparison between steam and electric traction on short-haul suburban passenger service. Owing to the short curves in the connecting tracks the General Electric Company's track could not be used for the steam locomotive tests.

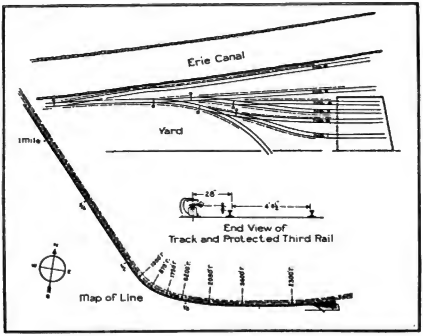


FIG. 1.—MAP OF GENERAL ELECTRIC RAILROAD

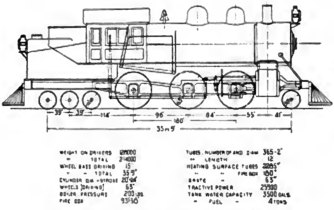


FIG. 2.—OUTLINE OF STEAM LOCOMOTIVE NO. 1407

The steam tests were therefore made on the New York Central main line tracks west of Schenectady.

The steam locomotive shown in Fig. 2 was built from the specifications of A. M. Waite, superintendent of motive power and rolling stock of the New York Central, by the Schenectady Locomotive Works. It was designed especially for the rapid acceleration work required in suburban service, being provided with large grate area and heating surface and a very large proportion of weight on its driving wheels.

The two electric motor cars were similar in form, 54 ft. over all, each weighing about thirty-five tons, including the electrical equipment, which consisted of four G. E.-55 motors and type M control. All axles being equipped with motors, the two cars together gave approximately the same weight upon the drivers as the steam locomotive. The acceleration was therefore directly comparable for trains of equal net weight, and to secure this comparison the same trail cars, arranged in the same order, were used in both steam and electric tests.

In the steam runs the draw-bar pull, speed and time were recorded by an Illinois Central dynamometer car, and the same car was used with the electric motor cars to determine the relation between current input and draw-bar pull. The dynamometer car had to be returned before the electric runs were completed, but not before a large number of readings were taken, from which curves were plotted showing the relation between amperes and draw-bar pull with different weights of train behind the motor cars. The draw-bar pull thus determined has been plotted on the attached electric motor car curves, which were taken subsequent to the return of the Illinois Central car.

The order of the tests, both steam and electric, was as follows:

A train of six cars, including five standard passenger coaches loaned by the New York Central Railroad, and the dynamometer car, was started and run over a mile of track, acceleration being made as rapidly as possible. These same runs were repeated, dropping off one car at a time, until only the dynamometer car remained. Automatic records were kept of the draw-bar pull, speed, time, distance and the strength and direction of the wind. The condition of rail and temperature were also noted. The same runs were repeated, using the two motor cars in place of the steam locomotive, the dynamometer car being used in some of the runs and a box car loaded to equal weight in subsequent runs. In the electric runs additional records were kept of voltage, ampere and wattmeter readings. The wattmeter was not carried on the car, but was placed stationary at the point of feeding the third rail, thus avoiding any inaccuracy due to jarring. The voltage leads of the wattmeter were connected to the extreme end of the third rail and track, thus receiving at all times the exact voltage at the train, so that the energy delivered to the motor cars represented the net input and did not include losses in the feeder system.

The cars used in this test and the weights are given below:

	Number	Pounds
New York Central locomotive	1407	214,000
General Electric motor car	4	78,000
General Electric motor car	5	70,000
Illinois Central dynamometer car	17	45,640
New York Central coach	1686	48,200
New York Central coach	543	60,250
New York Central coach	1700	53,700
New York Central coach	608	51,450
New York Central coach	1798	54,600

During the tests many runs were made, but for the illustration of this paper representative and average runs only are given.

ELECTRIC MOTOR CARS NO. 4 AND 5.

The electric runs were made upon the General Electric experimental track against a head wind of 15 m. p. h. The rail was dry, the temperature of 8 degs. C., and the grade practically level. In

No. of Run	Character of Load	Weight of Load, Tons	Total Weight Train, Tons	Maximum Speed	Average Speed	Watt Hours Per Ton Mile: From volt Amperes	Watt Hours Per Ton Mile: From Wattmeter
1	6 trailers	157.	228.5	36.4	27.2	75.9	79.4
3	5 "	130.	201.5	37.9	28.6	78.4	82.0
5	4 "	104.	175.5	39.1	29.8	84.3	86.9
7	3 "	77.	148.5	41.0	30.6	84.7	93.4
9	2 "	47.	118.5	42.8	32.0	98.5	99.4
11	1 "	23.	94.5	41.7	33.1	115.0	114.0
13	No "		71.5	46.7	34.6	138.3	129.0

* Read at the nineteenth annual convention of the American Institute of Electrical Engineers, Great Barrington, Mass., June 19, 1902.

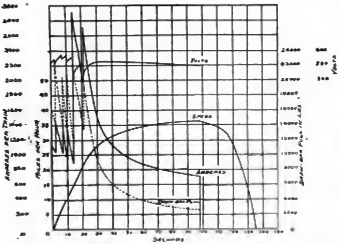


FIG. 3.—ELECTRIC RUN NO. 1. 6 TRAIL CARS—WEIGHT, 157 TONS. INCLUDING MOTOR CARS, 228.5 TONS. POWER ON, 4170 FT. DISTANCE RUN, 5380 FT. WATT HOURS PER TON MILE, 79.4

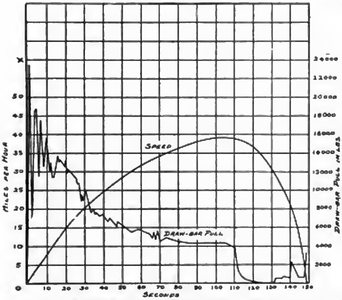


FIG. 4.—STEAM RUN NO. 2. 6 TRAIL CARS—WEIGHT, 157 TONS. INCLUDING LOCOMOTIVE, 264 TONS. POWER ON, 4035 FT. DISTANCE RUN, 6150 FT.

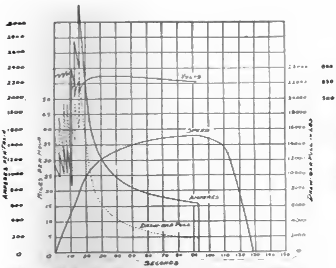


FIG. 5.—ELECTRIC RUN NO. 3. 5 TRAIL CARS—WEIGHT, 130 TONS. INCLUDING MOTOR CARS, 201.5 TONS. POWER ON, 4170 FT. DISTANCE RUN, 5380 FT. WATT HOURS PER TON MILE, 82

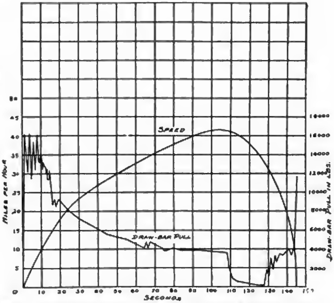


FIG. 6.—STEAM RUN NO. 4. 5 TRAIL CARS—WEIGHT, 130 TONS. INCLUDING LOCOMOTIVE, 237 TONS. POWER ON, 4270 FT. DISTANCE RUN, 6050 FT.

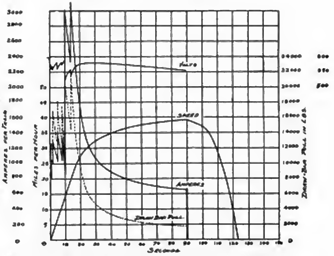


FIG. 7.—ELECTRIC RUN NO. 5. 4 TRAIL CARS—WEIGHT, 104 TONS. INCLUDING MOTOR CARS, 175.5 TONS, POWER ON, 4135 FT. DISTANCE RUN, 5380 FT. WATT HOURS PER TON MILE, 86.9

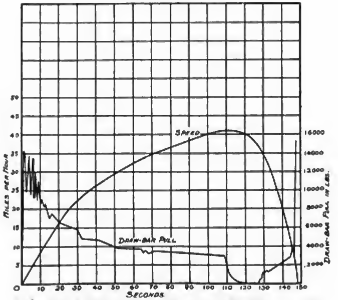


FIG. 8.—STEAM RUN NO. 6. 4 TRAIL CARS—WEIGHT, 104 TONS. INCLUDING LOCOMOTIVE, 211 TONS. POWER ON, 4490 FT. DISTANCE RUN, 5943 FT.

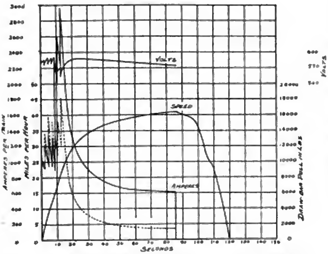


FIG. 9.—ELECTRIC RUN NO. 7. 3 TRAIL CARS—WEIGHT, 77 TONS. INCLUDING MOTOR CARS, 148.5 TONS. POWER ON, 1470 FT. DISTANCE RUN, 5370 FT. WATT HOURS PER TON MILE, 93.4

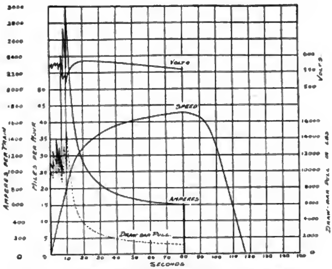


FIG. 11.—ELECTRIC RUN NO. 9. 2 TRAIL CARS—WEIGHT, 47 TONS. INCLUDING MOTOR CARS, 118.5 TONS POWER ON, 4100 FT. DISTANCE RUN, 5400 FT. WATT HOURS PER TON MILE, 99.4

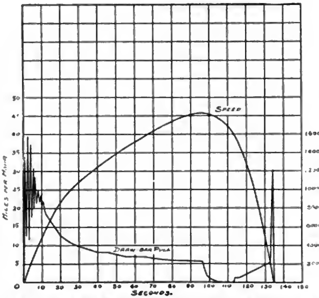


FIG. 10.—STEAM RUN NO. 8. 3 TRAIL CARS—WEIGHT, 77 TONS INCLUDING LOCOMOTIVE, 184 TONS. POWER ON, 4520 FT DISTANCE RUN, 5930 FT.

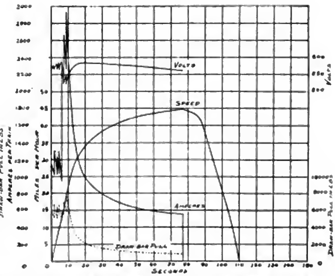


FIG. 13.—ELECTRIC RUN NO. 11. 1 TRAIL CAR—WEIGHT, 23 TONS. INCLUDING MOTOR CARS, 94.5 TONS. POWER ON, 4000 FT. DISTANCE RUN, 5350 FT. WATT HOURS PER TON MILE, 114

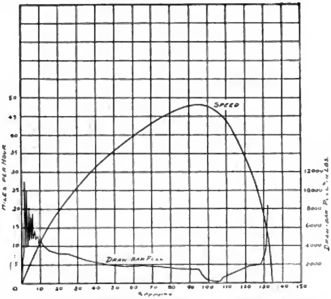


FIG. 12.—STEAM RUN NO. 10. 2 TRAIL CARS—WEIGHT, 47 TONS. INCLUDING LOCOMOTIVE, 154 TONS. POWER ON 4455 FT. DISTANCE RUN, 5927 FT.

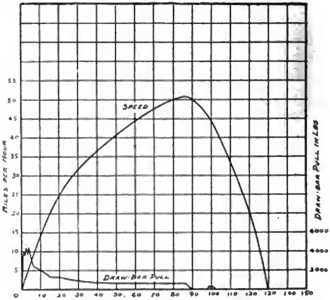


FIG 14.—STEAM RUN NO. 12. 1 TRAIL CAR—WEIGHT, 23 TONS. INCLUDING LOCOMOTIVE, 130 TONS POWER ON, 4460 FT. DISTANCE RUN, 6260 FT.

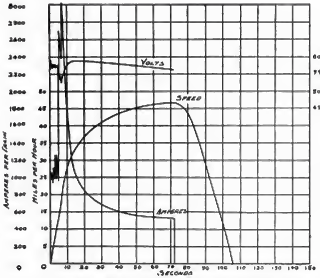


FIG. 15.—ELECTRIC RUN NO. 13. NO TRAILERS—MOTOR CARS, 71.5 TONS. POWER ON, 4080 FT. DISTANCE RUN, 5360 FT. WATT HOURS PER TON MILE, 129

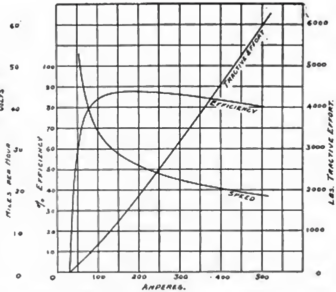


FIG. 16.—SPEED TORQUE CURVE OF G. E. 55 MOTOR

the middle of the run there was a curve having a minimum radius of 875 seconds, equivalent to about 6½ degs. curve, the effect of which may be assumed as approximately equivalent to the 1 per cent up-grade of the steam runs.

NEW YORK CENTRAL STEAM LOCOMOTIVE NO. 1407.

All steam locomotive runs were made upon the New York Central main line track west of Schenectady against an up grade of 1 per cent and a head wind of 15 m. p. h. The temperaturs was 4 degs. C. and the rail wet with a very light falling snow.

No. of Run	Character of Load	Weight of Load, Tons	Total Weight of Train, Tons	Maximum Speed, m. p. h.	Average Speed, m. p. h.
2	6 trailers..................	157.	264.	39.0	29.2
4	5 "	130.	237.	41.3	28.4
6	4 "	104	211.	40.9	27.4
8	3 "	77.	184.	45.7	27.8
10	2 "	47.	154	48.0	30.1
12	1 "	23	130	50.9	31.0

Although this locomotive was especially built for suburban or acceleration work, and was provided with a large fire box, giving it facilities for rapid steaming, the pressure dropped from 200 lbs. to less than 185 lbs. during the first part of acceleration. In starting, the throttle was opened wide and steam used full stroke, the engine being hooked up as acceleration proceeded. Curves showing details of these runs are given in Figs. 3 to 15 inclusive.

While the electric runs had the advantage of dryer rails than the steam runs the driving wheels were not slipped in either instance. Although the steam locomotive was able to give a maximum tractive effort at starting equal to that obtained electrically, this high tractive effort was not maintained, but immediately fell off with increased speed, even with the most expert handling.

As the acceleration curves produced by the steam locomotive and electric motor cars have different shapes, and as in the two tests there was about the same weight upon the drivers, it is interesting to note how well this driver weight was utilized. This is shown by the following tables, giving the speed reached in ten, twenty and thirty seconds with equal trailing load for both electric and steam trains:

MILES PER HOUR ATTAINED IN 10 SECONDS

No. of trailers..............	1	2	3	4	5	6
Motor cars No. 4 and 5......	22.5	20.7	17.3	14.4	12.6	11
Locomotive No. 1407..........	14	13.	12.5	12.	10.	9.7

MILES PER HOUR ATTAINED IN 20 SECONDS

No. of trailers..............	1	2	3	4	5	6
Motor cars No. 4 and 5.......	31.	32.3	29.4	27.4	24.5	21.2
Locomotive No. 1407..........	25.	21.2	21.5	19.5	18.	16.8

MILES PER HOUR ATTAINED IN 30 SECONDS

No. of trailers..............	1	2	3	4	5	6
Motor cars No. 4 and 5.......	38.2	36.4	34.2	32	30.3	28.1
Locomotive No. 1407..........	31.7	26.2	27.	24.7	23.2	20.8

An inspection of the tables brings out clearly the fact that the electric motors during acceleration can more effectively utilize the weight upon their drivers than a steam locomotive. As rapid acceleration is especially important when stops are a mile or so apart the electric motor has an advantage in being able to cover the same distance in the same time with less energy expended and at less maximum speed than with the steam locomotive, owing to its being able to maintain its maximum accelerating rate for a longer period.

FIG. 17.—ELECTRIC MOTOR CAR NO. 4

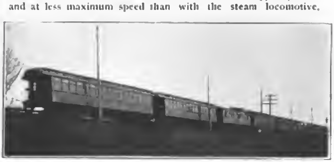


FIG. 18.—TRAIN USED IN ELECTRIC TESTS

The average speed given in both steam and electric tables is the average speed of the train while it is in motion, and does not include time of any stop at the end of the run. Starting from rest, the power was kept full on to the three-quarter mile post, where the power was shut off and the brakes applied in such a manner as to bring the train to rest as near the mile post as practicable. In the tests the steam train ran from 5 per cent to 15 per cent over a mile before the train was brought to rest, and the electric trains from 2 per cent to 4 per cent, but even with the longer

distance the average speed of the steam runs only approaches that attained in the electric runs made over the shorter distance. A comparison of the two sets of runs on the basis of average speed is, therefore, not quite fair to the electric motor car, as its average speed would have been considerably higher if the length of the run had been the same as that made with the steam locomotive. An inspection of the tables will show, however, that even with the short-distance run the electric motor cars were able to make higher average speeds than the steam locomotive over its longer distance, and these higher average speeds were obtained also with a lesser maximum speed.

The maximum speed of a train making a given run in a given time serves as an indication of its energy consumption. A train, therefore, which is so handled as to make a given run in a given time, with lowest maximum speed, will consume less energy for the run. The electric runs tabulated all show a lower maximum speed and a higher average speed than those runs made with the steam locomotive, and the energy consumption of the electric runs should therefore be less for the same service performed than with the steam locomotive.

The motors of an electrically equipped train may be placed upon the trucks of ordinary passenger coaches, each carrying its full complement of passengers, and thus lessen the gross weight by elimination of the locomotive. The true measure of comparison between steam and electrically propelled trains should be the energy per seat mile rather than per ton mile, as the latter value is based upon the total train weight and includes a considerable proportion of dead weight embodied in locomotive and tender. The weight of the electric motors is much less than the weight of a steam locomotive capable of performing the same service, as the latter, in addition to its tender, must be heavy enough upon its drivers to provide a draw-bar pull sufficient to accelerate the train.

As an illustration, the following table has been prepared from these tests showing the number of cars in the train, the number of passengers carried (each car seating sixty-four people) and the energy, which for convenience we have given in watt-hours, required per passenger for both steam and electric runs:

NET ENERGY PER PASSENGER CARRIED

Number of Cars	Number of Passengers	Watt Hours per Passenger Steam	Watt Hours per Passenger Electricity
6	384	41.9	29.7
5	320	52.2	32.1
4	256	67.5	31.5
3	192	77.4	37.5
2	128	109.0	45.2
1	64	187.8	45.2

This table is based upon the actual net energy delivered to the wheels of the train and does not include the losses inherent to any system of operation. The results tabulated may therefore be considered as fundamental and typical of the two systems of operation —the steam locomotive and the electric motor car.

The following table gives the efficiencies for the seven electric runs, the efficiency being the ratio between net energy output to the wheels and total volt ampere input:

EFFICIENCY OF ELECTRIC RUNS

Trailers	Average m. p. h.	Watt Hours per Ton Mile Output	Watt Hours per Ton Mile Input	Efficiency of Run
6	27.2	60.1	78.8	[illegible]
5	28.6	61.0	82.0	74.3%
4	29.8	65.8	84.9	77.5%
3	30.6	68.0	90.2	75.3%
2	32.	69.6	99.6	69.9%
1	33.1	75.3	112.8	66.7%
0	34.6	79.8	130.0	61.5%

An accurate comparison of the relative efficiency or coal consumption of steam and electric power for similar service would require an extensive series of tests with indicator and dynamometer on the performance of the steam locomotive.

As a matter of interest, we have secured an approximate comparison from a single test by weighing the coal and water taken by steam locomotive No. 1407 for a period of twenty-four hours, covering four trips between North White Plains and Grand Central Station, a distance of 24.75 miles, on the Harlem division of the New York Central Railroad. The trips occupied about four hours, the yard movement about one hour and the locomotive was idle for nineteen hours.

Following is a detailed record of the service covering the twenty-four hours:

NORTH WHITE PLAINS TO GRAND CENTRAL STATION

Time	Number of Cars	Number of Stops	Total Weight	Weight of Cars	Effective h. p. h.
61.5 min.	3	21	204 tons	97 tons	129
Lay-over		6 hours			

GRAND CENTRAL STATION TO NORTH WHITE PLAINS

Time	Number of Cars	Number of Stops	Total Weight	Weight of Cars	Effective h. p. h.
66.25 min.	5	17	278 tons	171 tons	255
Lay over		1½ hours			

NORTH WHITE PLAINS TO GRAND CENTRAL STATION

Time	Number of Cars	Number of Stops	Total Weight	Weight of Cars	Effective h. p. h.
60.3 min.	7	13	387 tons	250 tons	231
Lay-over		½ hour			

GRAND CENTRAL STATION TO NORTH WHITE PLAINS

Time	Number of Cars	Number of Stops	Total Weight	Weight of Cars	Effective h. p. h.
50.75 min.	4	20	256 tons	149 tons	246
Lay-over		1¼ hours			

Total effective horse-power hours, hauling coaches	861
Coal consumed	13,419 lbs.
Coal per effective horse-power hour	15.6 "

The effective hp-hours given is the energy required for movement of the cars only, exclusive of the locomotive, and was determined from the draw-bar pull taken by the dynamometer car in previous tests over the same route.

The coal consumption covers all coal burned during the period of twenty-four hours, not only for movement of cars, but also movement in the yard and the banking of fires during lay-overs.

The effective hp-hours to move the cars serves as a basis of comparison with electric service, the coal consumed by the locomotive for whatever purpose being properly chargeable to the net work done by the locomotive during the period.

The efficiency of an electrical system, as an average under variable load, may reasonably be assumed as follows:

Engine	90% Efficiency	
Alternator	92% "	
High Potential transmission	98% "	
Transformers	97% "	
Converters	92% "	
Third rail	95% "	
Motors, including control	75% "	51.3%

This percentage of effective horse-power output of motors to ihp of engine will vary somewhat, depending on the load factor. As an even figure we will assume an efficiency of 50 per cent.

Coal consumption per ihp-hour from actual records of electric power stations is in some cases less than 2 lbs., the average being about 2½ lbs. At the latter figure the coal per effective hp-hour output of electric motors would be 5 lbs. Assuming the head-end air resistance as 10 per cent, and as the electrical equipment would increase the weight of the cars about 20 per cent, the actual comparison of coal consumption would be approximately in the ratio of 6.6 for electric and 15.6 for steam.

Assuming that coal for a power station can be purchased for 80 per cent of the cost per ton of that used in the locomotives and that the cost of coal for electrical power is about one-third of the total cost, including maintenance and interest on investment, it is probable that the actual gross cost of electrical power would closely approximate the coal consumption of a steam locomotive in this class of service, the maintenance of the electrical equipment and attendance required being, however, considerably in favor of the electric power.

We wish to express our thanks to E. C. Schmidt, professor of railway and mechanical engineering, University of Illinois, for his able management of the dynamometer car, assisted by J. F. Snodgrass and R. W. Lohmann; also to A. H. Armstrong and E. F. Gould, of the General Electric Company, for their careful supervision and calculations of the electric test.

A Serious Accident in Massachusetts

A head-on collision between two heavily loaded cars on the Hudson Division of the Marlboro Street Railway, June 28, resulted in the death of the motorman of one of the cars and injuries to thirty-five passengers, several of them being seriously injured. The accident took place about two miles from Marlboro, and the cars came together with such force that they were almost completely demolished. Both cars were going fast and came in sight of each other as they were rounding a curve at the foot of a heavy grade. The motormen were unable to reverse in time to prevent a collision. Several passengers jumped from the cars before the collision occurred.

Plotting Speed-Time Curves *

BY C. O. MAILLOUX

PART I.

The most practical way at present known of studying and analyzing electric railway problems is by means of curves depicting the relation between the various factors or quantities which influence the conditions or effect the results, and showing how these factors and quantities vary with respect to each other or with respect to the time, the speed, the electric energy or some other determining feature or circumstance of the case.

The precise determination of most of the important factors entering into the problem in any specific case, for instance the electric power input, energy consumption, capacity and characteristics of motor equipment, station equipment required, heating of motors, line losses, etc., for a given electric railway service involves the general problem of not only determining what actually does take place, but also of predetermining what may, should and must take place at every successive interval of the total time consumed in an average run between two successive stations or stopping points, or, what is still better, at every instant of time during the entire trip with each kind of car or train to be used for and in the service.

The speed-time curve is the key to the solution of this general problem. It is the important connecting link whereby the relationship between the various factors and quantities is established and verified. It constitutes, in most cases, an important and essential—one may say indispensable—preliminary step in the study and solution of new and complex electric railroad problems, for the reason that many of the factors involved can be determined with precision only by its assistance and could scarcely be determined at all without it.

The use of a curve substantially equivalent to a speed-time curve was suggested in connection with certain problems of steam locomotive propulsion as early as 1890 in Godwin's Railroad Engineers' Field Book. This suggestion was commented upon favorably in an article published in the Railroad Gazette at the time (Vol. XXII., 1890, pp. 731-732). It does not appear, however, that much if any practical use was made of this idea in subsequent discussions of railway problems. It is only within the last five or six years, and entirely owing to the efforts of electrical engineers to substitute rational for empirical methods in electric railroad engineering, that the speed-time curve has been thought of seriously or used practically in connection with electric railroad problems. The idea of thus using the speed-time curve seems to have suggested itself to and to have been utilized by several individuals independently at about the same time. It was used in January, 1898, by S. T. Dodd and the writer, who collaborated in the preparation of certain estimates, charts, data, etc., forming part of a report on an electrical equipment for the Manhattan Elevated Railroad, of New York. The importance and the value of the curve were not generally understood or appreciated by electric railway engineers, however, until A. H. Armstrong read his able and interesting paper on some phases of rapid transit problems at the Omaha meeting of the Institute in June, 1898. In that paper the utility of the speed-time curve in the study of railway problems was demonstrated by Mr. Armstrong in a brilliant and convincing manner, and the curve has since become recognized as a very useful means of analysis in dealing with such problems.

Speed-time curves have been used in two different ways: First, as a method of approximation or generalization for the determination of rules and data pertaining to and useful in abstract or general cases; second, as a method of precision for the exact determination of rules and data in individual or concrete cases, and also as a criterion or test of their fitness for and applicability to such cases.

The process of plotting these curves is much less difficult and tedious in the first case than in the second. The reason is that in generalizing or in dealing with abstract cases the use of certain hypotheses or assumptions capable of simplifying methods is admissible, whereas in dealing with an individual case all hypotheses or assumptions not strictly consistent with the actual facts of the case should be eliminated in order that the method may lead to correct and reliable results.

As might be expected, the speed-time curve is influenced and complicated by certain features and conditions characteristic of each individual case, which ought to be taken into account in order to attain accurate, reliable results. When properly plotted so as to represent truly all the factors which influence it the curve becomes a valuable instrument of precision by means of which the practical results to be anticipated in the particular case under consideration may be analyzed, checked, criticised and corrected with accuracy and confidence. These factors include the constituents or components of that complex resultant called "train resistance," also the track gradients, track curvatures, train inertia (linear and rotational), capacity and gearing of motors, current limit, voltage, etc. In dealing with a general case, however, the engineer may greatly simplify the task of assorting these influencing factors and of assigning the proper value to each by making assumptions regarding some of them. The usual process of simplification is to make one or all of the following assumptions: That the line is absolutely level and tangent (straight); that the train resistance is constant at all speeds, and that all runs between stopping points are of the same length. It is needless to say that these idealized conditions are never all realized conjointly in any practical case. Consequently the more the conditions of the actual case depart from these idealized conditions the less reliance should be placed upon conclusions and data obtained by methods involving these assumptions. It is unfortunately not always easy to determine the point at which the simplified method should no longer be trusted in dealing with a practical case. The assumptions made usually lead to incorrect instantaneous speed values at certain points of the acceleration curve, and these errors tend to vitiate the subsidiary curves derived from the speed-curves, such as, for instance, the energy input curve, whose ordinate values depend upon the speed values. These errors in the energy input curve and in the energy consumption calculated therefrom are likely to affect the motor equipment and the generating station equipment provided for a given service, since the calculations and conclusions regarding them are based upon these subsidiary curves. A relatively small discrepancy between the idealized and the actual conditions may lead to radically different conclusions and results in these respects, thereby influencing greatly the total cost of equipment and reacting seriously upon the capital investment and the fixed charges involved in the project. Such cases have actually happened.

The "second way," or the use of the speed-time curve as a "method of precision" in concrete practical cases, while a trifle more troublesome, will, in the majority of cases, undoubtedly prove more satisfactory and less expensive in the end. The truth is, that the practicing engineer is very seldom called upon to deal with abstract or general cases. It might be said that every individual case becomes a specific concrete case very soon after the engineer begins the process of analyzing and studying it.

The object of this paper is to facilitate the use of the speed-time curve as a method of precision by contributing certain notes of theoretical and practical observations bearing upon its analysis or the study of its characteristics and upon its synthesis or the principles involved in plotting it.

Technical Definitions.—The generic term "speed-time curves," as used in this paper, is understood to denote any curve showing the velocity of a car or train at successive intervals of time. Figs. 1, 2 and 3 show three different kinds of speed-time curves. In plotting these curves the horizontal distances, or abscissæ, are generally used to represent time values (in seconds), and the vertical distances (ordinates) are used to represent speeds (usually measured in miles per hour in this country and in kilometers per hour wherever the metric system is used.)

The curve in each case not only shows the speed attained at any given interval of time, but it also shows the variations in speed occurring at various intervals of time. The slope of the curve at any time point is an indication and a measure of the time rate of change of speed at the corresponding instant of time; and it shows whether the speed is constant or increasing or decreasing.

A horizontal speed line indicates constant or uniform speed. An upward slope in the speed line indicates increasing speed, or acceleration; a downward slope indicates decreasing speed, or retardation. These characteristics serve to distinguish the different kinds of speed-time curves.

The term acceleration curve is usually restricted to curves or portions of curves in which the speed is increasing, or, at least, remaining constant or nearly constant. Such curves correspond to the portions of time during which power is being applied to the train so as to increase the speed or to keep it constant (Fig. 1).

The retardation curves are of two kinds, corresponding to different rates of retardation.

The term coasting curve or drifting curve is used to designate speed-time curves, or portions thereof, corresponding to intervals of time when the car or train is moving by its own momentum only and when the rate of retardation is relatively small (Fig. 2).

The term braking curve is applied to speed-time curves, or portions thereof, corresponding to intervals of time when the speed

* Read before the American Institute of Electrical Engineers, Great Barrington, Mass., June 19, 1902. (The second part of this paper is being revised by the author, and will appear in an early issue.)

is being purposely reduced by means of brakes and when the decline or decrease in velocity is relatively rapid (Fig. 3).

The term run curve is often used to denote a speed-time curve, showing all the changes in the speed of a car or train from the time it starts until it stops at the next station or stopping point (Fig. 4).

The first portion of every run curve, or the portion during which the train is gaining speed, is an acceleration curve. The run curve usually, but not always, contains a portion which is a coasting or drifting curve, and it also generally contains a portion which is a braking curve.

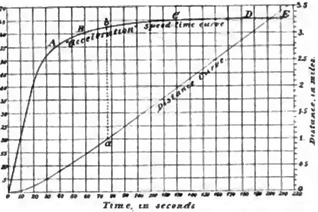


FIG. 1.—ACCELERATION CURVE

The terms velocity and speed are used as synonymous terms in this paper.

Analytical Definitions.—A certain knowledge of the physical nature and mathematical properties of the various time-function curves mentioned in the previous section is essential for the proper, intelligent use of these curves and is presumed to be possessed by those who make practical use of them. The precise definitions of these various curves and the analysis of their properties involve the analytical study of motion, more especially rectilinear motion. For the convenience and benefit of those who may wish to refresh their memories, or who may wish to go more deeply into the subject (no general treatment of the subject having as yet been published), a brief summarized analytical study of time-function curves, more especially the distance-time and speed-

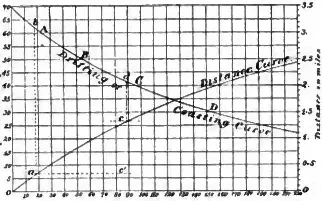


FIG. 2.—DRIFTING OR COASTING CURVE

time curves, is given separately at the end of this paper in Appendix A.

The derivation of the fundamental formulæ relating to train acceleration constituting the extension of this analytical study is given in Appendix B.

Appendix C and Appendix D contain the derivation of certain formulæ which are of use and convenience in plotting the run curves. These formulæ are not generally known.*

I.—ANALYSIS OF TRAIN MOTION.

The motion of a car or train under actual or assumed service conditions constitutes an aggregation of different forms or phases of motion.

The run-curve, which graphically depicts the train motion, is, therefore, a resultant curve. The analysis of the motion involves the separate determination and segregation of the elementary or fundamental forms of motion which constitutes the components of which the resultant motion is made up.

A glance at a run-curve shows three distinct characteristic kinds of lines which correspond to distinctive phases or kinds of motion, namely, the motions characteristic of acceleration, coasting or drifting and braking, respectively.

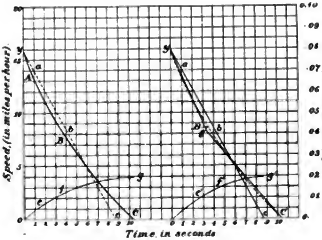


FIG. 3.—BRAKING CURVES

In Fig. 4 the curve *O b d* is a run curve of the simplest character. The first portion (*A*) is a simple acceleration curve. The second portion (*B*) is a drifting or coasting curve and the final portion (*C*) is a braking curve. The acceleration portion (*A*) is the same as the corresponding portion of the acceleration curve in Fig. 1, from which it was taken. The vertical dotted line (*a-b*) indicates the point at which the acceleration line was cut off. In like manner, the drifting portion of the run curve in Fig. 4 was taken from Fig. 2 between the points corresponding to the same letters (*b-d*). The vertical dotted lines (*a-b*, *c-d*) indicate the points at which this line was cut off. The braking portion (*C*) of the curve in Fig. 4 was calculated.

This particular run curve corresponds to a case in which the power

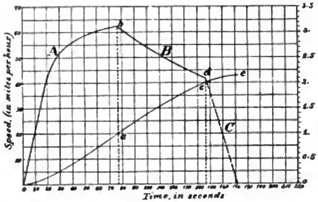


FIG. 4.—RUN CURVE

is applied to the car only once, or during the early portion of the run. In actual practice, however, it is often found necessary to allow, or purposely to cause, the speed to diminish and subsequently to cause it to increase again at intermediate points of the run. In such case the run curve will show notches or humps (Fig. 5). These notches or humps are almost always due to the occurrence of track curves having a relatively high degree of curvature at points intermediate between stopping points. These curves impose a limit on the speed which it is safe to maintain at such points of the line. When such curves occur at or near the stations they have less influence on the form of the run curve, because the speeds are lower, owing to the starting and stopping of trains. In such cases they do not cause humps or notches in the run curve, although they do affect the "angle" of the acceleration or of the retardation (braking) curve. The notch or hump in the

* These appendixes will be published in an early issue. [Eds.]

run curve indicates the fact that acceleration again takes place after the speed has been reduced to the proper or desired limit. This acceleration is followed by drifting and braking, and, in some cases, the run curve may contain several such notches, each of which, as will be readily understood, corresponds to what might be called an "acceleration cycle."

Acceleration.—Each acceleration cycle of a service run corresponds to the time during which energy from some source is applied to the car or train so as to cause the speed to increase.

(The physical and mathematical characteristics of acceleration are discussed summarily in Appendix A and in Appendix B.)

The energy imparted to a train during an acceleration cycle is absorbed and disposed of by the train in two ways: First, a portion of it is immediately converted into heat, which represents the energy required and expended in overcoming the various frictional resistances making up what is called "train resistance;" second, a portion is stored as mechanical energy in the "mass" of the train. This storage energy is the energy required either (*a*) to produce acceleration, in which case it is stored as kinetic energy, or (*b*) to lift the train on an up-grade; in the latter case it is stored as potential energy. The two forms of stored energy often occur simultaneously. When accelerating on a down-grade the stored energy at any instant would evidently be equal to the difference between these two kinds of energy at that instant.

The energy concerned in acceleration may be classified under three general heads, namely:

1. The energy required for overcoming the actual mechanical resistance to the motion of the car. This energy is immediately dissipated as heat.

2. The energy required to overcome grades. This energy is stored as potential energy.

3. The energy required to overcome the inertia of the car and give it momentum. This energy is stored as kinetic energy.

The third form of energy, namely, kinetic energy, is the only form usually recognized as being concerned in producing and entering into acceleration. It can be shown, however, that in any case in which acceleration occurs all other forces than that of kinetic energy may also be estimated in terms of an acceleration, which may be termed "equivalent" acceleration. This has been done in Appendix B in equations (24) to (29), by means of which an important theorem is deduced, to the effect that the total acceleration in a moving mass is the algebraical sum of the individnal accelerations corresponding to each of the forces acting to produce or prevent the motion of the body. This theorem is doubtless well known in kinematics, although its application to the speed-time curve appears to be new. It is one of those principles which, though not at first readily apparent, and somewhat difficult to work out, proves to be really very simple to understand and to apply. According to this theorem, the second form of energy, or the energy required to overcome grades, may be estimated in terms of equivalent acceleration. It is known, as a matter of fact, that the potential energy, or energy of position, in a car which is on a down-grade can produce the same acceleration that could be produced by an equivalent tractive effort in pounds per ton applied to the car in any other way. Conversely, the motion of the car in the contrary direction would produce a contrary effect, or a reduction of acceleration, which could be expressed in terms of equivalent loss of acceleration.

Energy of the first kind cannot, strictly speaking, be said to be capable of producing an acceleration. It may, nevertheless, be expressed in terms of equivalent acceleration, since, as in the case of a car going up-grade, it may be considered as equivalent to a force occasioning a loss of acceleration.

In the same manner, and by analogy, we might consider the kinetic energy absorbed in pure acceleration as an energy required to overcome an apparent increase in the train resistance due to the inertia of the train, and in like manner the energy required to overcome grades might be also ascribed to an apparent increase in the train resistance. From this standpoint the three forms of energy may be considered as having the same kinemetical character. The energy corresponding to an actual resistance represents energy necessarily lost, or which is not recoverable, while the energy corresponding to a spurious resistance (analogous to reactance in electro-kinetics) represents energy which is not primarily or necessarily lost, but which is really stored and which is recoverable wholly in theory and partially in practice. The former is analogous to the electrical energy dissipated by an ohmic resistance, and the latter to the wattless energy absorbed provisionally by a reactance, the analogy being so obvious as to require no further explanation.

An acceleration curve is, as pointed out in Appendix A, a speed-time curve, or velocity curve, having a positive differential coefficient. This differential coefficient, as shown in Appendix B, in equation (28) is equal to the algebraical sum of the differential coefficients corresponding to the various forces concerned and active in producing the acceleration.

Using the letter "k," with suitable affixes, to designate the individual coefficients corresponding to the individual forces concerned in each case, and using the letter A' to designate the resultant acceleration, we have, from equations (28) and (29) in Appendix B,

$$\frac{dv}{dt} = k \pm k' \pm k'' \pm \text{etc.} = A' \qquad (I)$$

Some of these individual coefficients may be positive, while others may be negative, but the algebraical sum, according to the above definition of an acceleration curve, must be a positive number.

When weights (W) are expressed in tons of 2000 lbs., and when p = the equivalent gross tractive effort or pull corresponding to each of the individual forces concerned in the resultant motion, we have, by analogy to equation (21*a*) in Appendix B,

$$k = \frac{dv}{dt} = .01098 \left(\frac{p}{W}\right) \qquad (II)$$

and, reconstructing equation (I) accordingly, we have

$$A' = .01098 \left(\frac{p}{W}\right) \pm .01098 \left(\frac{p'}{W}\right) \pm .01098 \left(\frac{p''}{W} \pm \text{etc.,}\right)$$

of which the simplest form is

$$A' = .01098 \div W \left(\frac{p}{W} \pm \frac{p'}{W} \pm \frac{p''}{W} \pm \frac{p'''}{W} \pm \text{etc.}\right) \qquad (III)$$

The factor $.01098 \div W$ is sometimes written $1 \div 91.1\ W$.

When each term "p" is taken in pounds per ton the term "W" disappears, and we then have

$$A' = .01098 \left(\frac{p}{W} \pm \frac{p'}{W} \pm \frac{p''}{W} + \frac{p'''}{W} + \text{etc.}\right) \qquad (IV)$$

We must now determine the number and character of the force factors (p), by reference to which the resultant acceleration is to be expressed.

The force of the equivalent acceleration corresponding to train resistance could be expressed by a single symbol, but it is more convenient to express it by means of two separate symbols, one of which (f) shall correspond to and shall include all the factors of train resistance except the increase of resistance due to curvature, which latter may advantageously be considered separately, in which case its equivalent force may be expressed by the symbol c. The force corresponding to grades may be expressed by the symbol G. The force corresponding to kinetic energy may be expressed by the symbol I. In this case, however, the effect is complicated by the fact that in a moving train there is inertia of two kinds, namely, linear inertia, or the inertia due to the entire mass of the car moving in a straight line, and rotational inertia, or the inertia due to the rotating parts of wheels, gears and motors. It is possible, however, to express the rotational inertia in terms of linear inertia. This fact was alluded to in the paper read before this Institute by N. W. Storer, in which it is stated that the rotational inertia has the same effect in increasing the total inertia as if the mass of the car were increased by a certain percentage. This percentage varies in different cases, but Mr. Storer recommends that it be taken at about to per cent. We may therefore use the same term to designate the effect of linear inertia or rotational inertia, if this term includes the proper correction for rotational inertia. It is just as simple, and it may be sometimes convenient to use a separate symbol i for the rotational inertia.

These several symbols express the forces which react upon and modify the propelling force applied to the car. The forces in each case are understood to be measured in pounds of pull per ton of train weight, this being the basis assumed in the fundamental equation (21*a*) in Appendix B. The propelling force of the motor may be expressed in terms of an equivalent gross tractive effort (P), also measured in pounds per ton. In the case of a series electric motor, this gross tractive effort depends upon the amount of current passing through the motor and also upon the gearing ratio of the motor. The amount of current itself passing through the motor is, as is well known, a function of speed, consequently the gross tractive effort of the motor is itself a function of the speed of the car.

Tabulating these symbols, we have

W = Weight of car or train (in tons of 2000 lbs.).

T = The total or gross traction (due to the current) per motor.

$P = T \div W$ = Gross traction in pounds per ton.

f = Force expended in overcoming the friction of all kinds (including axle friction, air and wind resistance, etc., but not including curve resistance) in pounds per ton.

c = The force expended in overcoming the additional resistance due to track curvature.
G = The equivalent traction due to grades. (This factor will have + sign on down grades and — sign on up grades.)
I = The force expended in overcoming linear inertia.
i = The force expended in overcoming rotational inertia.
p = Resultant force expended in acceleration. $(= I + i.)$

The factors f, c, G, I, i are all expressed in pounds per ton of train weight.

From this it is seen that we have to consider a total of six (6) terms of the type p.

The term f expressing train friction varies, as is well known, as a function of the train speed, same as the gross traction.

The term c varies with the degree of curvature. This term only occurs in those portions of acceleration curves which correspond to points on the run at which there are track curves. It is usual to assume this resistance as equivalent to from 0.7 lb. to 0.9 lb. per ton per degree of curvature. Thus, assuming a coefficient of 0.8, a track curvature of 5 degs. would increase the train resistance by an amount equal to four pounds per ton.

The term G depends upon the percentage of grade and is constant for each percentage. For example, a grade of 1 per cent, which means a rise of 1 ft. per 100, would be equivalent to lifting the train weight (W) one-hundredth of the distance or lifting one-hundredth of the weight the entire distance. Each ton of 2000 pounds would therefore occasion an apparent increase in train resistance equivalent to twenty pounds per ton.

From the above it is seen that the value of G in any particular case will be

$$G = 20\ q,$$

in which q expresses the percentage of grade.

The terms I and i together represent, as will be understood from the preceding discussion, the net force, or the force which is expended in acceleration.

We may retain the term p to express this net force, so that

$$p = I + i.$$

If we substitute the above terms for the terms p', p'', etc., in equation (IV) we have.

$$A' = .01098\ (P - f - c \pm G) = .01098\ p. \qquad (V)$$

The signs of f and c will always be minus.

The sign of G will be + when the car is on a down grade, and it will be — when the car is on an up-grade.

We thus see from equation (V) that the differential coefficient of an acceleration curve may be simplified in expression until it is equivalent to the algebraical sum of various factors representing real or spurious train resistances, multiplied by a constant. The algebraical sum referred to is nothing more than the net pull, since, if we equate the last two terms of the equation, the coefficient .01098 disappears and we have simply

$$p = P - f - c \pm G \qquad (VI)$$

Each term, taken separately with the constant, indicates the equivalent acceleration corresponding to said term expressed in miles per hour per second. Thus, in the case of the gross traction (P) the quantity .01098 P would mean the acceleration in miles per hour per second, which would be obtained if it were not for the modifying factors f, c and G.

Retardation.—In the second portion of each cycle of train motion there is a stage of motion during which the car moves without extraneous power being employed, it being impelled by the kinetic energy previously stored in it during acceleration. The car is then said to be "drifting" or "coasting." The coasting or drifting motion would continue, with the speed in the meantime gradually diminishing until the kinetic energy stored in the car or train has been entirely dissipated in overcoming the train resistances, when it will stop. When the rate of dissipation of the kinetic energy is purposely increased by friction shoes bearing against the car wheels the retardation is more rapid and the car is then said to be "braking." A braking curve is, therefore, a retardation curve showing a high rate of retardation.

A retardation curve may be defined as a velocity curve having a negative differential coefficient. (See Appendix A, last paragraph.)

In a coasting curve the coefficient is relatively small; in a braking curve it is high.

The same equations which apply to acceleration will apply to retardation. In this case, however, since power is no longer being applied to the car, the quantity P will be zero, and will consequently disappear from the equation. The only terms remaining will be f, c and G, so that the equation will now become.

$$-A' = .01098\ (-f - c \pm G) = .01098\ p \qquad (VII)$$

If there happen to be no curves or grades the equation will be simply

$$-A' = -.01098\ f = -.01098\ p \qquad (VIII)$$

whence we have

$$-f = -p$$

or the force (p) due to the kinetic energy is exactly equal to the force required to overcome the train resistance (f). The minus sign indicates that the acceleration is negative or that its rate is a decreasing one. The energy-producing acceleration comes, of course, from the kinetic energy stored in the car. The rate of decrease of the speed will be exactly such as to produce the force p $(= f)$ and no more. This is in accordance with equation (22) in Appendix B. It seems strange until we stop to consider the two following circumstances: First, that the only way in which the energy of the car can be dissipated when braking does not occur is by means of the friction due to train resistance; second, if the speed variation could in any way become greater than that which corresponds to and develops a force equal to that of the train resistance (in accordance with equation 22) there would be a surplus of force, and this surplus could only be expended in producing acceleration or in the reacceleration of the car. It is evident, therefore, that the rate of retardation of the car must of necessity be exactly such as, and can be no more than can and will suffice to cause the kinetic energy stored in the car to be dissipated at precisely the rate required to overcome the train resistance and also the effect of track curve resistances and of up-grades, if there be any. It is worth while to note that the case would be different if the car were running on a down grade, for, in this case, G is not equal to zero, but has a positive value, and, consequently, represents a force which is, of itself, capable of producing acceleration. Under these circumstances, we should, therefore, expect, and we find in practice, that a higher rate of acceleration is produced.

When braking the car there is, as already stated, an additional retarding force. This retarding force, which may be designated by the symbol B, enters in the fundamental equation with the negative sign, so that we have

$$-A' = -.01098\ (-B - f - c \pm G) \qquad (IX)$$

In practice it is usual to speak of a braking force of so many pounds per ton. For high-speed work the value generally taken is $B = 150$. As pointed out in section II, in discussing the subject of plotting braking curves, it is usual, for the purpose of simplification, to assume that this figure (150) also represents and includes the values of f and c, so that the equation, as used in practice, would generally be simplified to the following form:

$$-A' = -.01098\ (150 + G) = 1.647 + (.01098\ G) \qquad (X)$$

In the coasting curve, as well as in the braking curve, the effect of a down grade, which makes the sign of G a plus sign, will be evidently to decrease the rate of retardation, while the effect of an up-grade, making the sign of G minus, will be to increase the rate of retardation.

The equation shows that the slope of the braking curve will depend not only upon the value of the braking friction (B) but also upon the train resistance, also the track curvature and percentage of grade, if any.

The term B is generally assumed constant and independent of the speed. This is not exactly true, however. The true braking curve (y, A, B, C in Fig. 3) is, like the drifting curve, more or less convex to the axis of x. The straight line (y, a, b, c) indicates the (constant) rate or retardation that would be required to bring the car to stop within the same distance. It will be seen that, with a constant rate of retardation, the car would come to a stop a little sooner than is actually the case in practice. The data available from actual tests are still so meager, and the analysis of them is so incomplete, that engineers are still obliged to assume a constant rate of retardation in dealing with the braking curve. This point is again referred to in section II.

In the foregoing equations individual acceleration coefficients which go to make up the resultant coefficients are shown by means of various terms indicating a force or pull in pounds per ton, multiplied by a constant. This has been done out of deference to the established practice among engineers of estimating the accelerating force in pounds per ton. The writer believes that a more satisfactory way would be to estimate acceleration in miles per hour per second, using equations of type shown in equation (I) rather than those of the types shown in equation (IV). The advantage of equation (I) is the fact that it gives the resultant acceleration in terms of the individual accelerations expressed in miles per hour per second. Translated into words, this equation means that the total or resultant acceleration is obtained by taking the difference between all the positive acceleration co-efficients and the negative acceleration co-efficients. The transition from one type to the other has been clearly indicated, and it is not necessary, therefore, to repeat the equations in the modified form. In plotting the curves by the method which will now be described the values used are those obtained by equations corresponding to equations (V), (VII) and (IX), but patterned after equation (I).

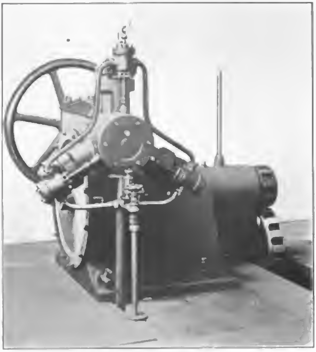
Interesting Turbine Work

American engineers will find much to interest and instruct them in the development of the water turbine in Europe and its numerous applications under widely varying conditions. The work of Escher, Wyss & Co., of Zurich, in this line is particularly interesting. Some idea of the extent of this concern's experience may be gained from the statement that up to the first of the present year it had built and installed upward of 3200 turbines, aggregating 372,303 hp. This work, of course, has not been confined to any particular locality, but extends over the entire continent of Europe, and examples are to be found wherever water power is utilized. Some of the more notable installations are those at Bellegrade, France, comprising two turbines of 1500 hp each; Kanderwerk, Switzerland, six turbines of 1400 hp each; Glommen, Norway, one turbine of 3000 hp; Isarwerke, Munich, Bavaria, two turbines of 1000 hp each, and St. Maurice, Switzerland, five turbines of 1000 hp each.

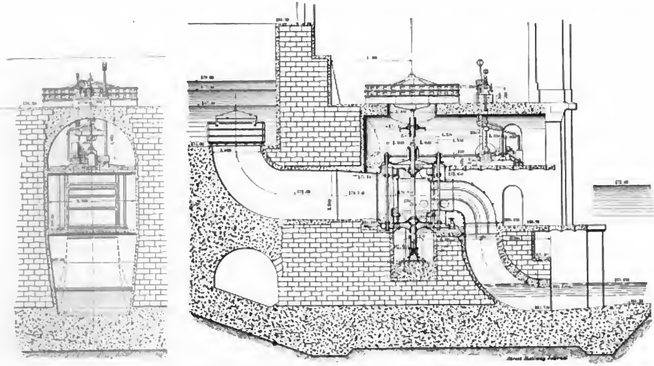
The turbines built for medium falls are in most cases of the Francis type and have, according to the prevailing circumstances, one, two or more runners, or turbine wheels, arranged on the same shaft One of the most interesting examples is the power plant of the Société Lyonnaise des Forces Motices du Rhône at Lyons, France, which has been supplied with double turbines. These machines were designed to produce 1500 hp each under a head of 10 m (32.81 ft.) and 1350 hp each under a head of 8 m (26.24 ft.) when operating at a speed of 120 r. p. m.

The design of this turbine and the general features of the installation may be readily understood by an examination of the accompanying plan. The turbine proper is situated in a flume of plate, which is closed at the upper and lower ends by means of split cast-iron covers. From the two turbine wheels the water flows into a common discharge dome, or draft chest, and thence through a draft tube, or suction pipe, which is constructed partly of plate and partly of concrete, into the tail-race. The vertical pressure on the shaft caused by the rotating parts of the turbine and dynamo as well as by the pressure of the water is partly provided for by a hydraulic balancing apparatus and partly by a pivot situated below the turbine. The regulation is effected by turning the adjustable guide-floats, which may be operated by means of a gearing from an auxiliary motor that works with oil pressure. The motor is regulated by the governor through a regulator valve and is supplied with a differential piston. The small surface of the piston is under continuous pressure and the larger piston surface is controlled by the governor through the regulating valve. The installation at Lyons, which has just been completed, consists of eight of these double turbines of 1500 hp each, eight 1250-hp conical turbines with three rows of buckets each and three exciter turbines of 250 hp each. A photographic reproduction of one of these double turbines of the Francis type is presented herewith and also a view of the starting apparatus.

For installations at high falls a special type of high-pressure turbines with spoon-shaped buckets has been designed. This type is illustrated in the cut on page 56. The discharge from the usual rectangular nozzle is regulated by a tongue which is placed and accurately fitted inside the cast-iron casing of the turbine. This tongue forms one arm of an angular lever, the other arm being connected with the piston of the auxiliary motor. The pressure of the water has always the tendency to open the tongue,



STARTING ENGINE FOR TURBINE INSTALLATIONS



DETAILS OF TURBINE INSTALLATION AT LYONS, FRANCE

but it is prevented from doing so by the power produced by the water pressure on the lower part of the piston of the auxiliary motor. If, however, the water is guided by the regulating valve into the upper and larger surface of the differential piston the tongue is opened, but it is shut again when the upper surface of the piston is shut off from the pressure water and connected with the discharge room.

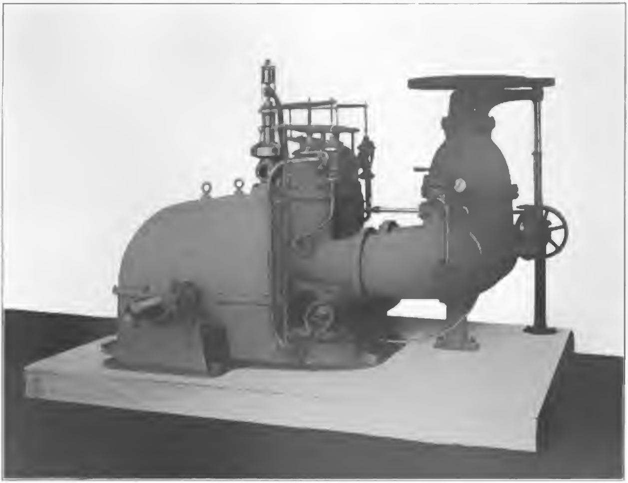
As a rule, these high-pressure turbines are provided with special pressure-regulating apparatus which is intended to avoid dangerous variations of pressure in the pipe line. These equipments permit the water, when it is cut off suddenly by the regulation on sudden changes of load, to flow out without a moment's delay through a side opening, which afterwards shuts automatically by means of an oil cataract. The tests which were made with this apparatus in several installations have shown that, even by a total discharge, the maximum variation of pressure did not exceed 2½ per cent, though there is no fly-wheel or air vessel connected with the apparatus.

Interurban Lines Projected in Scotland

Reports about the promotion of a mono-rail line between Edinburgh and Glasgow have been revived, but so far as the investing public is concerned it will probably prefer to await the result of the mono-rail experiment between Manchester and Liverpool At present there are three lines of railway between the two chief cities of Scotland, and the construction of a fourth does not seem very inviting to investors. Commenting upon this project, the Edinburgh Dispatch says, however, that railway companies and city authorities cannot close their eyes to the signs of the times, and it calls attention to the progress of the electric railway in this country. As an example of the work that is being done here it cites the interurban service of Western Pennsylvania and reproduces some statistics from the STREET RAILWAY JOURNAL of May 7 on the development in that region, with the comment that the value of such a great network of lines in developing the country cannot be exaggerated. At the conference of charity and kindred societies held in Edinburgh reference was made to the influence of cheap and rapid traction on the improvement of the condition of the poor, and it is interesting to note, says the *Dispatch*, "that additional confirmation of the beneficial effect of these railways is given in the article to which we have referred. Whatever agreement is come to regarding our Edinburgh tramways, it is earnestly to be hoped that nothing will be done that might have the effect in future years of checking the introduction of such suburban lines as those which are working a great revolution among American cities and improving the condition of the workers in a marvelous way."

Discussion of New York Central's Plan

In discussing Mr. Arnold's paper before the Institute upon the plans of the New York Central for substituting electricity for steam in the terminal work, Frank J. Sprague, who has given the subject special attention and is familiar with the conditions that exist there to-day, said that he was glad to note that the power requirements agreed very closely, considering the changed conditions, with the result of a similar investigation made under his direction three years ago. Mr. Arnold had very wisely confined himself to the problem of train movements within the limits of New York. For the specified service, the use of continuous current motors, to be operated at a moderate pressure, was the only safe recommendation. Mr. Arnold's paper had made special comparison of steam and electric operation in the matter of economy, with the result that no special advantage had been shown in favor of one or the other. Economy, however, was in this particular case the least important consideration, and he did not doubt that Mr. Arnold believed with himself that while this comparison was a necessary thing to be presented, there was no question, not only as to the practical possibility of electric operation, but of its economy. Wisdom, and even imperative need on the score of comfort and safety, required the change; and furthermore, the financial results would also entirely justify it. On account of the special nature of the problem, if the railway company should defer the adoption of electricity until some great

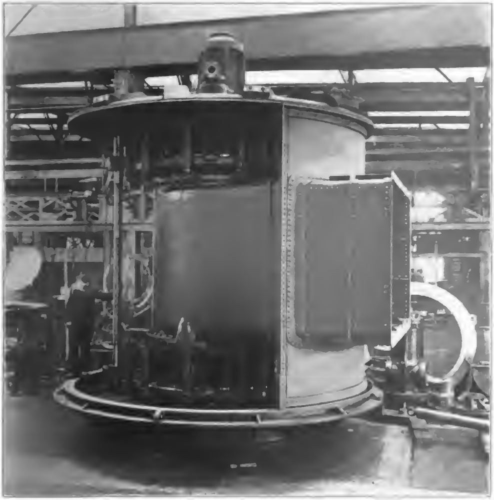


HIGH PRESSURE TURBINE FOR HIGH FALLS

saving in car-mile operation was manifest, steam would continue to be the motive power of the tunnel. Safety, cleanliness and comfort, however, being assured, increased dividends would most assuredly result from increased traffic.

The problem was a two-fold one—the replacing of the steam locotive on through trains and the operation of the suburban service. The requirements were to be met in different ways. At present both train services were operated by steam locomotives. The through service must remain such, but the suburban could be readily changed. No less than ten or a dozen types and sizes of locomotive were now in use, and at limited speeds. Train weights varied from a hundred and fifty to six or seven hundred tons. It would seem, therefore, that in so far as locomotive service was concerned, it could best be performed by units of, say, 30 to 35 tons weight, and of 700 hp to 800 hp, these units to be so equipped and controlled that one could be used for the lighter service and two operated as a single-unit for the heavier.

This condition made imperative what has already been well settled—electrical instead of hand operation of control equipments, and the grouping and simultaneous control of units; in short, the multiple-unit system of operation. For suburban service, individual equipment of cars and like control of any required number was now beyond question. Another thing should be borne in mind, and that was that electrical equipment not only would insure greater safety of operation by clearing the tunnel of smoke and condensed steam, but the adoption of electrical control would leave the engineer free to devote himself to the safe piloting of his train, untrammelled by the distractions of other duties. Mr. Sprague concluded by saying that, so far as the possibilities of the case were concerned, he would not hesitate—and he felt sure that he voiced the conviction and readiness of others in the room—to undertake the feat of putting the heaviest train from Mott Haven to the Grand Central Station under electric power on schedule time within six months. Of course, such demonstration would be a special one, for considering the many civil engineering and railway problems involved, from two to three years would be necessary to make a general change.



DOUBLE TURBINES OF THE FRANCIS TYPE FOR LYONS, FRANCE

The accompanying tables contain the data, in convenient form, that was presented and discussed by Mr. Arnold in his paper. At the time of publication the arrangement of this data had not been completed. It is presented as an inset, in order that those who may desire to do so may bind it in the last volume with the original paper, thus making a most complete record.

Opposed to Running Cars on Sunday

The promoters of electric railways have encountered a sturdy opponent in Aberdeen in the form of the United Free Presbytery. At a recent meeting the following resolution was unanimously adopted:

"The Presbytery having learned with deep concern that a proposal to run tramway cars on the Lord's Day is to be made in the Town Council of Aberdeen, resolve as follows: Whereas, this proposal, if carried, would involve a complete reversal of the habit and custom of the city in the matter of Sunday traffic on the street, a serious increase of Sunday labor on the part of men employed by the city, whose opportunities of rest are already very few, and a still more encouragement to the increase of Sunday traffic in general; and whereas this proposal has not arisen from any desire expressed by the community for a Sunday service of cars, but is certain to awaken strong disapproval on conscientious grounds on the part of a large section of the citizens; therefore, the Presbytery, while expressing their own strong conviction that the proposal is uncalled for, and is fitted to do lasting injury to the institution of the Christian Sabbath and to the best interests of the city, respectfully appeal to the Town Council to withhold consent to the action proposed until the mind of the citizens has been ascertained."

In the discussion that followed the introduction of this resolution the Rev. W. Mackintosh Mackay said that the movement would not be confined to Sunday morning, but was bound to be projected into the afternoon, and especially into the evening There should, at least, be a plebiscite of the community on the question.

Councillor Esslemont said he did not regard it as a sinful thing in itself that there should be means of locomotion on the Sunday, but the aspect that appealed to him was that Sunday cars could not be run without causing very serious inconvenience and a very great injury, in his opinion, to the employees of the corporation. It might be said that they would get a day off during the week in lieu of the Sunday; but nothing could take the place of the Scottish Sabbath for the Scottish working man. It was on that ground he intended to oppose the motion in the Town Council. There was a feeling, however, in the community in favor of the Sunday cars.

Principal Salmond said it would need a very strong argument to make out that there was any pressing reason, any necessity, for a change like this in the case of a city like Aberdeen.

Mr. Donaldson said if this was a modified service of cars to suit people going to church, he did not see how they could object to it, without objecting to carriages, for the car was simply the poor man's carriage. If those who could, by paying for it, obtain a cab to church, he did not think they could object to the modified use of cars. It was also resolved to recommend ministers to call the attention of their congregations to the subject, and the public questions committee was empowered to approach other churches with a view to joint action.

New Cars for Philadelphia Suburbs

Some handsome cars built by the J. G. Brill Company, of Philadelphia, have recently been put in commission on the lines of the Ardmore & Llanerch Street Railway Company. They are especially interesting on account of their fine appearance, structural strength and suitability to the service required of them. The heavy traffic between these fine residential suburbs requires an equipment modern in every respect and conducive to every convenience and comfort. The cars have smoking compartments seating twelve passengers. The main compartment seats twenty-eight. The doors and windows of the dividing bulkheads and

DOUBLE-TRUCK CAR FOR SUBURBAN SERVICE

INTERIOR OF SUBURBAN CAR

ends have drop sashes, which, together with the large windows and high and wide monitor decks, make the cars exceedingly pleasant in warm weather. The length over the bumpers is 41 ft. and the width at the belt line 8 ft. 4 ins. Heavy sill-plates, angle-iron reinforced platform timbers and Brill patented angle-iron bumpers are parts of the powerful construction. The interiors are done in natural-finished white quartered oak, and the ceilings of the same highly finished and decorated. The cars are equipped with Brill patented specialties, including sand-boxes, "Dedenda" gongs, radial draw-bars and track scrapers. The trucks are the Brill patented No. 27, which have a remarkable record for strength, ease and safety at high speed.

Automatic Block Signals

The system of signals for electric railways which has been perfected by the United States Electric Signal Company, of West Newton, Mass., was first introduced in 1898, and since that time has been installed on a large number of roads. The importance of a safety device of this kind under the conditions obtaining on high-speed interurban lines cannot be overestimated, and the expense of installation of an absolutely sure block signal system is very small when compared with the probable damage claims resulting from a single collision. The "United States" signal was conceived by some of the most expert engineers of the Gamewell Fire Alarm Company, which is sufficient guarantee that the mechanical details of the apparatus are of exceptional merit. The system works automatically, a small switch attached to the trolley wire operating the signals. The signal boxes, which are attached to the poles, have substantial cast-iron cases containing two colored windows, one red and one green, and the lights behind these windows are controlled by operating magnets. The system can be used on third rail or surface-contact roads with a slight variation of the standard equipment furnished for overhead construction.

Track and Trolley Wire Scrapers

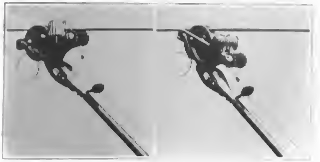
The accompanying illustrations show two ingenious devices which have recently been perfected by Fred. M. Root, of Kalamazoo, Mich. The Root track scraper is an ingenious device for cleaning the track thoroughly of all dirt and obstructions. The springs are made of oil-tempered steel, and the hand lever which is connected

TRACK SCRAPER FOR STREET CARS

to the bell crank under the front platform enables the motorman to maintain any pressure on these springs that may be desired. The shoe of the second scraper, being just the width of the rail head, is always on the track, and even should the rail be several inches below the pavement the surface is kept bright and clean under all conditions, insuring good electrical contact of the wheels with the consequent saving in power. The crank on the shaft to which the springs are attached is connected to the bell crank under the platform by a rod in the end of which are several holes to receive a set screw so that the apparatus can be perfectly adjusted to any car.

The other device is intended for cleaning trolley wires of ice and snow in a much more efficient manner than the ordinary corrugated wheels sometimes employed. The cuts show the rollers or knurls held against the wire when in operation and also removed from the wire when their use is not required. The conductor can control their position by means of the cord which runs down the

trolley pole. The two side rollers are held in position close to the trolley wire by means of springs on the side and yield readily to any diameter of ice on the wires. Having three corrugated wheels in the relative positions shown, the ice is thoroughly cracked up on three portions of the wire, on each side and underneath. In this way the wire is thoroughly cleaned before the trolley wheel reaches it and the groove of the latter makes good electrical contact.

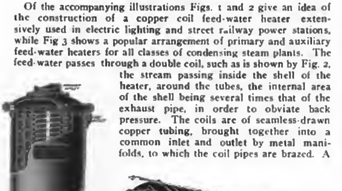


SLEET ATTACHMENT FOR TROLLEY WHEELS

By the use of the two devices described above the manufacturers claim that a large amount of power can be saved through the winter months, and with a power station equipment that is now hardly able to cope with the service at bad seasons of the year, roads may be run on schedule time without overtaxing the present facilities. Both pieces of apparatus are made by the Root Track Scraper Company, of Kalamazoo, Mich.

American Standard Feed-Water Heaters and Their Economical Arrangement

Of the accompanying illustrations Figs. 1 and 2 give an idea of the construction of a copper coil feed-water heater extensively used in electric lighting and street railway power stations, while Fig 3 shows a popular arrangement of primary and auxiliary feed-water heaters for all classes of condensing steam plants. The feed-water passes through a double coil, such as is shown by Fig. 2, the stream passing inside the shell of the heater, around the tubes, the internal area of the shell being several times that of the exhaust pipe, in order to obviate back pressure. The coils are of seamless-drawn copper tubing, brought together into a common inlet and outlet by metal manifolds, to which the coil pipes are brazed. A



FIGS. 1 AND 2.—DETAILS OF HEATER

patented form of clamp-stay permits of free expansion and contraction of the coils, at the same time holding them securely in place. In order to permit the renewal of packings without disturbing the pipe connections, an improved fitting is used, the feed pipe being screwed directly into it and not outside of it, so that the gland nut holding the coil in position may be run back on to feed-water pipe, while the asbestos packing is renewed. Each coil is tested to withstand 600 lbs. hydraulic pressure. The manufacturers direct special attention to the fact that the feed water comes in contact with no other metal than copper in passing through the heater, which takes up little room and has no removable or adjustable parts to get out of order. The arrangement of apparatus shown by Fig. 3 is one which obviates the use of a hot well, the feed water passing first through the horizontal primary heater, in which it attains a temperature depending upon the vacuum in the exhaust pipe. With a 26-in. vacuum in ordinary working the feed water should leave the primary heater at a temperature about 25 degs. above that of the hot well, say at 125 degs. From the primary heater the feed water passes to the vertical auxiliary heater, into which is discharged at atmospheric pressure all the exhaust steam from the feed, condenser and other steam pumps, small engines or any other auxiliary apparatus, the temperature of the feed water being raised nearly to boiling point. With this arrangement of heaters it is not generally economical to use a condenser driven from the engine shaft, because the exhaust steam from an independent condenser is usually required in the auxiliary heater to insure economical results, but in cases where the exhaust from the auxiliary machinery is more than sufficient to do the work, a part of such auxiliary apparatus may be exhausted into the primary heater, and thus work under vacuum with increased economy. Where the available amount of exhaust

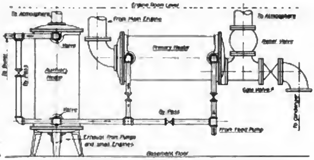


FIG. 3.—ARRANGEMENT OF FEED WATER HEATERS

steam is insufficient, however, the required amount of steam may be secured by "bleeding" the high-pressure exhaust of a compound engine or by taking steam direct from the boiler through a reducing valve. As to the relative sizes of the heaters it is considered good practice to have them of equal capacity, the work to be done being usually about the same in each. The primary heater is arranged to drip at the lower end, and the heaters are usually so by-passed as to permit either one to be used independently when necessary. As the primary heater itself acts as a partial condenser its use causes no impairment of the vacuum, while the fact that there are no threaded or expanded joints in the tubing, all connections being made by lapping and brazing, is a safeguard against any leakage that would prove detrimental to the maintenance of the vacuum. The heaters described are manufactured by the Whitlock Coil Pipe Company, Hartford, Conn.

An Efficient Ticket Destroyer

A machine has been designed for making valueless used tickets, transfers, etc., so as to leave no chance for fraud. It is known as the Patten ticket destroyer. It has frequently been found that the old method of burning is very ineffectual, and it is evidently doubtful policy to intrust a man with anything to destroy that may be of value to him if saved.

This apparatus can be set up in the auditor's department and the tickets destroyed under his immediate supervision. After passing through the machine the cuttings can be sold for paper stock or otherwise disposed of without fear of their being further presented for use. The construction of the apparatus is very simple, and, as it is strongly built, has large wearing surfaces, babbitted bearings, crucible steel cutters, etc., it is very durable. It may be run by a 1-hp motor or by hand power.

These machines are built by Paul B. Patten, of Salem, Mass., and are in practical operation on a number of street railways. Among the users may be mentioned the Boston & Northern Railroad, Old Colony Railway Company, Brockton Street Railway Company, Waterbury (Conn.) Electric Company, Bridgeport Traction Company, Buffalo Railway Company, Cincinnati Traction Company, Fitchburg & Leominster Railway Company and Youngstown & Sharon Railway.

The report of tests made with fuel oil at the plant of the Dallas Electric Light Company is attracting considerable attention among managers of power plants, although the data given out is incomplete, and consequently unsatisfactory. This test was made under a Babcock & Wilcox boiler of 317 hp rating, based on 10 square feet of heating surface on a run of eight hours. The evaporation of 212 degs. was said to be 13.77 lbs. of water to the pound of oil. At the time the test was made oil was worth 59 cents per barrel, delivered in Dallas, against $3.15 per ton for coal. As compared with an eight-hour run of coal, while evaporating 8.87 lbs. of water to the pound of coal, the actual saving was $3.66, without figuring on the fireman at $2 additional. This plant has since adopted the system used during the test, and the management estimates that it is saving approximately $2,000 per month on fuel and $26 a day on firemen.

A Light Interurban Car

The accompanying cut shows a light combination interurban car, which was part of an order recently completed by the John Stephenson Company, of Elizabeth, N. J., for the Montroseville, Bellevue & Norwalk Traction Company, of Sandusky, Ohio. The order comprised several different styles, but that shown in the engraving is the one of greatest interest. The body is 28 ft. long over the end panels and is divided into two compartments. One of these, about 8 ft. in length, is used for baggage as well as for smoking, and is provided with sliding doors on each side. The other compartment for passengers is about 20 ft. in length. The car measures 37 ft. over the dashers, with a width at sills of 8 ft. 4 ins. A straight side with the "Stephenson" double sheathing was adopted as making the best and most convenient method of constructing a car which required a sliding door in the side. As a car with such an opening requires unusual strength, on account of the side truss being interrupted, the sills are heavily plated with steel. As will be noticed in the engraving the plate is well secured by a double row of bolts, closely spaced. In addition to this there is the usual truss rod under each side sill, and two extra longitudinal sills along the center.

HANDSOME INTERBURBAN CAR WITH BAGGAGE COMPARTMENT

The vestibules are of the completely enclosed type with round ends, street car bonnets, three-dropped sash with metal stiles and channel-iron platform timbers. The metal stiles have the advantage of making a minimum obstruction to the view. The channel-iron platform timbers, with their riders ot oak, make a very solid construction, and being dropped bring the platform floor so near the head of the rail that only a single step is necessary. The buffers are of the Stephenson spring type. They are of channel-iron, and are so cushioned by the springs that the framing is entirely relieved from the shock of the inevitable blows which the end of a car receives in storing cars at night and at other times. This construction materially increases the life of the car body. The bonnet is built with bows and rafters of bent ash, and as is desirable in a car of this type, the roof is unusually stiff and strong, having nine steel rafters. The projection of the upper deck, both on the sides and at the ends, is sufficient to afford the ventilators ample protection against rain. The two compartments are divided by a partition, finished in panel work. The swinging door has glass in its upper portion.

The cars are mounted upon the No. 20 Stephenson truck. The use of this truck enables the body to be brought low, and, at the same time, there is ample room for the truck to swing clean of the timbers. This is effected by the dropped ends of the truck frame and by the arrangement of its swinging bolster. The No. 20 truck not only carries the car body with great steadiness, making what is recognized as an easy riding car, but the amount of power needed for propulsion is remarkably small. This is due to the way in which the truck frame is carried by the double journal springs and to the soft swing motion. One important point is worth attention, viz.: that no matter how far the swing beam moves from its normal position, even though the links may make a sharp angle with the vertical, no part of the swing motion can ever strike the wheels. The truck frames are of great strength owing to the stiff form given to the wheel pieces and the very effective manner in which the end pieces are secured to them.

These cars are arranged for double trolley poles and are provided with powerful motors, as they are intended to operate on a fast schedule.

Automatic Signal for Block Systems and Car Spacing

The American Electric Switch Company, Pittsburgh, Pa., is placing on the market an automatic signaling device to be used on both single track roads between turnouts and on double track roads. The time is approaching when the double track roads using high-speed cars will require a block system answering the same purpose as the block system on steam roads, as the cost of one bad rear end collision will equip an entire road with a block system.

In this system there is always a light burning at each turnout, incandescent lamps being used, which are so arranged that the sunlight will not strike them and confuse the motorman. All wiring is done with No. 12 B. & S. gage insulated iron wire or cable, as desired. No trolley wire is cut or separate section required, and there is no trigger or any obstruction for the trolley wheel or pole to strike against required to operate the signal, the current being taken directly through trolley wheel so that the device will operate whether the motorman uses his power or not. The signal is operated by the trolley wheel making contact between the trolley wire and an independent circuit, and the car crew have nothing to do with setting them.

For a single track road with turnouts, diagrammatically shown

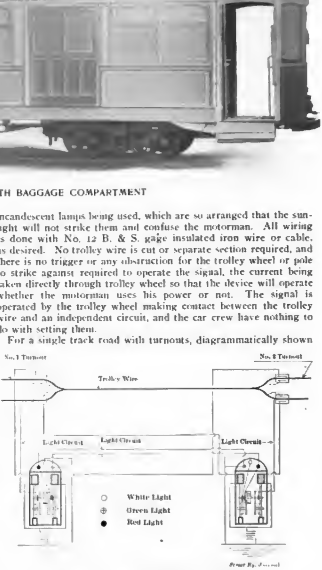


FIG. 1.—SINGLE TRACK INSTALLATION

in Fig. 1, the device works as follows: When a car crew desiring to leave the turnout runs out on the line, a white light signal being set, the trolley wheel passing over a certain point makes contact with an independent circuit operating the signal, setting a red light on the far turnout No. 2, and a green light on the near turnout No. 1. Thus the motorman, seeing a green light, knows that the signal is set at danger at the No. 2 turnout, causing any car proceeding in the opposite direction at No. 2 turnout to come to a dead stop. The car passing through the block and reaching No. 2 turnout the trolley wheel makes contact between the trolley wire and an independent circuit, throws out the red light at No. 2 turnout, and the green light at No. 1 turnout, lighting up a white light at No. 2 turnout and a white light at No. 1 turnout. Thus a white light is set at each end of the block, and a car can now enter from either end with a clear track.

This device will allow any number of cars, going in the same direction, to enter the gauntlet as follows: The first car, seeing a white light, throws up a red light at No. 2 turnout and a green at No. 1 turnout, and enters the block. The crew of the next car following, coming to No. 1 turnout, and seeing a green light, the motorman knows there is a car going in the same direction in the block, and therefore can enter, but proceeds with car under control. Three, four and five cars or more can run in the section likewise, and the white signal will not be set at No. 2 turnout until the fifth or last car has left the block. This is done automatically. The first car, passing over the point of trolley wire at No. 1 turnout, the trolley wheel makes connection with the independent circuit, energizing a magnet at No. 2 turnout which operates a drum or disc, on which are segments, throwing the drum forward one space so that a brush rests on the red light segment, lighting a red light at No. 2 turnout and a green light at No. 1 turnout. The second car, going in the same direction, seeing a green light at No. 1 turnout, runs into the block, throws the drum one space farther ahead, making the white segment two spaces from the brush. When the first car passes out of the block it throws the brush, revolving in the same direction as the drum but operated by a separate magnet, ahead one space, leaving the light still set at danger. When number two or the last car passes out of the block it throws the brush again one space ahead on to the white light segment, thus setting safety signals at each end.

On a double track system, shown in Fig. 2, as one car passes a given point, say *B*, it sets a red light signal at *B* and a green light signal at the block behind *A*. As the car runs off block *B* on to block *C*, it will extinguish red light at *B* and green light at *A*, setting red light at *C*, green light at *B* and white light at *A*. Thus any car following approaching block *A*, and seeing white light, can proceed at full or schedule speed; coming to block *B*, where a green light is set, the crew of car knows that the leader is one block ahead. Approaching block *C*, where a red light is set, the car comes to a dead stop or proceeds slowly with car under control, as the management of road desires. Any number of cars can enter a block without disarranging signals. It is evident the device can also be used as an efficient car spacer, allowing only one car in a block at the same time.

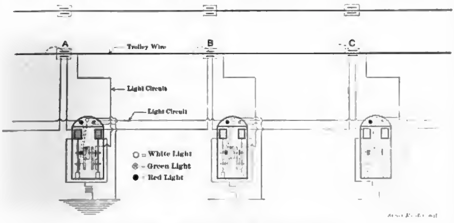


FIG. 2.—SIGNALS ON DOUBLE-TRACK SYSTEM

All Night on Trolley Cars

As a result of the severe storm on June 28 a number of persons camped out on electric cars between Belleville and East St. Louis all night.

At about 7 o'clock p. m., a great cottonwood tree which stood a short distance east of the Lake Bridge, between East St. Louis and the bluffs, was blown down across Rock Road, carrying all the wires with it and cutting off the current. One of the cars of the East St. Louis Suburban Railway was within a hundred yards of the tree when it fell. For three hours the car, and all the others of the system, lay motionless on the track. The wind blew a terrific gale. The car near the bridge rocked and swayed, and it seemed every minute that it would be blown over. By the time the wind died down it had become very dark, and for another two hours the people sat in the darkness. The car was then moved a short distance and stopped again. Ahead was the giant cottonwood tree across the track. Sunday morning had dawned before the tracks were cleared and the cars could proceed.

An Ingenious Safety Device

The apparatus illustrated herewith is intended for protecting property from the injurious effects which often result when the current from trolley wires escapes either by the falling of other wires across the overhead system, the breaking away of the trolley wire or other accidents. Where the conditions are such that the accident produces a bad ground of the system the circuit-breaker immediately goes out in the station; but it often happens that wires are so disarranged that they become dangerous without actually grounding the circuit, and until word can be sent to the station or some auxiliary cut-out box along the road there is some liability of injury to life and property. The device consists of a cast-iron box arranged to be fastened to the trolley pole and containing a spring switch. One side of this switch is connected to the trolley line and the other to ground, and unless held open the contact-maker will ground or earth the section of trolley wire which it controls. The contact-maker is held in an off position by a cord which passes over an insulated pulley and is fastened to a knob which passes through a pane of glass in the side of the box. In the event of accident, all that is required is to break this glass, thus releasing the cord, and the section is immediately grounded, throwing out the circuit-breaker at the station and making that part of the line dead, and therefore safe. On the front of the box is an inscription indicating what to do in case of wires falling, and it is of course possible for anyone to cut out the section in case of emergency. As soon as the glass is broken the engineers in the power station can tell immediately by the circuit-breaker that opens which section of the line is in trouble and a repair gang can be despatched rapidly to the desired point. While the contact-maker in the grounding device is allowed to make connection between earth and trolley wire, it will be impossible for the attendant at the switchboard to replace the breaker, or not, so that repairs can be made with perfect safety on the section.

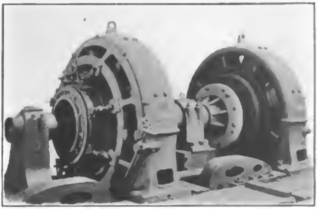
AUTOMATIC GROUNDING DEVICE

This apparatus is made by Heaton & Smith, Ltd., electrical engineers, of London, England, and has been used on a number of roads, the engineers pronouncing it very satisfactory. It has been tried in St. Helens and Oldham with equally good results and at present there are many other towns in England considering its installation. The company has been experimenting with devices of this kind for considerable time and has tried many different arrangements for obtaining the best results, both automatically and otherwise. The manufacturers claim that they have now succeeded in making a device which not only will work well when first turned out of the factory, but which after left standing for years without being used would be just as good as on the day it left the workshop, and immediately the glass is broken will automatically render the section upon which the accident has occurred perfectly safe.

The R. D. Nuttall Company report unusual activity in the trading of trolley wheels, many roads availing themselves of the opportunity offered to replace old types or worn-out trolleys with the latest forms, the old trolleys being accepted in part payment on the new. The most notable case is that of the Cincinnati Traction Company, which traded 700 of its old-form double trolleys not long ago for 1400 of the single type. Individual roads all over the country are taking advantage of the opportunity to re-equip their systems with more modern apparatus of this kind.

Siemens Multipolar Dynamos

The generators shown in the accompanying illustration have been made by Siemens Brothers & Company, Limited, of Woolwich, England, for the Corporation of Oldham. These machines are compound wound and are arranged to be driven by Willans

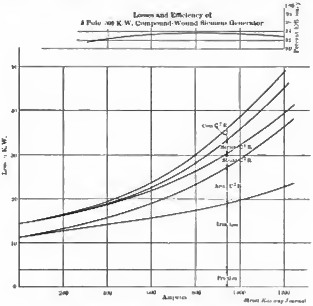


SIEMENS DYNAMOS COUPLED FOR TESTING

central valve engines, running at a speed of 300 revolutions per minute. The capacity is 500 kw each.

The field magnets consist of a ring of special quality cast iron, made in two parts and strongly bolted together, carrying eight poles of laminated steel. The core of the armature consists of discs of annealed mild steel accurately stamped and keyed to a cast iron body. The core is slotted and the bars securely held in the slots by means of hornbeam strips. The strips can be readily withdrawn to allow a coil to be replaced in the event of injury.

The commutator is built up of hard drawn copper segments, and



EFFICIENCY CURVES OF SIEMENS DYNAMOS

is insulated throughout with mica. The brush gear is mounted on a cast-iron ring, which is fixed concentrically with the armature, and which can be rotated so that the position of the brushes can be easily and simultaneously adjusted. The brush holders are neat and compact in design and are fitted with adjustable springs.

The two dynamos were erected for a Hopkinson test in Siemens Brothers & Company's test house at Woolwich, and a copy of the curve showing the efficiencies at various loads is reproduced. The voltage at no load is 500 volts, and at full load 550 volts.

New Publications

How to Become a Competent Motorman, by Virgil B. Livermore and James Williams. 232 pages. Illustrated. Price $1.00. Published by the Authors, 1902.

This book is a practical treatise on the proper method of operating an electric street car. The authors are both experienced, practical men in the handling of street railway apparatus, Mr. Livermore being chief instructor of the Brooklyn Rapid Transit Company and Mr. Williams shop foreman of the same company. They are, therefore, not only competent to give instructions as to the best method of keeping a car in good condition, but are familiar with every ordinary defect that is likely to occur upon the road and with its temporary repair. The value of such knowledge to the motorman cannot be overestimated, as the ability to repair his own car is the greatest safeguard that he has against being late at the end of his run. The book contains a great number of diagrams of controllers, etc., showing cross-connections that can be made to temporarily cut out different portions of the equipment and prevent a car from being stalled. This class of diagram is given very completely, but it is to be regretted that there has not been included in the volume a few diagrams showing the entire car equipment and connections, so that new men who are entirely ignorant of the electrical details would obtain a more tangible idea of the different parts described than can possibly be given in the text. As, however, the book is primarily intended for men who are actually in contact with the apparatus itself, this is not of very great importance. A catechism consisting of a series of questions and answers relative to the operation of electric cars is added, which will prove of great assistance to the ambitious motorman in fixing the knowledge obtained from the previous pages, and much of the information given will be of considerable benefit to the average inspector. The authors have been assisted in the preparation of this manual by Messrs. Kane and Geiss, instructors of motormen for the Metropolitan Street Railway Company, of New York, who have furnished data upon the underground conduit system. The subject of multiple unit control and storage battery operation is not touched upon. In other respects the exceptional facilities afforded by the equipments of the Brooklyn Rapid Transit Company, which from its consolidation of numerous individual lines has upon its cars a most varied assortment of controllers, motors, etc., has enabled the authors to speak authoritatively, from personal experience, upon nearly every type of apparatus employed at the present day.

The Electrical Catechism. Compiled from the regular issues of "Power," 216 pages. Illustrated. Price $2.00. Published by Hill Publishing Company, New York, 1902.

To a large majority of practical men, especially those who have not had the benefit of a college education, that class of books known as catechisms is of the greatest benefit. In "The Electrical Catechism," 533 plain answers are made to 533 practical questions about electrical apparatus, and the reader is given, in clear and concise language and in an entertaining manner, a great deal of valuable information regarding the construction of the apparatus and the requirements which should be expected of it. Only such branches of electrical work as come within the range of the average central station engineer are treated, and the majority of the questions relate to what the author terms in the preface as the "heavier branches of electrical engineering." Considerable space is allotted to the answering of questions devoted to strictly street railway subjects, such as car wiring, series motors, series-parallel controllers, the rotary converter, etc., as well as to such matters of dynamos, measuring instruments, alternating-current transmission, etc., which are as intimately connected with railway work as with lighting installations. The many illustrations consist mainly of diagrams and add greatly to the book's value.

Manual of Electrical Undertakings and Directory of Officials for 1901-1902. Compiled under the direction of Emil Garcke. 976 pages. Price 12s. 6d. net; delivery 6d. Publishing offices, Mowbray House, London, Eng.

This is the sixth annual volume of this manual. It contains data and general information upon British electrical undertakings both of the municipalities and of private companies. The information is classified under five sections, that pertaining to electric railways being in the first department. Lists of electric companies formed under the joint stock acts and of all electric undertakings belonging to municipalities are published in this manual. In the section devoted to "Progress of the Year" reference is made to the power bills, including those of the tramway power supply, the London underground railways and similar enterprises. A list has been added showing the electric tramways completed, under construction and authorized, and particulars are given of all orders and bills promoted and adopted during the last Parliamentary session relating to electric tramways and light railways. There is also a map showing the present condition of the electric railways in London. The directory of officials, which is a very important feature of this manual, contains upward of 4000 names and addresses of chairmen, directors, managers, secretaries, engineers, solicitors, bankers and auditors of electrical properties. The work shows evidence of careful compilation and constant improvement.

NEWS OF THE WEEK

Must Pay for Delays in Chicago

The City Council has passed an ordinance providing that in cases of street railway breakdowns causing a delay of ten minutes or more the companies must issue to the passengers coupons good for a trip at any time in any direction or return the fares. The ordinance provides that the fares shall be returned where the delay occurs by reason of any neglect of the company, or where "the delay is at the company's fault." Where the company could show that the delay was not due to its neglect or fault the fare need not be returned. It would seem that the passenger will have to prove that whatever happens to make the delay was the fault of the company in each case.

A Cyclone in Indiana

A most terrific storm swept over central Indiana at about 9 a. m. June 25. Telephone, telegraph and electric railway wires were torn down along its trail, and at 12 m. communication with the storm-swept section was almost entirely cut off. The storm spent most of its force in the country 20 or 30 miles northeast of Indianapolis, lying between the Indianapolis & Greenfield Electric Railway on the south and the Union Traction Company's lines to Anderson on the north. Maxwell, Cleveland and Pendleton suffered most severely. Houses in all of these towns were blown down and from ten to eighteen persons are reported to have been killed. The Union Traction Company's system between McCordsville and Anderson was tied-up for hours. In many cases trees were blown across the tracks of the electric railways and many hours elapsed before traffic was resumed on some of the lines.

New Low Fare Ordinance for Cleveland

Mayor Tom L. Johnson, of Cleveland, who is nothing if not persistent, says that, although he has met with a severe reversal in the recent Circuit Court decision declaring against his 3-cent fare ordinances, he is in no way dismayed and that no time will be lost in preparing plans for a new ordinance. The decision that has just been handed down is a complete reversal of that of Judge Strimple in the Common Pleas Court. As previously stated, the case was commenced some time ago by William M. Raynolds as a taxpayer. The city and Mr. Hoefgen, to whom the franchise was granted, claimed that Mr. Raynolds was simply acting for the companies now operating in the city, and the case was most bitterly fought in both Common Pleas and Circuit Courts. As soon as the case was brought a temporary injunction was granted, but after Judge Strimple had heard it he dissolved this injunction, giving a verdict for the defendant. The plaintiff immediately appealed the case and another temporary injunction was granted by Judge Caldwell. It was this injunction that has been made perpetual.

The Rhode Island Merger

Possession of the property of the Union Railroad, of Providence, the Pawtucket Street Railway and the Rhode Island Suburban Railway Company was assumed by the Rhode Island Company under a 999-year lease on June 24. The properties taken over are owned by the United Traction & Electric Company, the holders of whose $8,000,000 stock will receive under the lease dividends at the rate of 5 per cent per annum, and in addition a distribution of 25 per cent ($2,000,000) in the stock of the Rhode Island Securities Company, which will shortly be organized, with a capitalization consisting of $10,000,000 each of stock and bonds, to take over the $2,000,000 stock of the Rhode Island Company, with its lease of the street railway properties, and also the proposed lease of the gas and electric lighting properties. The $2,000,000 capital stock of the Rhode Island Company was subscribed by the United Gas Improvement Company of Philadelphia. The officers and directors of the Rhode Island Company are: Marsden J. Perry, of Providence, president; Samuel P. Colt, of Providence; Randall Morgan and Walton Clark, of Philadelphia, vice-presidents; Lewis Lillie, secretary-treasurer; Nelson W. Aldrich, William G. Roelker, J. Edward Studley, Howard O. Sturges, Walter F. Angell, Samuel M. Nicholson, of Providence, and Thomas Dolan, of Philadelphia.

The Providence Strike

There has been some cessation of violence at Providence and Pawtucket during the last week, but at times the outbreaks were renewed. Strikers armed with revolvers ambushed a car on the Pawtucket line. They lay in wait behind bushes on either side of East Avenue, near Pidge Street, and as the last car was returning to Providence opened fire upon it. There was but one passenger aboard, but he and the crew narrowly escaped being murdered. Twenty bullet holes were found in the woodwork of the car. On the same day, on the short line, the late cars were driven out of service by men who stoned the crews, one of the conductors being badly hurt. The militia were withdrawn on June 26.

On June 25 the Supreme Court rendered an opinion that the ten-hour law which was passed at the May session of the Legislature was constitutional, and that the United Traction Company cannot legally compel its employees to work eleven consecutive hours for a day. The original demand of the strikers was that not more than ten hours' work in every twelve at 22½ cents per hour be required, and recognition of the union to the extent of dictating who should be employed, but these demands have been reduced to 20 cents an hour, the strikers upon return to work to have their old places, and that the repair shop hands should have fifty-eight hours per week with sixty hours' pay and half-holiday on Saturdays until Sept 1.

The United States Circuit Court has declined to issue an injunction to restrain the Woonsocket Street Railway Company from obeying the Ten Hour Labor Law and also restraining the Attorney General from prosecuting the company if it fails to comply with the law.

Thomas Martin, of Chelsea, Mass., a large stockholder in the Woonsocket company, was the petitioner, who argued that the law, if complied with, would work injury to the interests of the stockholders. The question will be taken to the United States Supreme Court, which will also be called upon to pass upon the constitutionality of the law.

The United Traction Company raised the constitutional point when its men, refusing to accept reduced pay for reduced hours, struck. The company contends that the law is unconstitutional because its terms abridge the rights of a citizen to contract with a railway corporation for employment.

Overdoing a Boycott

The Citizens Protective League has been organized by the business men of Terre Haute, Ind., for self protection, because of the injury done to the business of the city through the boycotts growing out of the strike of the employees of the Terre Haute Electric Company. The strike has long since been a thing of the past to the company, for it was practically ineffective from the first, and all of the men who engaged in it have either returned to work or have secured other places. But the boycott that was first declared against the company by the Central Labor Union has been extended from time to time so that there are now brought under its ban merchants, manufacturers, shopkeepers and even clergymen. Without regard for anybody or anything the labor organizations have carried their high-handed practices to the point of overdoing. The STREET RAILWAY JOURNAL has already told some of the curious results that followed the declaration of the strike. As previously stated the boycotts were first declared against the company. Next they were extended to persons patronizing the cars. They were soon extended to the business men and dry goods stores, mills and factories were one after another placed on the boycott list. It would be thought now that no more boycotts could be declared, but there still was room for more. Clergymen and school teachers next were assailed, and then a traveling salesman who patronized the cars was prevented from making a sale. One man took his children out of school because one of them was seated next to the daughter of a merchant against whom a boycott had been declared. The teacher was requested to change the seats of the children, but this she refused to do. A boycott was proposed against the school, but it was voted down. A clergyman, who frankly declared that the conditions existing in Terre Haute were a disgrace to the city, and that the law should be enforced, was threatened with bodily harm, and a boycott was declared against his church.

Disclose Your Identity

To the electric railway promoter, who, though seeking a franchise from a council or other municipal body, persists, as some promoters do, for unknown reasons, in refusing to disclose the identity of those whom he represents, there is a lesson in the action taken by the council of one of the large cities in New York State To the Tommy Dod, of Whatville, who thus seeks his franchise, this tale will bear repeating. A Mr. Blank, of New York, went to the city in question, and there, stating that he had ample financial backing, made an earnest plea for a franchise. But this council challenged the veracity of the statement of Mr. Blank and asked him to disclose his associates in the enterprise and otherwise make his identity known. Mr. Blank, however, thought that it sufficed to say that he had ample financial backing. Thereupon the councilmen, the press and the public raised their voices, and Mr. Blank was told that the franchise grant would be voted down if he did not comply with the demand. He refused to heed the warning and the grant was voted down in council. In the comments of one of the local papers on the incident there are some things of interest. Among other things are the following:

The franchise has been a thing unknown and unknowable. Its quality first and last has been that of dense mystery. Whether "a strike," aimed as a reputable form of blackmail against the present company; whether speculative, seeking merely to get control of valuable public privileges which might subsequently be sold out; or whether a project honest in intention, but incapable and irresponsible financially, are things which no man has been able to find out. On this ground solely the enterprise at every turn has met and has deserved to meet a popular and an official disapproval, auguring its certain defeat. This public opposition, let it be clearly understood, is not opposition to any business-like and legitimate and needed street railway improvement within the limits of the city. If it can be publicly shown, as has been within twenty-four hours guardedly intimated, that the project now back of this franchise is not "a strike" nor "hold-up" nor speculation by irresponsible persons, but a legitimate enterprise seeking to give to the city added street railway conveniences to the full extent that such conveniences are lacking; that capital is available and waiting for investment in the extensions the franchise covers; that this waiting capital is home capital, and that home business men who are financially as strong as any we have are going to stand sponsor to the project and see it through—then every objection of every sort that has been raised, and thus far justly raised, falls absolutely, and the enterprise straightway becomes one the general public of the city will foster as earnestly as hitherto it has opposed. The franchise is a mystery whose merits and purpose have been quite unknown even to the Mayor himself, and the franchise permitting local street railway extension that home capital shall pay for and home capitalists own and operate, are radically different propositions. With the one the city should do nothing; with the other, it could hardly do too much.

Electric Plant in Amsterdam

The City Council of Amsterdam has voted a loan of $2,613,000 and a second one of $1,165,800 for building a plant to furnish electricity for lighting and motive power and for changing the street railway to electric traction. The contract for the building of the plant has as yet not been made. The steam engines, dynamos, and the installation will be furnished by German and Dutch manufacturers. Particulars of the cables will be published on July 1; bids to be delivered September 1, 1902.

Electric Opposition for New York Central

In the denial of the application of the New York Central Railroad for an injunction to restrain the Buffalo & Williamsville Electric Railway from extending its lines to Rochester the means pursued by steam railway companies generally to throttle electric competition are again brought to public notice. Some time before the Pan-American Exposition a company was organized to build an electric railway between Niagara Falls, Buffalo and Rochester, the promoters planning to have the line completed in time to carry passengers to the fair. When the application of the new company came before the railroad commissioners the New York Central representatives were there with argument upon argument to convince the commissioners that public necessity did not require the construction of the road. Hearing after hearing was held, and the proceedings dragged so that it was long after the exposition had closed before a certificate of necessity was granted to the electric railway company. At the hearing it was shown that the New York Central's service was not satisfactory to the people along the line, and that the territory through which its lines passed did not have the service that it required. The handwriting was there upon the wall, but the New York Central evidently did not care to interpret it. The new company went on perfecting its plans, and finally, after much deliberation, awarded the contract for construction. The New York Central however, as far as can be learned, made no efforts to improve its service, having confidence that the new road would not be built. And this confidence, it would seem, was not misplaced, for so far construction work on the line has not been begun. But a road already in operation, and for the extension of whose lines no certificate of necessity from the railroad commissioners is required, has stepped in and upset the calculations of the New York Central. Now the New York Central, it would seem, in the interval between the granting of the application of the company to build between Niagara Falls, Buffalo and Rochester, and the announcement by the Buffalo & Williamsville Electric Railway of its intention to extend its lines to Rochester, had time to meet the demands of its patrons, and, by improving its service, win them over. In this case there would have been little or no necessity for the extension of the Buffalo & Williamsville Railway. But the New York Central did nothing. It heeded not the experience of the Boston & Albany Railroad and other companies, neither did it profit by the experience of the New York, New Haven & Hartford Railroad, whose policy of opposition has resulted in the projection of a third-rail system that will parallel its lines for twenty-seven miles out of New York City and which will cut very materially into its passenger receipts.

PERSONAL MENTION

MR. HENRY A. EVERETT, accompanied by his wife and daughter, is now at Yellowstone Park, Wyoming, enjoying a much-needed rest.

MR. F. W. KINMOUTH has resigned as purchasing agent and superintendent of the Glens Falls, Sandy Hill & Fort Edward Street Railroad Company, of Glens Falls, N. Y., to become prominently identified with the Niagara, St. Catherines & Toronto Railway, of Niagara Falls, Ont.

MR. B. E. MERWIN has been appointed general superintendent of the Cincinnati & Eastern Electric Railway, of Cincinnati, Ohio, and will have charge of the operation of the road. Mr. Merwin was formerly general superintendent of the Lake Street Elevated Railroad, of Chicago, with which company he was connected eight years.

MR. C. N. DUFFY, who has occupied the position of auditor of the Chicago City Railway Company since Sept. 1, 1899, was elected secretary of the company on June 20 to succeed Mr. F. R. Greene, resigned. Mr. Greene, who was identified with the company for a number of years, has recently become president and general manager of the Chicago Street Car Advertising Company, and will devote his entire attention to that concern hereafter.

MR. JOHN DENHAM, of the Cape Government Railways, Cape Town, South Africa, who visited America last year and inspected many of the railway and lighting plants, recently read a paper on the subject of electrical engineering in Europe and America before the Cape Town Section of the Institution of Electrical Engineers. Mr. Denham was a guest of the American Institute of Electrical Engineers during its Buffalo convention, and made a great number of friends among American engineers.

MR. F. B. ROCKWELL, recently appointed general manager of the Syracuse, Lakeside & Baldwinsville Railway, of Syracuse, N. Y., although a young man, has had much experience in street railway work. Mr. Rockwell aided in the construction of the electric railway that was built at Scranton, Pa., in 1885. Prior to that time he had been engaged in the lighting of Scranton, Wilkesbarre and other Pennsylvania cities. Mr. Rockwell constructed, among other electric railways, the Middletown & Goshen Railway, the Athens, Waverly & Sayre Railway, the Staten Island & Midland Railway and the Richmond Beach Railroad. He was general manager and president of several of these roads, and retired from the last-named a few weeks ago, when it was bought by C. H. Schwab, of the United States Steel Corporation.

MR. A. H. FORD, who for several years has been general manager of the New Orleans & Carrollton Railroad, Light & Power Company, of New Orleans, La., will shortly leave the company and become confidential man in the brokerage and private banking office of Isidore Newman Mr. Ford will take the place of Mr. J. Newman, who will go to New York next winter to open a New York branch office of the firm of Isidore Newman. Mr. J. Newman, eldest son of Isidore Newman, has been the head of the office under his father since the removal of Sidney March to New York. Mr. Newman has also been president of the Carrollton Company since the Newman control reorganized the system. The sale of the Carrollton system to the Pearson syndicate left Mr. Newman in position to carry out his desire to have his oldest son establish a branch office in the great financial centre of the country. Mr. H. A. Davis, superintendent of equipment, is made acting manager of the railroad department of the company.

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Chicago Refunding Fare Ordinance Vetoed

Mayor Harrison, of Chicago, has vetoed the ordinance requiring street railway companies to refund fares in case of a breakdown on the lines, due to some fault of the company, as it is considered to be impracticable. This is one of the grandstand measures advocated by local politicians solely for the notoriety which comes to those engaged in the agitation.

Car-Ahead Ordinance Again

The New York Aldermen have passed another car-ahead ordinance, in spite of the fact that the clamor for such a measure has entirely died out. When the original ordinance was passed it was pointed out that it was impracticable and could not be enforced, but the wiseacres who are always ready with advice as to how other peoples' business should be conducted insisted upon the enactment of such a law, and then attempted to enforce it. Of course it failed; the cases were thrown out of court, and the Manhattan statesmen were compelled to start all over again. They have presented and passed an ordinance that is supposed—by them, at least—to be effective. We do not, however, expect that this measure is going to work any great change in New York transportation service.

The Providence Strike

The latest developments in the Providence-Pawtucket street railway strike are in keeping with the events that have marked the struggle from the beginning. It now appears that the legal advisers of the employees opposed the action of the men in going on a strike, pointing out to them that the legal status of the case they proposed to present for the consideration of the Attorney-General of the State, under the 10-hour law, would not be affected by their continuing in the service of the company pending a decision; in fact, he urged upon them the necessity of fortifying their position with the business men, by refraining from all acts that would injure trade. This warning was not heeded, however, and now after five weeks of struggle, trial, suffering and disgraceful scenes the men have decided to return to work at the same rates of wages and on the same terms that they enjoyed before the strike.

Mountain Railways

The Swiss, with that keen appreciation of practical business that is almost a natural characteristic, have gone more often and more successfully into the construction of mountain railways than any other people. Although no small amount of pioneer work in that line was done in this country, interest in it seems in large measure absent, and comparatively little has been accomplished of late years. Each season, however, sees the mountainous States awakening to a more lively interest in the possibilities of summer travel, and mountain railways are no unimportant feature of the game. The old pioneer Mount Washington road has done a land-office business, and yet there are scores of better opportunities for mountain roads than that furnished by the famous New Hampshire peak, for the weather there is notoriously uncertain and the season is short. But there are not a few mountain resorts in which a rack road would prove a great attraction and large money earner. Oftentimes a rack system is not needed, as in the famous Mt. Lowe Railway near Los Angeles, Cal., where a trolley line is terminated by a cable incline of moderate length. In this instance electric power is taken from a branch of the long transmission line from Redlands to Los Angeles, and the use of electrical power in general makes the operation of the mountain roads comparatively cheap and simple. Of course, the engineering for the roadbed is no joke, but if the peak gives a really fine view, even costly construction will frequently prove a paying investment. There are those who positively revile all mountain roads as Philistine and defilers of natural scenery, but there seems to be no good reason why the young and athletic should have a monopoly of mountain views. Besides the old trails are still open to those who prefer to do their own climbing, and no one will grudge the objectors free space to walk if they do not care to ride. America will never perhaps furnish a parallel to the Jungfrau Railway, now under construction, for the greater

American peaks have no near views like those furnished by the Alps, but there are certainly many cases more encouraging from a financial standpoint.

Akin to mountain roads in function are those roads which are deliberately built to accommodate summer or winter residents. We have often wondered why this field has not been more actively and thoroughly worked. The key to the solution of such problems in railroading is cheap construction. The earning capacity is often very great for a short season, but it stops almost short at a definite time, and the road must earn dividends in whatever time is available. There is no more reason for building such a road along ordinary interurban lines than there is in building a summer hotel as if it were to do a metropolitan business. The whole subject of light railways has been generously neglected in American practice, as we have often had occasion to remark, although from the viewpoint of rural traffic it is by no means unimportant. If a road can be built and equipped for $8000 or $10,000 a mile, it stands an excellent chance of paying where an ordinary road would fail, and on even earnings the cheaper line will be much the better investment. It is certain that in many summer resorts electric roads could be made thoroughly profitable. The only serious objection to their construction would be on the part of those who use the roads for driving, but the coming of the automobile has already made driving in many districts unpleasant and dangerous, and automobiles certainly have no rights that electric roads are bound to respect.

Electric Terminal System

We have already referred to the very important discussion of the New York Central terminal situation by Mr. Arnold, but there are a few more points in this valuable contribution to which we wish to call attention at this time. The more one studies this report the more favorable is the impression produced by the thorough and business-like tests there recorded. Guessing at the data in such a serious problem is very uncertain business, and the first step toward results is to make a searching investigation as to the fundamental facts. This Mr. Arnold was enabled to do, and the data thus secured are of great importance in the art.

In a general way the facts are not widely different from what would have been predicted on theoretical grounds. The comparisons instituted between several plans for the distribution of power were immensely instructive, and perhaps the most striking thing about them was the exceedingly good showing made by the storage battery as a sub-station auxiliary. It has taken a good many years of hard work to bring the battery to its present condition, but the time has come when it has made an important place for itself wherever it has a fair chance. Without some small safeguard the transmission of power to sub-stations from a single-generating plant is a rather precarious business, when one considers the disastrous results of a tie-up. We are sorry in this connection that the case of two quite independent generating stations was not considered for the sake of completeness. Although the aggregate power demanded for the work under immediate consideration was rather small, as railway power goes, we are more than half inclined to think that an examination of the case in its broader aspects would have shown that there was something still to be said for distributed stations as against transmission to sub-stations with rotaries. For, in spite of the thoroughness of Mr. Arnold's work, we must still remind our readers that there is in the discussion of the application of electricity to terminal working a broader problem, which in this instance was left quite untouched. The mere replacement of steam by electric locomotives is a makeshift, improving the situation in the tunnel, it is true, but not applying electric traction to its most important uses. The reorganization of the entrance of traffic into the metropolis ought to imply a full and adequate development of the suburban system. With this worked out by the methods of modern electric traction, the whole situation changes. It is a big problem in the technique of electric railroading, not merely the substitution of one motive power for another. When finally worked out it will probably involve a complete and radical change in the whole method of operation, the results differing from the present system as decisively as does this from that in use before the days of the telegraph. Of course, such deep seated changes are not in the least necessary to the adoption of electric motive power in the tunnel, but they lie along the line of improvement, and while they may be put off for a while they are bound to come sooner or later. Meanwhile we may be thankful that the study of the lesser problem has led to favorable results.

Steam Railroads Must Make Connections with Electric Lines

The opinion of the Court of Appeals of New York, which was prepared by Justice Haight, and in which his associates fully concurred, defines the legal rights of electric railway companies to compel steam railroads to make connections and interchange freight business with the electric lines, and confirms absolutely the right of the electric companies to compel such connections. The decision will have a far reaching effect upon the development of interurban lines for freight service in New York, as it will open up an extensive field and afford connections of great value.

In the case under consideration an effort had been made to compel the Boston & Maine Railroad to make connection with the Stillwater & Mechanicville Street Railway Company, which is an electric trolley line controlled by the Hudson Valley Railway Company. The steam railroad officials contended that the law did not authorize the court to compel them to work in conjunction with the electric line and permit the latter to use their system. Justice Haight, however, decided that the electric companies have this right under the Railroad Law of 1890, and he very clearly defines the relative positions of electric and steam roads under this act.

The decision takes the broad ground that the public good requires the utmost extension of the application and utilization of every improvement in transportation, and that the use of improved methods should be encouraged. "The provisions of the statute authorizing the courts to compel connections or the intersections of tracks between railroads, to our minds, was intended to promote the public interests independent of that of the railroad companies. Travelers and the distributors of merchandise and freight have the right to make use of all the facilities provided for in the articles of incorporation and the provisions of the statute pertaining thereto in the conduct of their business." This, the court thinks, is made clear by the provisions of the statute which requires that all railroad corporations whose roads are or shall be intersected shall receive from each other and forward to their destination all goods, merchandise and other property intended for points on their respective roads with the same despatch and at the same rate of freight not exceeding the local tariff rate.

The court next reviews the several laws relating to the establishment and management of railroads, and discusses their bearing upon the present case. In construing these statutes the opinion says: "It does not become us to shut our eyes to the purposes sought to be accomplished or the discoveries that have been made and the improvements accomplished in the transportation facilities of the conntry in recent years." It is pointed out that while the great steam railroad systems extend across the continent, and have become the great arteries of trade, it has not been considered profitable or practical for steam roads to be extended to every village, hamlet or productive district in the country, and that communication with many of these points is now being established by means of electric roads. The court recognizes the advantages which the farmer, the mill owner and the vendor of merchandise in distant places will enjoy because of their ability to reach the steam railroads, and through them the great markets of the larger cities. The advantages arising from this arrangement are not confined to the patrons of the electric road but will be enjoyed by the steam roads themselves, as they will thus be afforded an excellent feeding and distributing system with points which they could not otherwise conveniently reach.

Another point of special importance to the street railway industry which is touched upon in the opinion is the confirmation of the right of street railways to operate cars loaded with merchan-

dise and freight over street surface lines. The court holds that while it may be necessary to provide additional regulations by statute or ordinance limiting the time in which cars of this character should be permitted to run over street surface railroads, especially in cities and large villages, the legal right to do so is certainly vested in street railway companies, as was established by the ruling of the Court of Appeals in the case of De Grauw against the Long Island Railway Company.

Altogether, the decision is an important one in every respect, as it puts the electric railway companies of this class in New York upon exactly the same footing as the steam lines, and enables them to compel recognition of their rights, which has long been denied them. Just what influence the decision will have outside the State is hard to forecast. The opinion deals with a concrete case and not with an abstract proposition, but there can be no doubt that the attitude of this eminent legal authority will produce a profound impression on the judiciary throughout the country.

Storage Batteries for Small Roads

The use of storage batteries on a large scale in connection with railway power stations has now become so familiar that a suggestion of their usefulness in smaller plants seems almost needless and yet there are radical differences involved in the mere question of size. The storage battery, which has now just attained its majority, has had in many respects a peculiarly checkered career. No electrical invention was ever given a more enthusiastic welcome and none was better advertised, and yet it has taken years for it to win its present stable place. Heavy depreciation has been the hoodoo to which its evil fortunes must be charged, and not until bitter experience had taught the immense importance of solidity and sound mechanical, as well as electrical design, was the spell broken. For years a fetish was made of extreme lightness to the sorrow of all concerned, but experience, though a costly instructor, is thorough, and the lesson of sound design was finally learned. Of the place which the battery has now earned there is little need to speak in general terms, but it is certainly a fact that the small roads which can most benefit from it are somewhat slow in taking due advantage of their opportunity.

The principles that govern the problem of successful battery installations are really very simple. An electric railway power station finds itself possessed of a thoroughly bad load factor. Its load is fluctuating from morning till night, and on the average is far below the capacity of its engines and dynamos. The result is an enormously wasteful use of steam, great inefficiency in the dynamos and a resulting very high cost of power—high enough, when based on the mere cost of production—still worse when one considers the fixed charges and depreciation on the needlessly large plant.

In small systems the cost of power is generally high even under the most favorable circumstances, and when the conditions are aggravated by a very low load factor the case is far worse. Now the battery ought to be able to relieve such a condition, and so in fact it does. In cases which have actually come under our observation the effect of the battery has been not only to reduce the fluctuations of power at the prime mover to about 20 per cent of their former value, but to raise the general load factor by between 30 per cent and 40 per cent. This latter feature of battery practice is the important one from the standpoint of economy, although the checking of the fluctuations doubtless has a good effect on repairs. Of course power delivered through the battery is subject to losses incurred therein, so that taking the battery efficiency at 75 per cent all energy delivered via the battery costs on the line a third more than that delivered directly. Even so, since in a well planned plant the battery will handle only say half the total output in kilowatt-hours, the gross effect of the losses in the battery will be to raise the total cost of power by perhaps 10 per cent to 15 per cent, while the saving effected by the improved load factor is likely to be 30 per cent to 50 per cent.

The net result, therefore, is a considerable saving which is relatively greater in small stations than in large ones, and the general effect on the regulation of the system is most beneficial. Of course a battery equipment costs money, but on the other hand it largely increases the capacity of the station, which increase should be set off against its cost. And now comes the ever present question of depreciation. We have never quite understood why roads which have never in their history charged off one cent for the depreciation of their power station apparently should grow suddenly squeamish over a battery. But granting that they ought to be punctilious in reckoning with depreciation, the annual saving which can be effected by a skilfully planned battery auxiliary is enough to pay interest on the investment, and to allow for replacing the plates annually with a large margin over for profit. And even the most hardened enemy of the storage battery could scarcely protest that due allowance for depreciation had not thus been made. A battery of ample size, carefully installed and given proper attention, has a considerably lower depreciation than is allowed it by popular fancy, based on automobile practice. But good care must be regarded as essential, and when a railway plant puts in a battery it behooves the management to see that there is somebody available who has some practical knowledge of its limitations.

Storage batteries are not yet fool-proof, and a large proportion of the troubles which have come to them are due to lack of ordinary care in their management.

It would be an excellent thing if some of our technical schools would make a point of giving good, sound, practical instruction in modern battery practice, so that a body of trained men would in a few years be available, who would understand batteries and be able to put them to the best use. At present, specialists in this line are painfully rare.

Parsons' Bridge Terminal Relief Plan

The plan proposed by Chief Engineer Parsons, of the Rapid Transit Commission, for providing adequate transportation facilities between New York and Brooklyn, and relieving the present crush at the bridge terminal, is in many respects a radical departure from the lines along which other investigators have sought relief. It is proposed to lower the grade of the western approach, to open communication with the other bridges to the north for trains by means of a subway, to provide a similar tunnel running southward through Nassau Street for the trolley cars, and to erect a municipal building on the site of the existing station.

The details of this plan, as represented in Mr. Parsons' report to the Rapid Transit Commission, are given elsewhere in this issue. As compared with the reports of other experts who have studied the problem, it must be admitted that the Parsons plan is much more comprehensive and complete; that it makes greater provision for future development of traffic between New York and Brooklyn, and that it not only relieves the dangerous congestion of traffic at the bridge, but it eliminates another great defect by providing for subway connections and extensions instead of placing obstructions in the form of additional elevated structures in the already crowded downtown streets. It does this, however, at great expense, involving increased cost of construction, greater time consumed in construction, and a protracted interference with the bridge traffic during the period of construction. These objections were seriously considered by the Board of Experts, which reported on this subject some time ago, and whose recommendations formed the ground work for subsequent plans. The Board tried to keep the cost down to such a point that the city debt limit would not stand in the way of the project, to keep the time of construction down to the lowest possible limit, to begin to produce relief even before the construction was completed, and, finally, to permit practically no interference with the use of the bridge. These are all very important considerations and must be taken into account before any practicable plan can be evolved. It should be explained that Mr. Parsons report was not intended as a final plan, but rather as a series of suggestions indicating lines along which the chief engineer of the Rapid Transit Commission considered relief could best be obtained.

Recent Improvements on the Schuylkill Valley Railway

A handsome new power station has just been completed by the Schuylkill Valley Traction Company, at Collegeville, Pa. The road runs from Chestnut Hill, Philadelphia, to Sanatoga, and the Collegeville power house supplies the portion of the road west of it, which has been open but a short time, and easterly as far as Norristown. The present equipment consists of two direct-connected units, having a normal output of 500 kw each, but the building is intended for five such units, and it is expected that the present capacity will be increased in the near future.

FRONT VIEW OF NEW CAR HOUSE

The power station is but a few hundred yards from the tracks, and is located near the bank of Perkiomen Creek, from which water for both boiler and condensing purposes is obtained. The building consists of two distinct sections, one for the engines and one for the boiler, the engine room being considerably the higher. Both parts of the building have peaked roofs. The walls of the engine room are strengthened by lattice columns, which support girders carrying the track for a traveling crane which spans the entire room. This crane has a capacity of 25 tons, and was built by the Reading Crane & Iron Works. The floor of the engine room is of concrete resting upon corrugated iron arches supported from I-beams. The roofs are made of steel trusses covered with slate. Both sections of the power station are therefore strictly fireproof. The equipment so far installed is placed near the front of the building, taking up about two-fifths of the space available. In the boiler room is a battery of four Heine boilers of 300-hp capacity, placed in one row on the side of the room nearest the engine room. The floor of the engine room is considerably higher than that of the boiler room, so that the steam piping is carried from the tops of the boilers underneath the engine room floor to the cylinders. Three Smith-Vaile feed pumps, made by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, are used, and one Webster feed-water heater, made by Warren Webster & Co., of Camden, N. J. The stack is made of steel and is self supporting. It is placed near the center of the boiler house, and is 125 ft. high.

INTERIOR OF ENGINE ROOM

The two direct connected units installed consist of cross-compound, condensing engines, direct-connected to 500-kw, 555-volt compound generators. The engines are furnished by the Pennsylvania Iron Works, of Philadelphia, and are of 750 hp each, at a speed of 100 r. p. m. The generators are from the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., which concern also furnished the switchboard. This consists of standard railway panels, and is placed at one side of the room, where space is allowed for increasing its capacity by the addition of extra panels, as the power station equipment is completed.

The new Trappe & Limerick section of the Schuylkill Electric Traction Company's system has recently been opened, and is a very handsome example of standard interurban railway construction through a rather thickly settled country. Nearly all the route is laid out following the country roads, and in but one or two places is the track placed on the company's own right of way. This section of Pennsylvania is of an undulating nature and some very steep grades are encountered on the way. One of the steepest of these is about 13 per cent. a short distance from Collegeville, and therefore near the power station.

THE NEW POWER STATION

The opening of this section of the line has made it possible to operate through cars between Chestnut Hill and Sanatoga, and nineteen semi-convertible, double-truck interurban cars have been purchased from the J. G. Brill Company, of Philadelphia, for this purpose. These cars have a 30 ft. 8 in. body, and are 41 ft. over all. They are 8 ft. 6 ins. wide, the gage of the track being 5 ft. 2½ ins. The cars are equipped with four G. E. 1000 motors, mounted on Brill 27-G high-speed trucks, and have Brill sand boxes and Christensen air brakes with motor-driven compressors. The cars will seat forty-four passengers, the seats being made by the United States Railway Supply Company. They are of the walk-over pattern, covered with rattan. There are no grab handles at the corners of the backs of the seats, but hold straps from a rod near the transom are used in the same manner as in ordinary city service. The same car equipment is to be used in both summer and winter, the semi convertible feature being very popular with the

INTERIOR OF BOILER ROOM

management. The Brill semi-convertible car has a double sash, both upper and lower sash sliding into a receptacle in the roof when the car is open and giving as much open space above the passenger's elbow as can be obtained by any ordinary cross-bench open car. In the summer months when the windows are open smoking will be allowed on the three rear seats on each side of the aisle, the same as in regular open car work. International registers are used.

The road is single track throughout, with turnouts every five minutes; it is possible to run cars, therefore, on ten-minute headway, and at present the Sunday and holiday traffic requires that this be done. At other times a twenty-minute headway is made. The Ramsay block signal system, made by Williamson & Co., Allegheny, Pa., is employed. With the exception of some 9-in. girder rail, which is laid in the streets and towns through which the road passes, the track is composed of 75-lb. T-rail with Continuous joints. The bonding is all done by protected rail bonds.

GENERAL VIEW OF CAR HOUSE AND APPROACH

In addition to the new power station, a handsome new car house has been built on the outskirts of Norristown. Considerable property is owned here by the company, and the capacity of this car house, which is now seventy-five cars, may easily be doubled, as the house is set so far back that a long approach of track is necessary to reach it. If found desirable these yard tracks may be covered in by building the car house forward. The building is built of brick, and all of the car tracks entering it have pits their full length, the rails being supported on stringers resting on brick piers. Complete repair shop facilities have been placed in the car house as well as accommodations for the men, superintendents, etc. The various divisions of the shops are separated by steel rolling doors, made by the Kinnear Manufacturing Company, of Columbus, Ohio, so that danger from fire is eliminated as far as possible.

The Schuylkill Valley Traction Company is controlled by the United Power & Transportation Company, of Philadelphia, of which John A. Rigg is president, and F. L. Fuller general manager. The superintendent of the Schuylkill Valley road is George Hoeger.

Terms for a Second Tunnel Between New York and New Jersey Approved

The Rapid Transit Commission has passed the application of the New York & New Jersey Railroad for a franchise to build an underground road from a terminal in Christopher Street to Morton Street, to connect with the tunnel which it is building under the North River, and through which the North Jersey Street Railway Company will operate into New York.

It has been decided to give the company a franchise in perpetuity, the right being reserved to readjust the rental charges every twenty-five years. The tunnel will be less than a mile long and the company will pay 50 cents a linear foot of single track for the first ten years and $1 a foot the next fifteen years. A payment not asked for from the Pennsylvania Railroad for its franchise into the city has been imposed upon the New York & New Jersey, which will be required to pay 3 per cent of the gross receipts for the New York end of the railroad for the first ten years and 5 per cent for the following fifteen. The annual payments for the first ten years will be $14,386, and for the second period of fifteen years, $25,673, and the total revenue for the twenty-five years from the franchise will be nearly $530,000. The franchise now goes to the aldermen for approval.

Providence Strike Declared Off

The strike of the employees of the Union Traction & Electric Company has been declared off, and as many of the men will return to work as can be utilized by the company. The old rate of wages and the old regulations will remain in force. The men gain nothing. The union loses everything. The employees who went out have suffered considerably, as they received very little financial assistance, and many of the old men will have to look elsewhere for employment, as the company will not dismiss the new hands taken on during the strike. Ever since the scenes of disorder and violence were enacted that have been reported in part in the STREET RAILWAY JOURNAL from week to week, the more experienced leaders have realized that their case was hopeless, and at a meeting of the union, in Providence, Saturday, it was voted to declare the strike off. The vote in favor of ending the matter is said to have been 141 to 47. The members of the union who come from Pawtucket participated in the meeting, and in the main cast their ballots in favor of continuing the strike. After the meeting had adjourned the Pawtucket men held another meeting. At this gathering a ballot was taken, and by a vote of 41 to 10 it was decided to remain on strike. This action, it was stated, was due to a considerable degree to Pawtucket dissatisfaction with the management of the Providence union, as well as with the action of many of the members in returning to work. The Pawtucket men by refusing to abide by the decision of the union placed themselves outside the organization. The future action of the Pawtucket men will necessarily be outside of any labor body, and their organization, if they maintain one, will be independent of any regular union. It has since been announced that the Pawtucket strikers had reconsidered their action and are now willing to return to work.

It is now five weeks since the strike was inaugurated. There is no doubt that the people are getting rather tired of the inconveniences caused by the boycott, and would gladly welcome a return to normal conditions. The barge system of transportation, which is being patronized by many in place of the electric cars, is an unsatisfactory makeshift, and anything but a physical comfort. Business interests continue to suffer for the reason that women, who constitute the shopping majority, debarred from the usual means of transportation, either remain at home or, taking the steam cars, do their purchasing in Providence, and this is a condition of affairs which is likely to prevail as long as the strike continues, with no inconsiderable financial loss in consequence.

The ranks of the striking motormen and conductors still remain unbroken, but many of the men, some of whom would like to recede and go back to work if they dared, are beginning to look about for some other sort of occupation beside railroading. Receiving no strike pay from national headquarters, and obtaining only a small pittance through the union's methods resorted to to raise revenue for their benefit while out of employment, they are beginning to realize that the conflict is an unequal one, and feel that they are beaten in all but name.

The opinion is now generally prevalent that unless a compromise can be effected and the men return to work, as it is said they will before another week, the only alternative that is presented is to await the action of the State and Federal Courts.

Since it was announced that no benefits would be forthcoming from the International Union because the strike had not received the sanction of that body in the first place, there has been more or less dissatisfaction and discontent. The Pawtucket strikers organized independently, secured rooms and have held their meetings in Pawtucket, although in the early stages of the struggle they attended the meetings in Providence.

Sub-committees on soliciting funds were appointed, and at the end of the third week of the strike about $600 had been collected. From this fund each Pawtucket striker received $5 and since that time very little financial assistance has been given the strikers.

The Everett-Moore syndicate has closed its New York office, and Guy M. Walker, who has been in charge, will return to Cleveland.

Improvements and Extensions of the Colorado Springs Rapid Transit System

When the control of the Rapid Transit System of Colorado Springs passed to W. S. Stratton and his associates about a year ago, the Colorado Springs & Suburban Railway Company was formed to take over its business, improve the present system and extend its lines so as completely to cover the territory. The old equipment was considered one of the best of its kind, and for the size of the city one of the largest and most complete in the country, but under the new management it is proposed to extend and improve this service materially.

During the last year plans have been prepared providing for a complete revision of the present method of handling the passenger service of this district and introducing many improvements in the equipment and operation of the road. A large number of new cars, furnished by the J. G. Brill Company, have already been put in service, and more will be added as the extensions are completed. It is proposed to lay 90-lb. rails throughout the entire system, and at the present time several miles of new track are being built. A new power house is being constructed which, together with the equipment, will represent an investment of $300,000. In the accompanying illustrations an exterior view of this power plant is presented, together with views of the engine and boiler rooms, which were taken while the apparatus was being installed.

NEW STREET RAILWAY POWER PLANT AT COLORADO SPRINGS

The power house is 168 ft. long and 102 ft. wide, built of brick, with a stone foundation and a steel roof. It will be noticed that the chimney is a very conspicuous feature of the power plant. It is 150 ft. high and 10 ft. in diameter, standing upon a brick and concrete base 30 ft. high, which gives it a total height of 180 ft.

A complete system of handling coal and ashes by machinery has been provided. The coal is brought to the station on cars, and is dumped into a huge bin directly beneath the car rails, where it is crushed by automatic machinery. It is then raised by an endless chain of buckets into the suspended coal-conveying bins, from which it is delivered at any point desired in front of the boiler furnaces. The ash conveying plant is carried out along the same principle, the ashes being dumped into the bins below the grate, from which they are carried automatically out of the building.

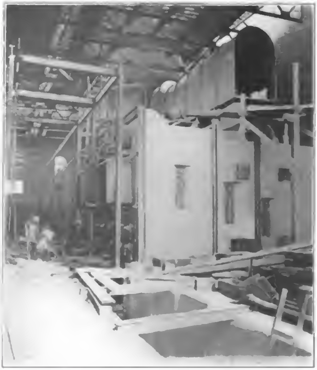
In the boiler room there is a battery of six boilers, of the Cahall horizontal water tube type, having an aggregate capacity of 2000 hp. They include four boilers of 300 hp. each and two of 400 hp., made by the Aultman & Taylor Company, of Mansfield, Ohio. There are also two Marsh feed pumps, each 12 ins. x 17½ ins. x 12 ins., with a capacity of 215 gallons per minute, and a Cochran heater furnished by the Harris Boiler Works, of Germantown, Pa. The steam piping was done by McLeod & Co., of Chicago.

The engine room is designed for four 750-hp. generating units. At the present time two of these engines are in place. They are of 750-hp. each, cross compound, and were built by the Allis-Chalmers Company. They are directly connected to two 500-kw generators, furnished by the General Electric Company. One 450-hp. engine directly connected with a 300-kw generator has also been installed. This gives the company 1800 hp. capacity at the present time, with ample space for increasing the equipment as the road is extended and the needs of traffic demand additional power.

All machinery throughout the building is oiled by the gravity system, so that from the time the oil is emptied from the barrel into the receiving tank it is not touched by hand.

The same standard that has been followed in station design and construction is found in the line equipment and road bed. Many lines are being rebuilt, others are being extended, and a great deal of new construction is being done in entirely new territory. Of the new lines the Cheyenne Canon route is especially worthy of attention. It is considered one of the finest pieces of street railway construction in the country. The five miles of road from the college reservation to Cheyenne Canon is doubled tracked, and is laid with 90-lb. rail. The bed is graded to a nicety, and sharp curves have been entirely eliminated throughout the line. The Prospect Lake line is entirely new, affording connection with the lake, where many attractions will be found. The Institute line is also new, and considerable work is yet to be done. Work is being rushed as rapidly as possible on the Platte Avenue Bridge, over which this line runs. The new Wahsatch Avenue line is completed. This line reaches a thickly settled part of the city. All cars will run from the loop in the business center of the city to their respective districts and suburbs. A system of transfers will be used across the city.

Another improvement which is being pushed vigorously is the building of another car house adjoining the present one. The new house will be 60 ft. wide by 180 ft. deep, and will conform in architecture to the rest of the building as it now stands. This will leave 80 ft. clear between the new house and the ground on which the office buildings and accommodations for the men will be built later. The office building will be one story in height, and will include accommodations for the operating and auditing departments of the street railway company. Back of these offices it is proposed to build a complete gymnasium and club room for the use of the employees of the company.



BOILER ROOM OF NEW STREET RAILWAY POWER PLANT AT COLORADO SPRINGS

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It is said that the purchasers of the Camden Interstate Railway have in contemplation the construction of a network of electric railways that will traverse five counties in West Virginia and connect them with Pittsburgh, and that over 200 miles of line will be built. In addition to the Camden Interstate Railway, whose organization will be maintained, the Morgantown Electric Light & Traction Company has been organized, and this company will build a number of the lines projected.

Street Railway Legislation in Massachusetts

The Massachusetts Legislature of 1902, which was prorogued June 28, equaled if not eclipsed its recent predecessors in the amount of street railway legislation which it enacted. From the opening of the session until practically its closing days, there were street railway bills in the calendars of the two branches or engaging the closest attention of various committees; the street railway committee, of course, having most of the bills to consider.

The recommendation of the Governor that the Commonwealth authorize the expenditure of $5,000,000 additional for its share of the expense of the elimination of grade crossings of railroads and highways was accompanied by the suggestion that wherever street railways had locations on crossings thus separated they should be brought in as a fourth contributing party to meeting the expense. This general court has reflected the views of Governor Crane in numerous ways, and the stamp of his individuality is on a very large amount of the legislation suggested; and therefore it was not strange that the committees on railroads and street railways, sitting jointly, should have agreed in reporting legislation on the lines he laid down. A bill was reported April 30, and the House committee on ways and means took it in hand as a matter of secondary reference. Then it was discovered that a great many committees were interested in that provision of the measure which permitted the Attorney General to ask dismissal of proceedings already begun under the grade crossing act where the grade crossing commission had not reported to the court. The section read as follows:

> Any case now pending in the Superior Court under the provisions of section 149 of chapter 111 of the Revised Laws, in which the final report of the commission has not been filed in said court under the provisions of section 152 of said chapter, may, upon motion of the attorney general, and after such notice as the court may order to the other parties, be dismissed by said court without prejudice to the right of any subsequent party under said section 149, as amended by this act, to file a new petition for the abolition of the same crossing. Provided, however, that in the proceedings upon any subsequent petition, no person shall be appointed a member of the commission referred to in said section 149 who was a member of such commission appointed in the proceedings in the case so dismissed, unless all parties to the proceedings upon such subsequent petition assent to such appointment.

The section further provided for a division of the expense among the contributing parties so far as any had been incurred. The city of New Bedford had spent many years in preparing to eliminate her grade crossings, and the commission was about to report, and to set aside the work at this time would mean to lose the benefit of $50,000 which had already been expended. As a consequence her Mayor and other officials protested against this section remaining in the bill, and it was stricken out by the ways and means committee, which reported in its place a provision that street railway companies should be brought in as a fourth contributing party upon all petitions hereafter filed and upon all now pending "on which no commission has been appointed," where the street railway company or corporation has tracks duly located in that part of the public way in which the crossing or crossings sought to be abolished, discontinued or altered are situated. Under the bill, as it finally came from the ways and means committee and was enacted by both branches, grade crossing commissions may, in future, assess 65 per cent of the expense of abolishing crossings upon steam railroads, not exceeding 15 per cent. upon street railways and 10 per cent upon cities and towns, while the balance shall be paid by the commonwealth from the $5,000,000 provided. The provision referred to, that the street railways shall only be brought in in such proceedings as have already begun where commissions have not as yet been appointed, eliminates street railways from any expenditure in proceedings in progress in New Bedford, Worcester, Fall River, Haverhill and other places, and as a result it is assumed that very few street railway companies will be affected during the next ten years, as the work of eliminating crossings in the places mentioned will practically use up the $500,000 which the commonwealth, under the provisions of the bill, can annually expend. Of course the work which it is proposed to begin as soon as possible in Lynn, Malden and elsewhere will include the street railway companies, but it is difficult to see how anything but the preparation of plans, etc., can go on in these places during the next decade.

ENGINE ROOM OF NEW STREET RAILWAY POWER PLANT OF COLORADO SPRINGS

Another recommendation of the Governor was that in future the railroad commissioners be granted supervision over new locations of street railway companies in all cities and towns. Some years ago a law was passed to provide that no extension of locations should be granted in Boston, Cambridge and Brookline without the concurrence of the Board, and it was through the recommendations of this body that the Governor was led to ask that this law be extended to all cities and towns. There was a disposition on the part of the local authorities to protest against this measure, and, therefore, it was referred for a hearing to a special committee, consisting of members of the committees on street railways, cities and towns. This committee finally reported a bill for this supervision, which took all its readings and was approved May 15. While this matter was pending a number of bills and petitions were offered to provide for a referendum in cities and towns on the question of locations granted by the authorities, but these were all adversely reported upon and rejected. Another measure affecting street railway locations provided for their revocation after petition and hearings, and this was very hotly urged by representatives from the West Roxbury district, which, for some years, has been seeking to secure 5 cent fares to Boston; these men assuming that if certain locations of the Old Colony system could be revoked and the Boston Elevated system extended, the 5-cent fare would be obtained. While the discussion was in progress the Railroad Commissioners sent in a recommendation that a bill be passed to permit the Elevated Company to lease the Old Colony locations within the limits of Boston, and this bill was passed. The street railway location revocation bill was thereupon adversely reported upon and rejected. Another bill relative to revocation of street railway locations was petitioned for by Revere parties, who felt that it was time that the association organized to build between Chelsea and Revere proceed with its work of construction or abandon its charter. The bill reported upon this petition provides that if in any city or town the original location of tracks of a street railway company already organized or in process of organization expires, is revoked, or otherwise becomes void before or after the passage of the act, the provisions of section 7 of chapter 127 of the Revised Laws shall apply for a new petition in the city or town unless the petition is brought for an extension or alteration of the tracks of the company. This provision in the street railway chapter referred to simply puts the petitioners on the same basis as though they never before had filed a petition.

A resolution was adopted providing that the Railroad Commission shall investigate and report on the merits of street car fenders. A bill to compel the use of automatic brakes on street cars was referred to the next General Court after hearings and some debate. Another enactment provides that the Railroad Commissioners shall be authorized and directed to investigate the advisability and necessity of having all street railway cars equipped with jack screws or other implements of machinery of sufficient power to raise the cars to such height as will allow the removal of injured persons from under them, and to report thereon by January 15 of next year.

A bill to regulate the speed of electric cars was referred to the

next General Court. A bill was approved at the very close of the session to provide that hereafter street railway companies shall bear a part of the expense of building bridges on highways upon which they have locations. This measure was the cause of a good deal of discussion, and an effort was made to amend it so as to provide that but 15 per cent of the expense should be met by the street railway company, but this was defeated, and the matter is left to the settlement of the several interested parties.

A very important measure was passed providing that a street railway corporation may increase its capital stock or issue bonds beyond the amount fixed and limited by its agreement of association or its charter or by any special law to the extent the Board of Railroad Commissioners shall determine will realize the amount which has been properly expended, or will be reasonably required, without an appraisal of its entire property for the following purposes: Building a branch or extension, acquiring land for pleasure resorts, building power houses or car houses, park buildings, acquiring and equipping additional rolling stock, changing motive power, abolishing grade crossings, paying betterment assessments for the widening and construction of streets, complying with any requirements lawfully imposed under delegated legislative authority, making permanent investments or improvements, acquiring additional real or personal property necessary or convenient for its corporate objects, refunding its funded debt, and payment of money borrowed for any lawful purposes.

A bill to provide that street railway companies shall pay a part of the expense of maintaining the streets they use was engrossed by the House, but was referred to the next General Court by the Senate.

The street railway committee refused to recommend the enactment of a bill to provide that school children, other than those attending the public schools, shall be carried at reduced rates by the street railway companies.

A bill was enacted which will permit street railway companies not only to carry road making material, for their own use, but to deliver it to any connecting street railway company, and they may transport such material for cities and towns.

A bill was passed upon the recommendation of the Railroad Commissioners to increase from $1,500 to $2,000 the salaries of railroad and railway inspectors, so as to make it possible for the board to retain the services of men in whom they have confidence, who are greatly desired as employees by some of the corporations.

A bill was reported by the joint judiciary committee to provide that the breaking of any part or attachment of a car or locomotive on a railroad or railway, shall be deemed prima facie evidence of negligence on the part of the person or corporation, owning, controlling, directing or operating it, in any action to revoke for the injury or death, or both caused thereby. This measure was engrossed by the House, but was finally rejected in the Senate.

The committee on banks and banking reported a bill, which was enacted and approved, to permit savings banks and institutions for savings to invest in the bonds of any street railway company incorporated in this commonwealth, which has earned and paid annually for the five years last preceding dividends, and not less than 5 per cent per annum upon all of its outstanding capital stock, providing that such bonds have been certified first by the Board of Railroad Commissioners, on or before January 15 of each year, are to submit to the Board of Savings Bank Commissioners a list of all street railway companies that appear from the returns made to have properly paid their dividends without impairment of assets or capital stock, and the Savings Bank Commissioners are to prepare a list of bonds issued by any street railway company which the board shall deem good and safe securities for investment. This new law will at present affect the bonds of fifteen street railway companies now in operation.

Among the special acts passed were bills to extend the corporate powers of the Conway Electric Street Railway Company, the Dartmouth and Westport Street Railway Company, the Worcester, Rochdale, and Charlton depot, and the Worcester & Southbridge Street Railway Companies, the Greenfield & Deerfield Street Railway Company, the Springfield & Eastern Street Railway Company, the Lowell, Acton & Maynard Street Railway Company, the Pittsfield Electric Street Railway Company, the Framingham Union Street Railway Company, the Providence & Fall River Street Railway Company, the Stoughton & Randolph Street Railway Company, and the Hampshire Street Railway Company.

The Rockingham Light & Power Company, of Portsmouth, N. H., was given authority to furnish electricity for power to street railway companies along the Merrimac River which enter Massachusetts from New Hampshire.

An extension of time was granted for completing the Haverhill & Southern New Hampshire Street Railway Company and the Lawrence & Methuen Street Railway Company connecting with the systems above referred to; also for the construction of the Western Hampshire Street Railway Company, the Waltham Street Railway, the Mt. Wachusett Street Railway, the Barre Street Railway, and the Berkshire & Canaan Street Railway.

Charters, with special powers, were granted the Deerfield, Whateley & Hartford Street Railway Company, and the Danvers & Georgetown Street Railway Company. The charter of the Barnstable County Street Railway Company was extended.

The General Court declined to permit the Haverhill, Georgetown & Danvers Company to lease to the Exeter, Hampton & Amesbury Company, but passed a bill to permit the Haverhill & Plaistow Company to lease to the Exeter, Hampton & Amesbury Company. Another petition which was refused was that of the Hartford & Worcester Street Railway Company, that it might do an express and common carrier business.

An effort to secure amendments to the law permitting street railways to acquire land to avoid grade crossings failed; as did an effort to provide for a license for every street railway and elevated road; several efforts to secure street railway express charters; to secure lower fares at certain hours of the day; State or municipal ownership of street railways, and the transportation of street superintendents by street railways.

An important measure, which was passed, permits the Grafton & Upton Railroad Company, the Upton Street Railway Company, the Milford & Uxbridge Street Railway Company, and the Milford, Holliston & Framingham Street Railway Companies to make contracts for lease and sale, etc. This in effect, permits a steam railroad company to absorb three street railway companies and operate them together. The conditions in the vicinity of Milford are peculiar, and, therefore, the Legislature consented to this special act, but declined to pass a bill, which was heard by the committees on railroad and street railways sittings jointly, to provide that railroad corporations may purchase and vote the stock of street railway companies. Had the latter general bill passed it would have almost revolutionized railroading in Massachusetts.

The most important bill considered by the General Court provides for the construction of a new subway or tunnel under Washington Street, in Boston, for use by the Boston Elevated Railway Company. This measure was not considered by the street railway committee, by the committee on metropolitan affairs, and for over five months it was under consideration before the Elevated Company, the Mayor of Boston, and the Governor came to an agreement as to its provisions. The Boston Associated Board of Trade was greatly interested in the proposition, and its counsel appeared at all the hearings and in the conferences which followed. Finally a bill was agreed upon by all, and was reported, and passed its readings in both branches with but one amentment of a material character. The provisions of the bill, as approved, were outlined in the last issue.

A bill was passed on the recommendation of the Railroad Commissioners to permit the board to employ its own experts in determining the value of the property of railroad and street railway companies seeking approval of securities. This was much aided in its passage by the fact that during the time the Legislature was in session two street railway companies sought approval of bond issues through testimony of an expert engineer who acted as appraiser, who, by his own testimony with that of others, conclusively proved that he had fixed a value upon some of the property through the statements of officers of the companies rather than by his personal investigation.

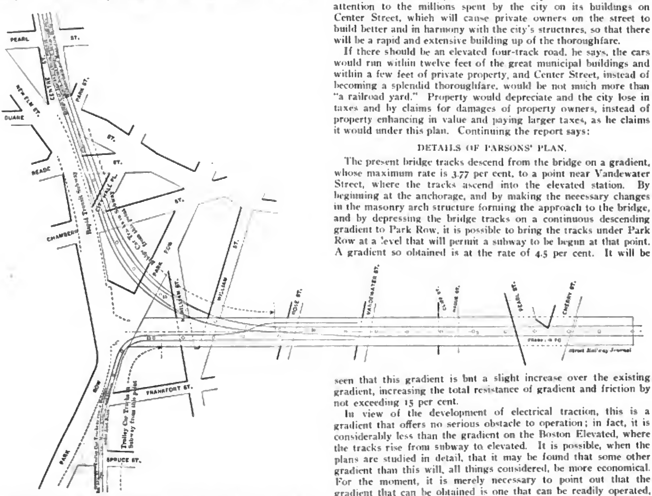
Perhaps the most important charter granted, as it replaced a petition for a steam railroad charter over the same route, which has been pending for some years, but was abandoned when this was granted, incorporates the New York & Berkshire Street Railroad Company, with a capital of $600,000, Roscoe C. Taft, W. C. Dalzell and J. F. Whiting being leading incorporators. The company has the right to locate on private land, in part, and may do an express and freight carrying business in Mount Washington, Egremont, Great Barrington, Monterey, Otis, Sandisfield, Tolland, Granville, Russell, Blandford, Southwick, Westfield and Agawam.

An Immense New Plant for Baltimore

A deal which contemplates the absorption of the United Electric Light & Power Comany and the Mount Washington Electric Light Company, and which provides for the erection, on the Susquehanna River, of an immense new power plant, that will supply power for operating the lines of the United Railways & Electric Company and for lighting the city, has just been closed. The deal has been pending for over a year, and the company that will carry it to completion will be organized under the direction of the Continental Trust Company, of Baltimore, it is said. The reported purchase price is $900,000.

Parsons' Solution of Brooklyn Bridge Problem

The Rapid Transit Commission is considering a report made by its chief engineer, William Barclay Parsons, providing for permanent relief from the congestion of traffic at Brooklyn Bridge, and offering additional transportation facilities between the two boroughs. The plan calls for a tunnel from the Brooklyn Bridge through Nassau Street to Maiden Lane, and a tunnel from Maiden Lane to Brooklyn for the exclusive use of trolley cars if they are to remain on the bridge. If they are to be removed, Mr. Parsons recommends the moving platform. The cost of the improvement, exclusive of the work that would be necessary to grade the bridge properly, is estimated at $2,750,000. The plan prepared by C. C. Martin, then chief engineer of the bridge, would have cost $2,405,300, but Mr. Parsons believes that a considerably larger sum would be granted for abutting damages than that estimated in the Martin plan. Mr. Parsons says that the present plan would enhance real estate values and increase the taxation. The removal of the Manhattan terminal of the bridge, as proposed in the Parsons plan, it is claimed by the engineer, would leave a piece of land upon which could be built a large municipal office building. After the report was read, Mayor Low presented a resolution recommending that the report be accepted as a solution of the bridge problem, and that Mr. Parsons be directed to co-operate with Bridge Commissioner Lindenthal for the perfection of the plan. This resolution was adopted.



PLAN PROPOSED FOR RELIEVING CONGESTION AT BROOKLYN BRIDGE

In his report Mr. Parsons calls attention to the recommendations of Messrs. Boller, Prout and Whinery, comprising a special commission of experts on this subject, the report of C. C. Martin, superintendent of the Brooklyn Bridge, and Bridge Commissioner Lindenthal. He says that the suggestions of Mr. Martin are a modification of the report of the special commission, and he adds:

"Mr. Martin's plan proposes to carry the elevated tracks over Park Row to Center Street, thence with four tracks along Centre Street to Walker, and thence along Center to Grand, along Grand to Essex, and Essex to Delancey, to the terminus of Bridge No. 2. In connection with this line there is a projected Y branch, whose arms—one of which diverges at White Street and the other near Howard Street—converge into Canal and thence pass along Canal to Chrystie Street, where connection would be made with Bridge No. 3. Mr. Lindenthal disapproved of this plan on the ground "that a four-track elevated railroad on Center Street would needlessly ruin the costly and architecturally monumental city property on that street."

Mr. Parsons then outlines the plan of Commissioner Lindenthal, including tracks to be above those of the Manhattan tracks over Park Row and the Bowery to Delancey Street, and thence to the Williamsburg Bridge, and another elevated structure to run from Bridge No. 3 to the Hudson River at West Street, and then to pass over the Manhattan elevated lines, where passengers could be transferred to the Manhattan system. He partially approves of Mr. Martin's plan, but mainly as to the route, believing that Center Street would serve the public better than any other street. He calls attention to the millions spent by the city on its buildings on Center Street, which will cause private owners on the street to build better and in harmony with the city's structures, so that there will be a rapid and extensive building up of the thoroughfare.

If there should be an elevated four-track road, he says, the cars would run within twelve feet of the great municipal buildings and within a few feet of private property, and Center Street, instead of becoming a splendid thoroughfare, would be not much more than "a railroad yard." Property would depreciate and the city lose in taxes and by claims for damages of property owners, instead of property enhancing in value and paying larger taxes, as he claims it would under this plan. Continuing the report says:

DETAILS OF PARSONS' PLAN.

The present bridge tracks descend from the bridge on a gradient, whose maximum rate is 3.77 per cent, to a point near Vandewater Street, where the tracks ascend into the elevated station. By beginning at the anchorage, and by making the necessary changes in the masonry arch structure forming the approach to the bridge, and by depressing the bridge tracks on a continuous descending gradient to Park Row, it is possible to bring the tracks under Park Row at a level that will permit a subway to be begun at that point. A gradient so obtained is at the rate of 4.5 per cent. It will be seen that this gradient is but a slight increase over the existing gradient, increasing the total resistance of gradient and friction by not exceeding 15 per cent.

In view of the development of electrical traction, this is a gradient that offers no serious obstacle to operation; in fact, it is considerably less than the gradient on the Boston Elevated, where the tracks rise from subway to elevated. It is possible, when the plans are studied in detail, that it may be found that some other gradient than this will, all things considered, be more economical. For the moment, it is merely necessary to point out that the gradient that can be obtained is one that can be readily operated, is within the reach of the motive power equipment on the Brooklyn Elevated system, is less than that overcome on the Boston Elevated, and is but slightly in excess of the one now existing.

Once under Park Row the line can be made to curve to the north under private property between Park Row and Center Street, and thence, with four tracks under Center Street, to such point as may be desired, when two or any other number of tracks may be carried under Grand or Delancey or other street to the Williamsburg Bridge. In the case of the Williamsburgh Bridge the necessary arrangements to bring the cars from bridge to subway are easier and simpler than at the Brooklyn Bridge. The station near the Brooklyn Bridge should be located not upon the bridge itself, but under the private property between Park Row and Center Street, and on substantially the same level as the station of the Rapid Transit subway now being constructed. Approach to this station can be had from several points, and the portion of the travel that now seeks the bridge trains at the bridge would be taken care of before the bridge is reached. Additional stations could be located in Center Street and elsewhere, according to Mr. Martin's plan or upon such other plan as may be approved by the Bridge Commissioner.

The depressing of these bridge tracks would involve the closing of North William Street. This, however, is a short street, only one block long, running from Park Row to an archway beneath the

bridge, and the travel over it can be diverted, or if desired North William Street can be connected at small expense with William Street by a roadway running parallel to the bridge on the northern side. It would also involve a change in William Street itself, lowering the same by some few feet to an extent dependent upon the rate of the gradient adopted on the bridge approach. William Street, between the bridge and Duane Street, is now occupied by two warehouses and a number of old houses that were originally used as residences, but now are used as junkshops. The warehouses could be adapted at moderate expense to a change of grade.

In Mr. Martin's report an estimate is given by him as to the cost of constructing the elevated railway between the Brooklyn and Williamsburgh bridges, the total figures being as follows:

For construction, including station	$757,000
Property, damages, etc.	1,405,300
Total	$2,162,300

The foregoing estimate will be seen to have a large proportion of the cost absorbed by abutting damages. The structural estimate made by Mr. Martin is, for the usual style of structure, correct; but the abuttal damage estimate is necessarily an indeterminate figure, depending upon an award by jury. Personally, I believe that a considerably larger amount than this would be granted. The actual value of the property along the proposed four-track section is at least $5,000,000, and the actual value of the property along the two-track section is at least $12,500,000, amounting together to $17,500,000, exclusive of any allowance for the city's own property. It will be noticed that Mr. Martin's estimate is only about 8 per cent of this amount.

When it is remembered how close the cars would run to the abutting buildings, I am forced to the conclusion that the damages would be considerably in excess of the estimate. Taking the same route and the same stations between the same points, I have computed the quantities that will be required for underground construction. Using the same unit prices that we are now paying on the Rapid Transit subway for similar work, and making a generous allowance for contingencies and extras, I place the cost of underground construction at $2,750,000. This figure is somewhat in excess of Mr. Martin's estimate, but I do not believe it will be in excess of what the actual cost of the proposed elevated structure and damage allowance together would amount to. The abutting property would, in the case of the subway, be benefited and not depreciated, and the city would receive an increased and not a decreased revenue from taxation.

As to the trolley cars upon the Brooklyn Bridge; Mr. Lindenthal recommends for the present the construction of additional loops at the Manhattan end of the Brooklyn Bridge in order to provide more facilities for passengers to reach the cars, and suggests that on the completion of the two bridges now under construction, the operation of trolley cars should be limited to the Brooklyn side, and that passengers be carried across the present bridge by a movable platform. Additional loops or some similar rearrangement of the tracks at the Manhattan end is the only suggestion that I can see to provide for immediate relief. Such relief, however, would be temporary only.

A movable platform undoubtedly possesses great merit, and is capable of moving more people than any other device. As to whether it is better to withdraw the trolley cars entirely and substitute therefore the movable platform and so carry all the people away from Manhattan as fast as they arrive at the end of the bridge and arrange for their distribution in Brooklyn, where there is more space, is a matter which I do not enter into, as I deem it beyond the scope of my investigation. If, however, the trolley cars are to remain, I beg leave to call the board's attention to the fact that these trolley lines can be treated in a manner similar to what I have suggested for the elevated lines, namely, they too can be depressed, be brought under Park Row and carried in a subway south under Nassau Street to, say, Maiden Lane, and thence in a tunnel under Maiden Lane and the East River, to Brooklyn, rising to the surface at some desired point in the neighborhood of Borough Hall.

The Board of Engineers in their report recommended the construction of an elevated line south from the bridge and across the city, in order to supply facilities for passengers going to and coming from points below the bridge. This suggestion was most valuable, as such a line would intercept a large volume of traffic before it reaches the bridge. Mr. Martin, however, disapproved of it on account of difficulties of construction. By means of a subway for the trolley cars it is possible of accomplishment, and I have therefore included it.

Trans-fluvial facilities are being provided by the city by the building of three bridges across the East River above the Brooklyn Bridge, and by building the rapid transit subway from South Ferry to Joralemon Street. No provision has as yet been seriously projected to furnish continuous rail communication at any point between the existing bridge and the south end of Manhattan Island, in order to connect the financial district with Brooklyn.

The board has directed me to prepare a general plan of extending the rapid transit facilities throughout the city. One of the features of such a plan will be a tunnel from Brooklyn to the vicinity of Maiden Lane and then crossing Manhattan to the Hudson River. Such a tunnel would more than double the facilities for trolley cars now offered by the bridge, and do so in the cheapest possible manner. By connecting this tunnel with the bridge there would be gained a relief to congestion by trolley car passengers, in the same way as the Center Street extension will relieve congestion by passengers at the train platforms. The two improvements are, however, quite distinct, neither depending of necessity upon the other.

The improvements here outlined can be completed, so far as the bridge is concerned, without any serious interference with the operation of either the elevated or the surface tracks.

The Bridge Commissioner has pointed out that the Second Avenue elevated line could effectively be brought over the tracks of the City Hall branch in Park Row, so as to make a double station at Park Row for both the East Side elevated systems. This is a most admirable suggestion, and one that I cordially indorse. Work is now in progress on the Blackwell's Island Bridge. If the Second Avenue line be brought to City Hall, additional express trains could be run not only to Harlem and The Bronx, but also, by constructing suitable connections across the new bridge, to the Borough of Queens, and thus bring that borough into direct and rapid communication with the City Hall. If this improvement were made, there would be a joint station of the Second and Third Avenue lines on one level and directly beneath them another joint station of the subway, the Brooklyn elevated and surface cars. Connection between the upper and lower levels could be made by moving stairways.

When these improvements are finished, both cars and trains will have disappeared from the surface of the bridge from Rose Street to Park Row, and the present terminal station with the bridge across Park Row can be removed. This station building is unspeakably unsightly and in every sense unworthy to constitute the approach to what is now the greatest bridge in the world. Æsthetic considerations would demand that when these buildings are removed the space be reserved to afford an uninterrupted view of the massive masonry towers and the graceful curve of the cables.

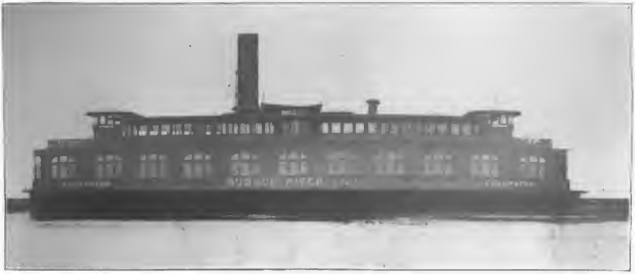
There is, however, a very general demand both on the score of economy and convenience for the construction of a great public building, in which can be located the various department bureaus, for which building no suitable site seems available. With the disappearance of trains from the Manhattan entrance of the bridge and the abandoning of the bridge approach as a station, for which it was never intended, the area covered by the present station, together with such private property as can be readily acquired to the north, forms an exceptional site for such a public building. This building, by proper architectural treatment, could be made a fitting approach for the bridge itself by piercing the building with a large arched way to form a spacious entrance to the bridge, which arch would afford a fine vista of the bridge from City Hall Park. Such a building would afford accommodation for all the city offices beneath a single roof. It would be near the City Hall and the general court house; it would face the City Hall Park, and, moreover, would have light and air on the other three sides. If a similar amount of land had to be purchased near by, the cost of the land alone would probably be nearly equal to the cost of the whole construction above proposed; whereas, by depressing the tracks as above suggested, this land becomes available practically without expense as an incident to such construction.

Boston Postal Service

The management of the electric mail car service in Boston was recently transferred from Edward J. Ryan, superintendent of the railway mail service, to Postmaster George A. Hibbard. The service consists of eight cars and fifteen men at present, and about 120,000 pieces of mail matter are handled daily. It was believed that the work performed by the clerks on the cars should be paid for by the Boston postoffice rather than the railway mail service, and this policy is in line with that now followed in other cities, the electric railway postal service being under the supervision of the postmaster. The clerks will thus be paid out of the first assistant postmaster general's appropriation, and the payment for the use of the Boston Elevated Railway Company's cars and tracks will continue to be charged to the second assistant postmaster general. Last year the revenue of the electric mail service to the Boston Elevated was $21,600.08, or 11.2 cents per car mile, the total car mileage being 193,495.

The Ferryboat "Edgewater" of the New Jersey & Hudson River Railway and Ferry Company

One of the most complete and handsomely equipped ferryboats ever built has just been placed in regular service between 130th Street, in New York, and Edgewater, N. J. The New Jersey & Hudson River Railway & Ferry Company has its terminus at Edgewater, and what was formerly the Fort Lee Ferry now lands there. On Thursday, July 3, a number of prominent men interested in the railway and in the district along the Palisades in New Jersey that it serves, at the invitation of the company made a very pleasant trip up the Hudson River on the new ferryboat, the "Edgwater," where every opportunity was given to make a thorough inspection of her original points of design, both in cabin furnishings and in machinery. Frank R. Ford, second vice-president and general manager of the railway company, was on board and explained the details to his interested guests.


GENERAL VIEW OF THE "EDGEWATER"

Contracts were awarded last November to P. Sanford Ross, Incorporated, of Jersey City, for the building of the dock work on both sides of the river, and to John Monk & Son, of New York, for the New York ferry house building. The work on the New York side has been delayed by the construction of the new bulkhead by the city at this point, but this has now been so far completed as to enable the ferry construction to proceed, and it is expected that the latter will be completed by the early winter. The ferry building at the foot of West 130th Street will be of the best modern design and construction and provided with all the most recent improvements. It will be a steel structure with copper front and clock tower, the latter to form a prominent feature of the shore front, both as seen from the river and the Riverside Drive viaduct over Manhattan Valley, directly behind it. The interior finish of the building will be of stamped metal and quartered oak, somewhat similar to that of the Desbrosses Street ferry house. Adjoining the building there will be a power house containing the necessary machinery for heating and electric lighting. The building will be located on the new bulkhead line directly at the foot of West 130th Street, but about 150 ft. further out in the river than the old Fort Lee ferry house. This provides sufficient space for the new marginal street at this location similar to West Street in lower New York. On the New Jersey side a new slip has been built south of the present one, and a new gangway house added, which practically doubles the capacity of the present building.

The new ferryboat "Edgewater," which was built for the company by the Harlan & Hollingsworth Company, of Wilmington, Del., has just been delivered. The boat is a double-decked steel ferryboat of the latest design, with upper works of somewhat similar appearance to the Pennsylvania Railroad ferryboats, the lower cabins extending to the extreme ends of the boat. The length over all is 180 ft., the width 60 ft. A corps of engineering specialists has been engaged in its design, Colonel E. A. Stevens, of Hoboken; Captain C. W. Woolsey and H. B. Roelker, supervising the design of the hull and machinery, and Ford, Bacon & Davis, the electrical equipment and interior arrangement and finish.

The hull of the boat has been so constructed as to make it one of the swiftest ferryboats in the harbor, besides forming a powerful ice breaker to force the way through the large ice floes encountered in this part of the "North River." The main engine is a three-cylinder compound of the marine type, developing at 150 r. p. m. ot the propeller upwards of 850 hp. The engine shaft is coupled to the main shaft, extending through the entire length of the boat to a propeller at each end. Two additional engines, direct-connected to electric dynamos, furnish electricity for light, and blowing and steering engines are also provided, besides the usual equipment of condenser, feed, bilge and fire pumps. Two marine boilers furnish steam to these engines and pumps.

The design and equipment of this ferryboat are such as to make it the safest of any in the harbor. The steel hull is constructed as a complete double shell at the water line, there being eight separate water-tight compartments divided by steel-plate collision bulkheads, rendering the boat practically unsinkable. The protection from fire is also perfect. A steel deck and steel center house, from hull to hurricane deck, would isolate any fire in the hull and prevent it from communicating to the cabins and decks until assistance could be obtained. Powerful fire pumps are connected to a special fire


VIEW OF CABIN INTERIOR

pipe line with regulation New York Fire Department outlets and hose at eight points on the three decks. In addition to the old-fashioned hand buckets required by the government regulations, at four convenient points are provided standard fire extinguisher bucket tanks filled with chemical solution. Double the number of life preservers required by law are provided, in accessible locations, and in addition to the usual life boats there are carried ring buoys and life rafts which can be quickly thrown overboard.

As this ferry is a part of the "Hudson River Line" from New York to Englewood, Hackensack and Paterson, it has been the object of the management to provide a ferryboat which in convenience of arrangement and elegance of finish would be as notable as its electric cars. The main deck is in general of the usual arrangement. A cabin on each side extends the entire length of the boat, one being for smokers and one for non-smokers. Stairways in the center of each cabin lead to the upper cabins. Between the main cabins are the usual teamways, with accommodation for thirty average wagons. For sanitary reasons the company experimented with a number of waterproof paving materials for the teamways, including rock asphalt, asphalt mastic, vitrified brick, granite block and compressed cork brick, but these were found unsatisfactory on account of horses slipping on them when starting heavy loads. The paving material used is creosoted spruce, which is an improvement over the untreated wood. A portion of the center house between the teamways is used as a drivers' cabin, enabling these men to have a shelter in winter and still be close to their teams. The promenade deck is provided with the usual seats.

Great care has been taken in the design of the interior finish. All cabinet work is of specially selected quartered white oak, with plain moldings, giving a simple though elegant effect. The panelling of walls and ceilings is in burlap of natural color. A touch of bright color has been added in the elliptical transom windows of the lower cabin, which are of stained glass, made by the Tiffany Company. The hardware and fixtures are of solid bronze. The color scheme is uniform throughout, harmonizing with the natural wood color of the oak. All of the work is along honest and substantial lines, and the effect is most pleasing; a private yacht would not be more handsomely finished. The lower cabin and stairway floors are covered with rubber tiling in a simple design, and the upper cabin floors with cork carpet. Spring rattan seats, similar to those used in street cars, are provided in the lower cabins, a novelty for this service and affording additional comfort.

The boat is heated by the Sturtevant hot air system. Cold air, which is taken at an opening above the center house on the hurricane deck, is heated by being passed over steam coils in the hold, and is then blown into the cabins from outlets near the ceilings. On cooling, the heated air descends and is exhausted at openings under the seats and discharged into the open air by ventilating fans. The difference between this system and the usual heating by radiators under the seats, without any ventilation, is readily noticeable. The electric lighting of the boat is upon an unusually generous scale, there being 50 per cent more lamps used than on the best lighted ferryboats in the harbor. A sufficient supply of electricity has also been provided for search light and exterior electric signs.

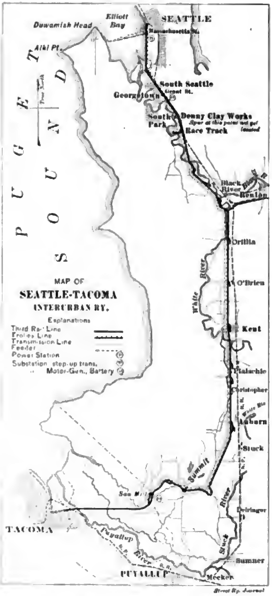
The Seattle-Tacoma Interurban Railway

One of the most interesting high-speed electric railways now under construction in America is being built between the cities of Seattle and Tacoma, Wash. The line is about thirty-six miles long from end to end, and is to be equipped with the most modern apparatus available for quick transit.

Starting in the thickly settled part of Tacoma, the line runs easterly across the Puyalup Indian Reservation, through the valley of the Stuck River northerly to Auburn, about 14.5 miles from Tacoma, then passes to the town of Kent via Christopher and Thomas, Kent being about nineteen miles from the starting point. Thence the track extends through O'Brien, Orillia, Renton Junction, and follows the Duwarmish River through Race Track, Georgetown and South Seattle to King Street, Seattle proper, the cars to operate on the tracks of the Seattle Electric Company within the city.

The road is being built largely on a private right of way, extending between the Tacoma city line and Race Track. Current for the trains will be taken from a 100-lb. per yd. third rail on the private right of way and from a 00 B. & S. trolley wire on highways. The third rail is to be supplemented by a 350,000-circ. mil cable. The track rails are 70-lb. Chase-Shawmut 500,000-circ. mil bonds will be used on the track and 750,000-circ. mil on the third-rail.

Sub-stations located at Saw Mill, Kent and Grant Streets, about 6.5, 19 and 32.4 miles from Tacoma, respectively, will serve as distributing points for the current supply. Current will probably be generated in the new Post Street power station of the Seattle Electric Company in Seattle, transmitted about one mile over a 0000 B. & S. two-phase circuit at 2,200 volts to the Massachusetts Street step-up transformer station. Here four 500-kw water-cooled General Electric transformers will raise the voltage to about 27,500 maximum and feed the high-tension transmission line with 60-cycle, 3-phase current over three No. 1 B. & S. copper wires as far as Race Track, where the line will change to three No. 4 B. & S. copper wires and be carried through to Sawmill substation in this size. The step-up transformers in the Massachusetts Street sub-station are to be equipped with regu-



MAP OF SEATTLE-TACOMA LINE

lating dials giving various secondary voltages with variations in the primary between 2,000 and 2,200. Each transformer is guaranteed to regulate within 1 per cent at 100 per cent power factor, and within 3 per cent at 80 per cent power factor.

At each of the sub-stations there will be one 300-kw motor-generator set, fed by two 180-kw oil-cooled, step-down three-phase two-phase transformers. The machines consist of an eight-pole, 300-kw, 450-r. p. m., 600-volt flat-characteristic, direct-current General Electric railway generator direct-connected to a G. E. 16-pole, 450-hp, 2,200 volt, 2-phase induction motor. Each machine has a 50 per cent overload capacity for two hours. It is expected that the control of the railway current through motor generators instead of rotary converters will give an unusual flexibility in operation.

Supplementing the motor generators and taking up the fluctuations which the trains will superimpose upon each sub-station will be three storage batteries, made by the Electric Storage Battery

Company, of Philadelphia. The Grant Street and Kent sub-stations will each contain 288 cells with Type G17 plates, each battery having a capacity of discharging 640 amps. at the hour rate, and the Saw Mill battery will be 288 cells of Type G15, all plates in the three batteries, however, being in Type G23 tanks to allow for future growth. These batteries will be charged and discharged through differential boosters, General Electric Type MP 6-pole, 35-kw, 600-r. p. m. 50-volt to 110-volt generators direct connected to General Electric Type MP 4-pole, 53-hp, 600-volt motors.

These boosters will be designed to bring an average load upon the motor-generator sets. When the line current becomes great the booster's series ampere turns overpower the shunt turns, generating a voltage in the booster armature coincident in direction with the battery voltage, so that the battery discharges, taking up the fluctuations. At times of extremely light load, the shunt field overpowers the series, giving a voltage in opposition to the battery, and charging it from the generator. At average load the shunt and series fields just balance and the battery floats on the bus-bars, inactive, with the load coming on the generator. The batteries can also be operated without boosters by giving the motor-generators a falling voltage characteristic as the load comes on.

On the Seattle power station current will be derived from two 1600-kw Westinghouse 2,200-volt, 60-cycle alternators. The local cars in Seattle depending primarily on this station will be supplied through 500-kw rotary converters connected to step-down transformers.

The Seattle Electric Company has also at present a connection with the lines of the Snoqualmie Falls Power Company, which transmits power from the Falls thirty-one miles to Seattle and forty-four miles to Tacoma over a 30,000-volt, 3-phase line, using aluminum wire. A recent test on this line made by sending current from the Falls to Seattle, back to the Falls, then to Tacoma and back to the Falls, 153 miles in all, gave, with a line resistance of 241 ohms, 13½ per cent power loss at 60-cycles. The insulation resistance was 70,000 ohms, and the charging power 112 kw.

The interurban transmission line will be made up on red cedar poles 40 ft. to 45 ft. long, spaced 110 ft. to 120 ft. apart. The upper transmission cross-arms will be 8 ft. 6 ins. long by 6 ins. square at the ends, with two pins 7 ft. on centres. The lower arms will be 12 ft. long, 6 ins. x 6 ins. at the ends, with four pins 3 ft. 6 ins. on centres. Thus the transmission wires will be spaced on a 42-in. eqilateral triangle. The telephone arm will be at least 4 ft. below the transmission arm and standard in size.

The railway feeders will be run on standard 4-pin arms. Pins are of eucalyptus, insulators are of the Locke type, with porcelain petticoats and glass supports, designed for a working pressure of 60,000 volts. Lighting arresters will be used in the substations.

The passenger motor cars are to be combination smoking and baggage type, length over end panels 32 ft. 6 ins. and 41 ft. 6 in over vestibules, equipped with Van Dorn automatic couplers, Ham sand boxes, and Hale and Kilburn walkover seats. They are mounted on Brill "27E" trucks. There are also similar cars without compartment to operate both as motor and trail cars. The multiple unit system of control will be used, each motor car having four G. E.-66 motors mounted on its trucks, giving a rated capacity per car, on the hour basis, of 500 hp. The equipment will probably attain a maximum speed of 60 miles per hour with a 30-ton motor car hauling a 20-ton trailer. G. E. Type M control is to be used on the cars. There will also be two 4-motor G. E.-66 freight equipments in operation, capable of hauling a trailing load of 275 tons behind a 35-ton locomotive at twelve miles per hour. The passenger gear ratio is 1.55, and the freight, 3.95. Two of the motors of each freight equipment are connected permanently in series.

The schedule time and train service of the road has not yet been given out, but the speed capabilities of the equipment and favorable characteristics of the right of way, as regards alignment and grade, except between Saw Mill and Auburn, where 2 per cent grades and sharp curves abound, should ultimately cut down the running time to within an hour and a half under favorable circumstances and perhaps better it. Boston capital, principally, is backing the enterprise.

New Car-Ahead Ordinance

The car-ahead ordinance, which was passed several months ago by the New York Aldermen, was pronounced invalid the first time it was submitted to the test of judicial consideration. Now, another ordinance has been framed, and its advocates claim that the defects of the original law have been avoided. Here is the text of the measure which was adopted by the Board of Aldermen July 7:

Section 1. Every car owned, operated, managed or controlled by a street surface railroad company in the streets or highways of the City of New York, shall carry throughout its route, on the outside, in front and on top of each and every car so operated, a signboard or placard upon which shall appear conspicuously the destination of the said car. Every such company must carry for a single fare upon such car, without change therefrom, each and every passenger to any regular stopping place desired by him, upon said car's route, in the direction of the destination so designated; and for every violation of the ordinance there shall be recoverable against the company so offending a penalty of $100 in an action to be brought in the name of the City of New York.

Sec. 2. This ordinance shall not apply to a transfer made to a connecting line, going in a different direction from that in which such car may be going, nor where, by reason of any accident, compliance with the ordinance is rendered impossible.

Sec. 3. This ordinance shall take effect immediately.

Operating Electric Cars on Steam Roads

One of the most important legal decisions affecting the electric railway interests was handed down by Justice Haight in the litigation over the effort of the Hudson Valley Railway Company to operate its lines in conjunction with the Boston & Maine Railroad. The opinion of the Court of Appeals, which accompanies this decision and in which Judges Parker, Gray, O'Brien, Vann Cullen and Werner concur with Justice Haight, confirms absolutely the right of electric railroads to compel the steam railroads to make connections and interchange freight business with electric railroads. The case came before the Court of Appeals of New York for revision upon motion of the Stillwater & Mechanicville Street Railway Company, which is one of the lines controlled by the Hudson Valley Railway Company, to set aside the decision of the Appellate Division, which had reversed the findings of the commissioners adjudging that an intersection and connection of the electric line with the steam road should be made. The case was carried through the courts by Thomas O'Connor, of Waterford, and was argued in the Court of Appeals by ex-Senator Hill, for the Hudson Valley Railway Company. The text of this important opinion follows:

JUDGE HAIGHT'S OPINION.

This proceeding was instituted by the Stillwater & Mechanicville Street Railway Company to obtain an order permitting it to unite and connect the tracks of its railroad with those of the Boston & Maine Railroad Company, in order to facilitate the free interchanging of cars between the two roads.

The Stillwater & Mechanicville Street Railway Company was organized under the General Railroad law of this State, with the right to transport both passengers and freight, and is operated as an electric railroad by the trolley system.

The Boston & Maine Railroad is a foreign corporation, organized under the laws of Massachusetts, and is operating a steam railroad. It is contended upon its behalf that the statute does not authorize the court to compel a connection of the tracks of the two roads. The question, therefore, raised for our review is, as to the proper construction of the statute.

The Railroad Law of 1890 (chapter 565, section 12) provides as follows:

Every railroad corporation, whose road is or shall be intersected by any new railroad, shall unite with the corporation owning such new railroad in forming the necessary intersections and connections, and grant the requisite facilities therefor; and if the two corporations cannot agree upon the amount of compensation to be made therefor or upon the line or lines, grade or grades, points or manner of such intersections and connections, the same shall be ascertained and determined by commissioners, one of whom must be a practical civil engineer and surveyor, to be appointed by the court, as is provided in the condemnation law; and such commissioners may determine whether the crossing or crossings of any railroad before constructed shall be beneath, at, or above the existing grade of such railroad, and upon the route designated upon the map of the corporation seeking the crossing or otherwise. All railroad corporations whose roads are or shall hereafter be so crossed, intersected or joined, shall receive from each other and forward to their destination all goods, merchandise and other property intended for points on their respective roads, with the same dispatch as, and at a rate of freight, not exceeding the local tariff rate charged for similar goods, merchandise and other property received at and forwarded from the same point for individuals and other corporations.

It will be observed that this statute contains two provisions, one for the crossing of the tracks of another railroad at, above or beneath grade; and the other provides for the intersection of the tracks of such railroads, and upon the making of such connections the roads shall receive from each other and forward to their destination all goods, merchandise and other property intended for points on their respective lines.

The court below seems to have been of opinion that this statute had reference to steam railroads, and did not pertain to roads

operated by electricity. In determining this question it becomes necessary to examine more fully the Railroad Law for the purpose of ascertaining the legislative intent. By referring to section 2 of the act we find provisions for the incorporation of railroads which is to be accomplished by the execution of a certificate of fifteen or more persons which shall contain the name of the corporation, the number of years it is to continue and the kind of road to be built or operated. The section contains other provisions, among which is sub-division 11, which provides that "if a street surface railroad, the names and description of the streets, avenues and highways in which the road is to be constructed." It is thus apparent that the articles of incorporation provided for have reference to all kinds of railroads for public use, including steam railroads, street, surface and electric roads.

Again, passing to section 4, sub-division 5, of the act, we find that every railroad corporation, in addition to the power given by the general stock corporation law, shall have power "to cross, intersect, join or unite its railroad with any other railroad before constructed, at any point on its route and upon the ground of such other railroad corporation, with the necessary turnouts, sidings, switches and other conveniences in furtherance of the objects of its connection."

Section 34. Every railroad corporation shall start and run its cars for the transportation of passengers and property at regular times, to be fixed by public notice, and shall furnish sufficient accommodations for the transportation of all passengers and property which shall be offered for transportation at the place of starting, within a reasonable time previously thereto, and at the junctions of other railroads, and at the usual stopping places established for receiving and discharging way passengers and freight for that train; and shall take, transport and discharge such passengers and property at, from and to, such places, on due payment of the fare or freight legally authorized therefor.

Sec. 35. Every railroad corporation whose road, at or near the same place, connects with or is intersected by two or more railroads competing for its business, shall fairly and impartially afford to each of such connecting or intersecting roads equal terms of accommodation, privileges and facilities in the transportation of cars, passengers, baggage and freight over and upon its roads, and over and upon their roads and equal facilities in the interchange and use of passenger, baggage, freight and other cars required to accommodate the business of each road, and in furnishing passage tickets to passengers who may desire to make a continuous trip over any part of its roads and either of such connecting roads. The Board of Railroad Commissioners may, upon application of the corporation owning or operating either of the connecting or intersecting roads, and upon fourteen days' notice to the corporation owning or operating the other road, prescribe such regulations as will secure, in their judgment, the enjoyment of equal privileges, accommodations and facilities to such connecting or intersecting roads as may be acquired to accommodate the business of each road, and the terms and conditions upon which the same shall be afforded to each road. The decision of the commissioners shall be binding on the parties for two years, and the Supreme Court shall have power to compel the performance thereof by attachment, mandamus, or otherwise.

It will be observed that each of these provisions of the statute, to which reference has been made, expressly refers to every railroad corporation, and thereby includes every railroad incorporated under the provisions of section 2 of the act.

The contention is now made that to compel a track connection of steam railroads by electric or street surface railroads for the interchanging of traffic, would be a burden and a hardship to steam railroads that was not contemplated when the statute was passed; that to permit connections with steam railroads by the large number of electric railroads which have been, or are being constructed, would result in confusion to the steam railroads and make their operation difficult.

The learned Appellate Division appears to have been impressed with this argument, for it states in its opinion that the proceeding and purpose is new, and obviously opens a field of inquiry of the greatest importance, not alone to railroad corporations, but to the general public, which has an interest in the streets and highways of towns, villages and cities of the State; that if the street surface railways are to be recognized as an integral part of the great system of steam railroads, that the purpose should be made clear by the Legislature. Travelers and the shippers of merchandise and freight have the right to make use of all the facilities provided for in the articles of incorporation, and the provisions of the statute pertaining thereto, in the conduct of their business. This, we think, is made clear by the provisions of the statute which requires that all railroad corporations whose roads are, or shall be intersected, shall receive from each other and forward to their destination all goods, mechandise and other property intended for points on their respective roads, with the same dispatch and at the rate of freight not exceeding the local tariff rate, etc. Bearing this purpose in mind, we pass to a consideration of the meaning of the law. As we have seen, by the statute authorizing the incorporation of railroads, the Legislature contemplated making provisions for all kinds of railroads, street surface, as well as steam railroads. By section 4, sub-division 7, all roads organized under the provisions of the act were empowered "to take and convey persons and property on its railroad by the power or force of steam, or animals, or by any mechanical power." It is true that the statute contains numerous provisions which apply alone to steam railroads, and other provisions which apply alone to electric or street surface roads; but in most of these provisions there is specific reference either to steam or street surface roads. The great body of the statute was intended to apply to all railroads incorporated under its provisions, especially so far as those provisions were applicable. The revision of the Railroad Law of 1850 is of recent date and after the street surface railroads in our cities and villages had become very numerous. The Legislature in undertaking a revision of the railroad laws attempted so far as possible to establish a complete system under which all kinds of railroads could be operated and the public interests subserved. In construing these statutes it does not become us to shut our eyes to the purposes sought to be accomplished, or the discoveries that have been made and the improvements accomplished in the transportations of the country in recent years. The great steam roads have extended across the continent from ocean to ocean, and from the far North down to the tropics. These roads have become great arteries over which is transported the greater part of the commerce of the continent. It has not been considered profitable or practical for steam roads to be constructed to every village, hamlet or productive district in the country. This, however, is rapidly being accomplished by the numerous electric roads that are in process of construction, or are contemplated. By their means the farmer, the mill owner and the merchandise vendor in distant places may be able to reach the steam railroads, and through them the great markets of our cities, with their merchandise and products, and in this way one road may become a feeder and distributor of the other.

If one electric road were seeking a connection with another road operated by the same power, it would hardly be claimed that the provisions of section 12 did not apply. It is practically conceded that electric roads may be united with other roads of the same character and operated by the same power. But the statute has not limited the courts to the requiring of intersections and connections between roads of the same character. Very likely electric roads tendering cars to steam roads for transportation should only offer those properly equipped with brakes and couplers, so that they may be taken and transported readily and safely. It may be that additional regulations will become necessary in order that equal privileges, accommodations and facilities may be afforded in connecting and intersecting roads, but all this may be controlled by the Board of Railroad Commissioners, who, under the provisions of section 35, to which we have referred, is given full authority in the premises.

It is said that the rights of the public in the streets and highways of our cities, towns and villages should be protected, and that cars loaded with merchandise and freight should not be permitted to be run over street surface railroads. It may be that additional regulations should be provided either by statute or by ordinance, limiting the time in which cars of this character should be permitted to run over street-surface railroads, especially in cities and large villages; but that the power exists to run such cars is no longer an open question in this court.

This question was elaborately considered in the case of De Graw vs. Long Island Electric Railway Company (43 App. Div., 502), which case was affirmed in this court on the opinion below (163 N. Y., 597).

Again, bearing in mind the legislative purpose, its intent, to our minds, appears reasonably clear, in the use made of the provision to cross, intersect, join or unite its railroad with any other railroad. The word "cross" is used in connection with the word "connect," and the Legislature could hardly have intended that one word should mean one kind of a railroad, and the other another kind. One of the most important rights which the Legislature undertook to provide for and to protect was that of the right of one railroad to cross the tracks of another which had previously been constructed. Were it not for this, one road running north and south through the State could absolutely prevent the constructing of another extending east and west. The Legislature was careful to make ample provision for crossings in the same section in which intersections were provided for, and these provisions, with reference to crossings, have been held to apply to electric and street surface roads crossing steam roads, or of steam roads crossing electric or street-surface roads. (Buffalo, B. & L. R. R. Co. vs. N. Y., L. E. & W. R. R. Co., 72 Hun, 583; Port Richmond & P. P. El. R. R. Co. vs. Staten Island R. T. R. R. Co., 71 Hun, 179; affd., 144 N. Y., 445.)

It appears to us that the Legislature has clearly empowered the court to order connections such as is sought by the petitioner in these proceedings. The order of the Appellate Division should, therefore, be reversed, and that of the special term affirmed with costs.

The Bill Providing for the Purchase of Street Railway Bonds by Massachusetts Savings Banks

As the contents of the bill passed by the Massachusetts Legislature authorizing savings banks to invest in street railway bonds, which becomes operative on July 16, is of general interest, the text is herewith presented:

Sec. 1.—In addition to the investments authorized by section 26 of chapter 113 of the Revised Laws, savings banks and institutions for savings may invest their deposits and the income derived therefrom in the bonds, approved by the Board of Commissioners of Savings Banks, as hereinafter provided for, of any street railway company incorporated in this commonwealth, the railway of which is situated wholly or partly therein, and which has earned and paid annually for the five years last preceding the certification of the Board of Railroad Commissioners, hereinafter provided for, dividends of not less than 5 per centum per annum upon all of its outstanding capital stock. In any case where two or more companies have been consolidated by purchase or otherwise during the five years prior to the certification hereinbefore named the payment severally from the earnings of each year of dividends equivalent in the aggregate to a dividend of 5 per centum upon the aggregate capital stocks of several companies during the years preceding such consolidation shall be sufficient for the purpose of this act. Dividends paid to the stockholders of the West End Street Railway by way of rental shall be deemed to have been earned and paid by said West End.

Sec. 2.—The Board of Railroad Commissioners shall on or before the fifteenth day of January of each year transmit to the Board of Savings Bank Commissioners a list of all street railway companies that appear from the returns made by these companies to have properly paid the dividends required by the preceding section without impairment of assets of capital stock.

Sec. 3.—The Board of Savings Bank Commissioners shall as soon as may be after the receipt of the lists provided for in the preceding section, prepare a list of such bonds issued by any street railway company certified by the Board of Railroad Commissioners in accordance with the provisions of the preceding section as the Board of Savings Bank Commissioners shall deem good and safe securities for the investments of savings banks and institutions for savings. Such lists shall at all times be kept open to the inspection of the public.

Waltham Locations Granted

The closing scene in one of the most active and protracted street railway contests ever held in Massachusetts was enacted on July 2, when the Waltham Street Railway Company and the city government of Waltham petitioned for approval of a grant of location, the former's petition also including the Newton Street Railway Company. The matter was first brought up two years ago. While there is every reason to believe that the company has paved a way to the building of its line through Waltham, there still remains the securing of location in Newton. The Waltham contest is said to be but a sham battle in comparison with the task ahead of the company in Newton.

The hearing was before the Railroad Commissioners, under the new law requiring the board to approve all locations. At the outset an interesting question arose. The Waltham aldermen petitioned for the approval as well as the street railway company, and it was a problem whether the board should ignore the application of the company. City Solicitor Harvey argued in the negative, while L. E. Chamberlain and H. S. Milton took the opposite ground, as did William H. Coolidge, counsel for the Newton company. Finally the Waltham company withdrew its petition, and as there was no remonstrance the hearing closed.

The petition of the Waltham Street Railway Company to cross the tracks of the Fitchburg division of the Boston & Maine Railroad, at Roberts's Station, was postponed to September 23 at the request of the interested parties.

New England Street Railway Club Outing

The New England Street Railway Club held an out-door meeting, at Whalom Park, Fitchburg, Mass., on July 1, which was attended by 115 members. A special train left the North Station, Boston, at 9:30 a. m., and also a special car of the Worcester Consolidated Street Railway Company left Union Station, Fitchburg, at 9:30 a. m., running direct to the park for the benefit of members from the western and southern parts of the State, Connecticut and Rhode Island. Every attraction at Whalom Park was placed at the disposal of the club through the kindness of Superintendent W. W. Sargent, and the directors of the Fitchburg & Leominster Street Railway Company.

On arrival at the park, which was described in detail in the STREET RAILWAY JOURNAL of Feb. 1, 1902, the members engaged in boating, swimming, races, bowling, billiards, pool and other games and pastimes. Dinner was served at the park, at which Mr. Dan. L. Prendergast, real estate agent of the Boston Elevated Railway Company, presided as toastmaster. Speeches were made by Hon. Mr. O'Connell, of Fitchburg; Marcus A. Coolidge, of Fitchburg; Mr. Ogden, of the Concord, Maynard & Hudson; Frank Ridlon, of Boston, and others. In the afternoon the company attended a performance of the "Black Hussar" at the Whalom Park Theater, and after a vote of thanks to Superintendent Sargent and Mr. Kirby, for courtesies extended the club, left for home about 8:40 p. m., with a most enjoyable time in its remembrance. This is the last club meeting before fall, when the regular meetings will be resumed.

New York Street Railway Men Enjoy Themselves

The fifth annual outing of the employees of the Broadway, Columbus Avenue, Lexington Avenue, Sixth Avenue, Seventh Avenue and Lenox Avenue divisions of the Metropolitan Street Railway Company, of New York, was held on July 5 at Donnelly's Grove, College Point, Long Island. About 700 motormen, conductors and officials of the several divisions, arrayed in white trousers, neglige shirts of white and black, and white caps with black peak, assembled about 8:45 p. m., and, escorted by a band of twenty-five pieces and the Metropolitan Street Railway Drum and Fife Corps, which is composed of employees of the company, made their way to the steamer "Sylvester," at the foot of Fiftieth Street, New York, which was in waiting to convey the party to College Point.

When the party landed at College Point an excellent lunch was served. A special table was set aside for guests and the committee in charge of the affair, and at the head of this table was seated Mr. Oren Root, Jr., assistant general manager of the company, who presided over the feast. Three hearty cheers were given for Mr. Root after the men had finished their repast. Other officials were also cheered by the men.

A good athletic programme had been arranged for the afternoon, and excepting a heavy shower, which came up when the sport was at its height, there was nothing to mar the afternoon's fun. The programme comprised a 100-yard dash, a 100 yard "dash" for men weighing over 225 lbs., a shoe race, a one-half-mile run, a sack race, a 100-yard consolation dash, and two ball games. The prizes in the ball games were $10 gold pieces to the winners, and in each of the other events, the shoe race, the sack race and the 100-yard consolation race excepted, two prizes—gold medals for the winners and siver medals for the second men—were awarded. One prize in each event was offered in the shoe race, the sack race and the 100-yard consolation race. The rivalry between the several divisions was most keen, and the winner of each event was applauded vociferously by his division associates.

The 100-dash, open to all, was won by a man of the Broadway division, a Lexington Avenue man being second. The 100-yard dash for fat men, in which each contestant weighed over 225 lbs., was won by a Lexington Avenue man, a member of the Broadway division being second. The shoe race went to Sixth Avenue. In the one-half mile run, the contestants started off at a lively clip, and but three men finished, although a dozen or more started. The honors for this event went to a Broadway man, while a Sixth Avenue man took second prize. When this event was finished shelter from the rain was sought at the hotel, but when the rain ceased the programme was concluded. The sack race was won by a Sixth Avenue man, as was also the 100-yard consolation race. The finish of this event was the most exciting of the day. The ball games, which concluded the athletic programme, were between two scrub teams, each member of which weighed over 200 lbs., Lexington Avenue vs. Broadway. Interest centered in the game between the Lexington Avenue and Broadway divisions, and considering the slippery condition of the field the game was a most creditable one. It was won by the Lexington Avenue men, whose pitcher, considering the conditions under which he labored, had most excellent control of the ball. Dinner was served after the ball game, and the men returned to New York.

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Among the prominent officials of the company present were: Oren Root, Jr., assistant general manager; J. J. Cahill, superintendent of the Broadway, Sixth Avenue and Seventh Avenue divisions, and president of the various divisions of the outing; A. Snydstrip, superintendent of the Lexington Avenue division; J. N. Nelson, chief clerk.

Topics of the Week

Several attempts have been made lately to wreck electric trains on the Brooklyn system, but fortunately none of them succeeded. Last week a man was discovered in the act of placing obstructions upon the track before a six-car train crowded with excursionists. Fortunately disaster was averted. The man was captured, and it was learned that he was insane.

Rate wars between competing steam and electric railways are now common occurrences, but when competing electric railways begin to sacrifice rates in order to secure traffic more than passing attention is attracted to "the war." Two lines between Jackson and Grass Lake, Mich., twenty miles distant, are engaged in a fierce struggle of this kind, and as a result the residents of the territory through which the lines pass are enjoying a twenty-mile ride for 5 cents.

The Fire Department of New York has had its first experience in fighting fire upon the elevated structure of the Manhattan Railway system while current was carried on the third rail. More than usual care was exercised, but there was no delay in reaching the flames. The fire was not due to any electrical cause, and the men suffered no injury or inconvenience on account of the presence of the third rail.

For New York and such other cities as have in contemplation the passage of an ordinance to prohibit passengers standing between the seats of a street car there is a lesson in a court decision handed down a few days ago at Fall River, Mass. It would seem that persons with ideas as to how a street railway ought to be run succeeded in having passed an ordinance to the effect that passengers could not stand between the car seats. Some one who had to stand brought the case before the court, and the judge before whom the case was heard ruled that any such ordinance was unconstitutional.

Comptroller Grout is making lots of trouble for the Rapid Transit Commission and the contractors engaged upon the subway work. Although the board passed a resolution recognizing the ducts for the carrying of the electric feeders in the Manhattan subway as part of the construction work, the Comptroller refused to pay the contractor for his work until the courts have passed upon the question. The issue involves $1,500,000. If the ducts are held to be construction work, the city will have to advance the cost, but in case they are adjudged to be part of the equipment of the road the contractor will have to bear the outlay.

Judge Grosscup, in the United States Circuit Court, at Chicago, last week heard arguments upon the Peoria electrolysis case, and has taken the matter under advisement. This action was begun four years ago, and the hearing in Chicago was upon the report of the special motion in chancery. The defendants in the case before Judge Grosscup are the Central and the Peoria & Prospect Heights Railway Companies, of Peoria. The water works company of Peoria is seeking an injunction to restrain the traction companies from using the single overhead trolley wire along their lines, upon the ground that the returning electric current escapes to the complainant's piping system and causes injury to the mains.

Every new industry produces a new crop of experts, who pose as authorities until practical experience develops some actual data to form a groundwork, and then the pioneers are relegated to obscurity, if they have not found some new field in which to exercise their peculiar talents. In the case of the oil fuel industry of Texas it seems that the breed has been unusually prolific, and, as might be expected, the general run is of even a lower order than the average. A prominent engineer, who had occasion to investigate the claims of Texas oil boomers, said: "My experience has been that most of the men in Texas who claim to know all about combustion, the instaliation and operation of power plants, and the best method of handling crude oil, ought to be shoveling coal, rather than installing oil burners."

The Brooklyn Rapid Transit Company officials have been haled before the Health Department for violation of the smoke ordinance, and have admitted the charges preferred against them, setting up the plea, however, that they "couldn't help it." The Manhattan Company, which made the same excuse until the District Attorney took a hand in the proceedings, is now burning hard coal, and it has promised not to violate the ordinance in the future. The smoke nuisance in Brooklyn is as bad as that which aroused New York several weeks ago, and the Health Department is daily receiving numerous complaints from the people along the lines upon which the soft coal is burned. The city power plants, which were also violating the ordinance, have been put on the list, and the Mayor has called the officials in charge of this department sharply to account. Naturally, while the city plants offend private interests cannot be compelled to comply with the law.

Readers of the STREET RAILWAY JOURNAL will recall the discussion in these columns of the practicability of introducing a breakfast service upon suburban lines, as proposed by a Chicago real estate boomer, who had city lots for sale on the outskirts of Cook County. Now a New York commuter asks the Sun: "Why wouldn't dining cars, that is to say, breakfast cars, be a good thing on the 'L' roads?" and adds: "If a man knew that he could get a seat and a breakfast for a fair sum on his way to work, he would be pretty sure to stop crowding himself at home for time and gulping down his breakfast, and take it leisurely on the train. It would not be necessary to have tables and ordinary seats, a lunch counter and stools being sufficient, besides affording accommodations for more people.' It may be that there is a real demand, after all, for some such service, and the Chicago hustler's proposition was the result of observation and experience. Will some one give it a trial?

It looks now as if the Jim Crow laws recently enacted in Southern States would give the street railway companies trouble, and their enforcement may lead to more serious disturbances than mere controversial argument. In Louisiana, where the new law goes into effect October 1, the negroes are organizing to fight the enforcement of its provisions in the courts, and it is claimed that enough money has already been subscribed to defray the expenses of carrying the case through the Federal courts, if necessary. The law requires the separation of whites and blacks. The street railroad companies may operate separate cars for white and blacks, or separate them in the same car by a wire partition. A colored girl carrying a white child is permitted to enter the white section of the car. It is upon this point that the test case will hinge. Two negro girls, one of them carrying a white child, will board a car together and take seats in the compartments set aside for whites. Under the law the conductor will then be compelled to order the girl unaccompanied by a white child to go to the negro section of the car. Upon her refusal to do so she will be ejected from the car or arrested and locked up for breach of the peace. The question, therefore, that will go before the court is whether a white baby accompanying a negro girl can secure for that girl privileges which have been refused to her companion, also a nurse girl, but not having a white child, and therefore, whether the Wilson law is not class legislation, granting unequal privileges.

There still seems to be considerable doubt as to the attitude of the New York Aldermen toward the Pennsylvania tunnel franchise. The contract between the City of New York and the Pennsylvania Railroad Company for the construction of a tunnel under the North River has been presented to the Board of Aldermen and referred, unread, to the committee on railroads, which in turn fixed Friday, July 11, as the time for the first public hearing on the question. It is not probable that the board will act on the franchise before the summer vacation. There is to be a meeting next Tuesday, but a report from the committee is not expected at that time. It was claimed by friends of the measure that if no vote is taken prior to adjournment the Mayor will soon gain full and final control of it, under the provision of the charter which limits the authority of the aldermen in such cases to a period of six weeks after favorable action by the Board of Estimate and Apportionment, but the aldermen contend that the contract must be advertised in the City Record before the board acts, and that the charter provision requiring the Board of Aldermen to act within six weeks on all public business where the Board of Estimate has joint power was not incorporated in the special act of the Legislature under which this franchise is to be granted. Under the circumstances it is not to be expected that the aldermen will act hastily in this matter. However, it is still hoped that public opinion will finally secure from the aldermen favorable action on this proposed improvement.

Bids for Constructing a Tunnel in Philadelphia

It is the expectation of the Philadelphia Rapid Transit Company to be in a position to advertise for bids for the construction of the Market Street subway, between Broad Street and Twenty-Third Street, within the next sixty days.

Turbo-Generators for Subway Plant

Contracts have been given by the Rapid Transit Subway Construction Company, of New York, for three Westinghouse turbo-generators, to be installed in the main power station at Fifty-Eighth Street and Ninth Avenue. The sets will consist of steam turbines of the Westinghouse type, directly connected to 1250-kw Westinghouse alternators. This equipment will be used for lighting purposes only, and will supply the power for illuminating both the tunnel itself and the stations and stairways.

A Large Brake Order

The United States Steel Company, of Boston, has closed a contract for supplying 170 brake equipments to the North Jersey Street Railway Company, and the Jersey City, Hoboken & Paterson Street Railway Company. The brakes are of the improved "Neal Duplex" type, made by the United States Steel Company, and are the same kind that are being tried on a large number of roads throughout the country. The closing of the 170-equipment order was the result of a several months' test, made under the severest conditions on the Jersey roads.

New Transfer System at Providence

The Union Traction Company, of Providence, R. I., is perfecting a new transfer system, which it expects to be able to put into effect very soon. Like the spokes of a wheel from a hub the street railway lines of Providence project from the City Hall in various directions, and the city, irregularly formed, presents difficulties that make the selection of a system that will be beneficial to the city and prevent abuse of the privilege by patrons a difficult task. A careful study of the transfer system as operated in many of the large cities has been made by the officials of the company, and they feel confident that the system, as finally evolved by them, will meet the demands of the most exacting.

Americans Secure Electric Railway Franchise at Havana

Park & Hamilton, of Youngstown, Ohio, have secured all required franchises for an electric railway in Havana, Cuba. Some time ago this syndicate received a grant for a line from the city limits of Havana to a pleasure resort six miles from the city. They at once commenced construction work, and by demonstrating that they meant business they have been enabled to secure a more important grant into the center of the city. Mr. Hamilton states that the franchise will permit the building of a line through the city, starting at the steamer landings, also for a loop which will traverse other parts of the city. The intention is to begin construction work at once. Associated with Park & Hamilton are Devitt, Trimble & Co., of Chicago; G. F. Penhale & Co., of New York; W. H. Whipple, of New York; W. H. McDonald & Co., of Chicago, and W. J. Hayes & Sons, of Cleveland.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JUNE 24, 1902

702,938. Trolley for Electric Railways; F. W. Garrett, Johnstown, Pa. App. filed Sept. 10, 1901. An expanding bushing takes up wear.

702,981. Control of Electric Motors; F. A. Merrick and E. W. Stull, Johnstown, Pa. App. filed Sept. 10, 1901. The object is to dispense with master controllers and pilot motors and to control the train by manually operated controllers on the platforms. The motors are connected to a number of train wires, and one or both controllers on each car is connected to each wire, the corresponding contacts of the several controllers being connected to different wires.

702,986. Electric Third Rail; P. E. McIntosh, New York, N. Y. App. filed Dec. 22, 1900. An improved chair for third rails.

703,022. Circuit Controller; E. W. Vogel, Chicago, Ill. App. filed July 23, 1901. A pivoted lever arranged above the sagging portion of the trolley wire is moved to close a circuit when the wire is lifted by the passing trolley.

703,037. Street Railway Switch; W. J. Bell, Los Angeles, Cal. App. filed March 25, 1902. Yielding devices which ordinarily permit the car wheel to move the switch point, are made rigid when desired by closing a circuit through a magnet to carry the car onto a branch.

703,040. Car Fender; W. Bonham, Philadelphia, Pa. App. filed Nov. 8, 1900. Details.

703,106. Brake Operating Device; M. O. Wicks, Babylon, N. Y. App. filed Sept. 24, 1901. The pawl which holds the brake staff is beneath the platform and controlled by a push-pin, passing through the floor.

703,108. Car Truck; W. S. G. Baker, Baltimore, Md. App. filed Jan. 16, 1902. The side frames of a center-bearing truck are formed with axle box pedestals and provided with springs for the boxes below the same; the lookout beams are secured to the body and extend over the axle boxes to the rear thereof and terminate close to the car bolster.

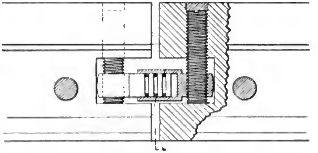
703,112. Sand Box; J. L. Chedell, Providence, and E. V. Scott, Arlington, R. I. App. filed Oct. 21, 1901. Inclined rods which extend upward through the sand box, are flexibly connected with a sliding bottom so that when the latter is moved the rods will stir up the sand.

703,117. Car Truck Bolster; D. C. Courtney, Elkins, W. Va. App. filed June 4, 1901. Details.

703,143. Plate Metal Car Wheel; H. F. Mann, Allegheny, Pa. App. filed April 19, 1902. One-fourth of the thickness of the plate metal is composed of high carbon steel, while the remainder is of low carbon steel, and the wheel is so shaped as to bring the high carbon portion into the tread and flange.

703,148. Roller Side Bearing for Railway Cars; S. W. McMunn and E. S. Woods, Chicago, Ill. App. filed Nov. 4, 1901. The roller trunnions travel in groves in the casting.

703,274. Rail Bond; J. E. Jones, Hazleton, Pa. App. filed May 1, 1902. The webs of the rail ends are cut away to form a chamber for the bond, which is attached by means of screws and is covered by the fish plates.



PATENT NO. 703,274

703,297. Auxiliary Trolley Contact and Sleet and Ice Cutting Device; W. H. Oliphant, Mount Holly, N. J. App. filed Sept. 13, 1901. Two wheels supported on a single pole run in tandem, their treads being formed to remove the ice.

703,311. Street Railway Switch; G. Shoemaker, Philadelphia, Pa. App. filed Nov. 15, 1901. The switch tongue is a wide plate having the proper grooves and flanges, and it slides under overhanging plates on each side, which protect it.

703,337. Car Mover; J. W. Dear, Dayton, Ohio. App. filed March 15, 1902. A prying lever is pivoted to a frame which also carries a wedge adapted to close up against the wheel after it is moved with the lever, to prevent its return.

703,361. Third Rail System or Magnetic Electric Railway; W. H. Wright, Buffalo, N. Y. App. filed Aug. 19, 1901. Pivoted levers in a conduit are moved by the attraction of a magnet on the car to close the circuit between a bare conductor and a third rail.

UNITED STATES PATENTS ISSUED JULY 1, 1902

703,379. Car Bolster; H. C. Buhoup, Chicago, Ill. App. filed March 14, 1902. The body bolster carries a projecting central knob which enters a socket in the truck bolster.

703,476. Overhead Trolley; G. H. Russell, Pittsfield, Mass. App. filed Jan. 27, 1902. The wheel bearings are in sliding blocks, which enter the harp and are secured therein by spring latches.

703,503. Bolster Guide Block; N. H. Tunks, Toledo, Ohio. App. filed Oct. 24, 1901. A movable guide for a truck bolster provided with flanges to embrace the edges of a guide bar; and also having means for uniting the same to the end of a bolster in such a manner that the said guide can move relative to the bolster.

703,536. Street Car Fender; E. F. Cannon, Chicago, Ill. App. filed Sept. 21, 1901. Details.

703,561. Automatic Switch; H. H. Doll and M. H. Bostian, Camden, N. J. App. filed March 27, 1901. A projection can be thrown downward from the car to operate a switch ahead through mechanical connections.

703,563. Guard for Third Rail Systems; J. Elliott, Boston, Mass. App. filed April 3, 1902. Two guards rest upon the foot flange on each side of the rail and are held in an upright position by bolts passing through the web of the rail.

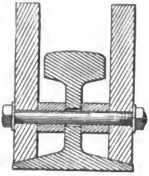
703,565. Car Wheel; G. B. Farrell, Wilkesbarre, Pa. App. filed Jan. 20, 1902. A wheel comprising a rim having integral spokes and a hub having sockets to receive the spokes, the sockets being box-like arms projecting from the hub.

703,589. Trolley for Electric Cars; C. J. Johnson and C. W. Benedict, St. Louis, Mo. App. filed Sept. 23, 1901. An attachment for dropping the pole when it rises above the overhead wire.

703,609. Car Bolsters; G. P. Ritters, Chicago, Ill. App. filed April 24, 1902. In this invention the strut and end sections of a trussed bolster are combined with interposed spanners for the support of the car sills, whereby the tension members are relieved of the direct load, which is thus divided up between the strut and the compression members of the structure.

703,700. Trolley Wheel; W. F. Hall, Boston, Mass. App. filed April 29, 1902. The tread and side flanges are held in place on a sleeve by spring rings which enter grooves in the end of the sleeve.

703,701. Trolley Wheel; W. F. Hall, Boston, Mass. App. filed April 30, 1902. A modification of the preceding patent.



PATENT NO 703,563

703,782. Trolley Fork; E. L. Gentis, Newport News, Va. App. filed Feb. 21, 1902. Provision is made for allowing the bearings to tip laterally.

703,786. Apparatus for Preventing Trolley Wheels from Leaving the Feed Wire; G. W. Hammond, Philadelphia, Pa. App. filed March 3, 1902. The jaws which prevent the wheel from leaving the wire are designed to easily pass a cross wire.

703,818. Car Brake; J. Plattenburg, McKeesport, Pa. App. filed Feb. 21, 1902. A center rail having inclined surfaces is adapted to be engaged by a shoe carried by the car and having corresponding inclined surfaces. The purpose is to provide an emergency brake.

703,921. Trolley Pole; J. D. Hickman, Anderson, Ind. App. filed Oct. 11, 1901. The trolley harp is pivoted to the upper end of the pole and can be tilted downward to release the wheel from the wire without lowering the pole itself.

PERSONAL MENTION

MR. B. H. RANNELS, general manager of the Dayton & Kenton Traction Company, has resigned his position with that company, but has not announced his plans for the future.

MR. A. E. WALDEN, formerly superintendent of the Blackstone Electric Light Company, of Blackstone, Mass., has accepted the position of general manager of the Mobile Light & Railroad Company, of Mobile, Ala.

MR. THOMAS L. HACKETT has been appointed soliciting freight and passenger agent of the Grand Rapids, Grand Haven & Muskegon Railway Company, with headquarters at Grand Rapids, Mich. Mr. Hackett assumed his new duties on July 1.

COLONEL ALLAN C. BAKEWELL, second vice-president and general manager of the Sprague Electric Company, was recently elected Department Commander at the New York State Encampment of the G. A. R., held at Saratoga Springs. There was a strong opposition ticket in the field, but Colonel Bakewell, in recognition of his services in both the State and national work of the organization, was elected by a handsome majority.

MR. GEORGE B. FRANCIS recently read an interesting paper before the Boston Society of Civil Engineers, on "Light Mountain Railways," which has since been published in the journal of the Association of Engineering Societies. The paper contains a very complete index to the literature on this subject as well as much data regarding the gage and weight of rail on roads in operation.

MR. W. H. WILLIAMS, who has been superintendent and electrical engineer of the Eads Bridge Electric Road, of St. Louis, for thirteen years, has resigned from the company, his resignation to take effect in August. General Manager J. Bramlette will take charge of the bridge line as soon as the cars run over the road, and manage it in connection with other East Side electric railways, of East St. Louis.

MR. G. W. EDWARDS has been appointed superintendent of the elevated division of the Brooklyn Rapid Transit Company, vice Mr. B. W. Folger resigned. Mr. Edwards has served the road well for many years, and enjoys the respect and friendship of his men as well as the confidence of his superiors. His promotion to his present position has thus been most satisfactory to all concerned. Mr. Edwards will be assisted in his general work by Mr. F. L. Morse, while Mr. E. F. Rives will be in charge particularly of the Bridge Division. Mr. Rives combines with these duties the management of the surface cars on the bridge, as was recently mentioned in this column. Mr. Morse takes the place of Mr. Reginald Fay, who resigned with Mr. Folger.

MR. EDWARD H. JENKINS, the president of the Southwestern Gas, Electric & Street Railway Association, and late president of the San Antonio Gas & Electric Company, and San Antonio Traction Company, of San Antonio, Tex., died a few days ago. Mr. Jenkins, in promoting the interests of the association, in harmonizing and reconciling the business to the necessities and demands of the public, won for himself the cordial support and sympathy of all with whom he came in contact. He was recognized as possessing exceptional executive talent, and his thoughtful consideration of the necessities of the employees of the companies under his management and his careful attention to matters involving their comfort, welfare and happiness won for him their lasting affection.

MR. A. C. RALPH, superintendent of the Marlboro Street Railway Company, of Marlboro, Mass., has been selected as superintendent of the Boston & Worcester Street Railway, now building between Boston and Worcester, and will assume his duties with that company when its lines are completed. Both the Marlboro Street Railway and the Boston & Worcester Railway are controlled by the same interests, and the selection of Mr. Ralph as superintendent of so important a road as the Boston & Worcester Railway is a testimonial of his fitness to deal with the most important questions to be solved in electric railroading. Mr. Ralph was born in Warren, Vt., and entered the street railway field about fourteen years ago, becoming connected with the West End Street Railway, of Boston. Mr. Ralph later became connected with the Thomson-Houston Company, and passed several years in the South while in the employ of this company, working in Nashville and Atlanta. Mr. Ralph then went to Paterson, N. J., and from there he went to Bridgewater, Mass., where he assumed the supervision of five roads under construction by J. F. Shaw & Co.

MR. HOWARD P. QUICK, member of the American Society of Mechanical Engineers and for thirteen years chief draughtsman and mechanical engineer for the West End Company and the Boston Elevated Railway Company, of Boston, has entered the employ of Ford, Bacon & Davis, of New York, and will be connected with their Kansas City office, in the design of the new power house construction for the Metropolitan Street Railway Company of that city. Mr. Quick's ability and designs are represented in Boston by most of the surface railway power stations, overhead construction and car houses. The design of the late "West End" power stations, in Boston, has crystallized into a standard station layout, with provision for expansion along regular lines, largely resulting from Mr. Quick's work in collaboration with Mr. C. F. Baker, superintendent of motive power and machinery. Mr. Quick is a member of the Boston Society of Arts, the New England Railroad Club and the University Club, and although he is only thirty-six years of age he already has executed important works, investigations and designs which required extensive traveling in this country and Canada. A few years ago he compiled data and made designs for an arch suspension bridge for Boston harbor, accompanying his report with photographs and drawings of all the important bridges in the world. He has also collected descriptions and views of all kinds of railway equipment. Prior to his connection with the Boston Elevated Railway Company he worked with Mr. Howard A. Carson, the present chief engineer of the Boston Transit Commission, for the Metropolitan Sewer Commission.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR

Testimony of Physicians as to Declarations by Patients

The New York Code of Civil Procedure provides (Sec. 834) that "A person, duly authorized to practice physic or surgery, shall not be allowed to disclose any information which he acquired in attending a patient, in a professional capacity, and which was necessary to enable him to act in that capacity." Such statute may be taken as substantially typical of the law throughout the Union. Each State has some provision rendering communications made by a patient to his physician privileged from disclosure against the patient in an action to which he is a party. The particular limitations of the application of such principle will depend upon the terms of the statute in force in any State.

Interpreting and applying the New York statute, the New York Court of Appeals has recently, in the case of Griffiths vs. Metropolitan St. Ry. Co. (171 N. Y., 106), held that the testimony of a person, who was a physician, as to declarations made by a plaintiff in an action for personal injuries ought to have been admitted, and was improperly excluded. It appeared that the witness was at the scene of an accident when the ambulance arrived and rendered first aid to the plaintiff, who had been seriously injured. He rode with plaintiff in the ambulance part of the way to the hospital, at which he was an attending physician; but had no other relations with the plaintiff until ten days thereafter, when he called upon plaintiff, at the instance of the defendant, and had a conversation with him about the details of the accident. This, he testified, was distinct from any treatment as a physician. In rendering the decision the Court of Appeals emphasizes the principle that where the testimony of a physician is sought to be excluded, the burden is upon the objecting party to bring the case within the terms of the law quoted: "He must make it appear not only that the information which he seeks to exclude was acquired by the witness while attending him in a professional capacity, but also that it was necessary to enable him to perform some professional act."

In another case decided on the same day (Green vs. Metropolitan St. Ry. Co., 171 N. Y., 201), the same court went further in strict construction of a physician's disqualification. It appeared that the witness was the physician in charge of the ambulance that responded to a call, and conveyed plaintiff to a hospital after his injury. The witness stated that the hospital rules required him to ask questions to find out how an accident occurred, and further "distinctly asserted that whatever information he aquired from the patient was in reference to his condition, and for the purpose of prescribing for him." The Court of Appeals, nevertheless, held that the physician should have been permitted to disclose what, if anything, the plaintiff had said as to how the accident happened. It is remarked in the prevailing opinion: "We may, readily, admit that Dr. M. acquired the information, which the question called for, while attending the plaintiff in a professional capacity, and, still, we would be far from the point of the legislative purpose in enacting the section of the code. That was, that the information should be of a character necessary to enable Dr. M., or the hospital staff, to act professionally upon the case."

The decision of the Court of Appeals in the Green case was made by a bare majority of the court, three of its members dissenting, and in both the Griffiths case and the Green case the judgment of the courts below, holding that the doctor's testimony was not admissible, was reversed. These decisions would seem to represent a modification of the policy on the subject which has heretofore prevailed in the New York courts. (Edington vs. Mut. Life Ins. Co., 67 N. Y., 185-194; Grattan vs. Met. Life Ins. Co., 80 N. Y., 281, 297; Feeney vs. L. I. R. R. Co., 116 N. Y., 375, 381.) In that State the present attitude is one of great liberality towards the introduction of testimony of physicians as to information derived from—including declarations made by—their patients. It is of very considerable advantage to street railway companies to have such testimony presumably admissible instead of presumably incompetent, so that they may prove a plaintiff's declarations against him unless it clearly and affirmatively appears that the information derived by the physician was necessary for professional treatment.

It will not do, however, to rely upon these recent New York decisions in litigations in other jurisdictions. As before pointed out the extent of the disqualification in any forum will depend upon the phraseology of the local statute. Moreover, even if the words of a statute are the same, or substantially the same, as that of New York, a different policy of interpretation may be adopted by the courts, as indeed was entertained by the Appellate Division of the New York Supreme Court in the Griffiths case and the Green case. The obtaining of information as to how an injury occurred is often an important factor for rendering medical assistance, especially first aid to the injured. The previous history of the patient, including how he received injuries that may or may not have caused abnormal conditions found to exist, is of greatest consequence upon questions of diagnosis and prognosis. It is remarked in the opinion of the New York Court of Appeals in the Green case that "the object of the statute, as we are bound to presume, was the accomplishment of a just and salutary purpose; which was that the relations between physician and patient should be protected against public disclosure, so that the patient might unbosom himself, freely, to his medical adviser, and thus receive the full benefit of his professional skill." Accepting this general conception of the purpose of disqualifying physicians from testifying against their patients, it is not unlikely that some courts would construe a similar statute more liberally than did that court, in aid of the remedy in view. It might be held in other jurisdictions that any information relating to a patient's injuries or physical condition, derived from the patient himself by a physician while attending him in a professional capacity, would presumably be privileged from disclosure, and that, in order to render testimony of such character by a physician competent, the burden would be upon the party seeking to introduce it to show that the information was not necessary to enable the physician to act in his professional capacity, rather than upon the patient to show affirmatively that it was necessary.

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LIABILITY FOR NEGLIGENCE.

ILLINOIS.—Instructions—Questions of Fact.

The words "how they should find any question of fact" in instruction that the jury are judges of the questions of fact, and the court does not intend to instruct how they should find any question of fact, plainly mean at what conclusion they should arrive and do not refer to the manner of finding a fact. (South Chicago City Ry. Co. vs. McDonald, 63 N. E. Rep., 654.)

ILLINOIS.—Master and Servant—Personal Injuries—Car Repairer—Unexpected Movement of Car—Foreman's Failure to Give Warning—Contributory Negligence—Fellow Servant—Assumption of Risk.

1. Defendant furnished a certain variety of cars to various lines of railroad, the railroad companies having charge of the arrangement and movement of the cars. Defendant repaired its cars in the switch yards of the companies using them. Cars which required extensive repairs were sent to a closed track, where no switching was done, while those needing only slight repairs were repaired on open tracks, where they were liable at any time to be moved by switching. Plaintiff was a car repairer for defendant, and was directed by its foreman to make slight repairs between two cars on an open track. The foreman then directed the train crew to take a car out of the string in which plaintiff was working to the closed track, giving plaintiff no notice of such order. The car was taken out of the string by the switching crew, and the other cars which it was necessary to move to get the one required were kicked back against those among which plaintiff was working, injuring him. The foreman stood on an adjoining string of cars and saw the whole proceeding, but gave plaintiff no warning. Held, to require the submission to the jury of the issue as to defendant's negligence.

2. Plaintiff worked in company with another repairer, and it was customary to have one of the men keep watch in such cases when work was being done under a car, but not when the men were merely required to go between the cars. Held, that plaintiff's failure to have his companion keep watch was not contributory negligence as a matter of law.

3. The companion's failure to keep watch was not negligence of a fellow servant defeating recovery.

4. While plaintiff assumed the risk incident to the usual method of doing the work he did not assume the increased hazard arising from the foreman's negligence. (Street's Western Stable Car Line vs. Bonander, 63 N. E. Rep., 688.)

ILLINOIS.—Street Railroads—Injuries to Person on Track—Instructions—Presumption of Negligence from Injury—Regulation of Speed.

1. In an action against a street railway company for injuries to a traveler on its track an instruction that no presumption of negligence against defendant arose from the fact of injury was properly refused as misleading.

2. In an action for personal injuries it was not error to refuse an instruction that no presumption of negligence against defendant arose from the fact of the injury itself where the jury were charged that plaintiff could not recover unless plaintiff was in the exercise of ordinary care and the defendant guilty of negligence which was the direct cause of the injury.

3. In an action for personal injuries caused by defendant's street car colliding with a sleigh being driven across its tracks near a street crossing an instruction that the defendant was not bound to be on guard against the unusual and extraordinary and "not reasonably to be expected," and was not bound to stop its car until defendant had notice of the crossing of the track by the sleigh, if the same was unusual, was properly refused, where there was no evidence that the crossing of the track by a sleigh at the place was unusual and extraordinary.

4. The instruction was also properly refused, as it ignored the duty of the defendant in approaching crossings to so regulate the speed of its cars that collisions with persons crossing the street could be avoided.

5. It was not error to refuse such instruction where the jury were charged that if the sleigh was driven in front of the car so suddenly that the motorman had no notice of the danger, so as to give him an opportunity to avoid the same by exercise of ordinary care under the circumstances, and that the car was being operated with ordinary care, plaintiff could not recover.

6. An instruction authorizing a recovery if plaintiff was in the exercise of ordinary care and was injured "by reason of the alleged negligence of defendant" is not erroneous in using the word "alleged," as it did not authorize a recovery if negligence was merely alleged. (West Chicago St. R. Co. vs. Petters, 63 N. E. Rep., 662.)

INDIANA.—Street Railroads—Injuries at Crossing—Pleading—Negligence—Wilful Conduct—Instructions—Evidence—Contributory Negligence—Defense—Statute—Constitutionality.

1. In an action for personal injuries sustained in a collision with a street car, an instruction that if defendant's motorman knew that plaintiff was under the car fender, and knew that he could stop the car and thereby prevent the injury, and did not do so, defendant was liable for the injury inflicted after the car could have been stopped, was erroneous, where the complaint merely charged that defendant negligently ran into plaintiff and caught him by and under the fender and dragged him.

2. In an action for personal injuries sustained in a collision with a street car through the alleged wilful act of defendant's motorman, an instruction that if the motorman knew that he could stop the car fender, and knew that he could stop the car and prevent the injury, and did not do so, defendant was liable for the injury inflicted after the car could have been stopped, was erroneous, for, upon the facts stated in the instruction, it could not be said, as a matter of law, that the motorman was guilty of intentionally injuring plaintiff after he fell under the fender.

3. The instruction was erroneous where the evidence not only did not show that the motorman knew he could stop the car before inflicting any injury, but showed that the car could not have been so stopped, and that the motorman reversed the power, applied the brake, and sanded the track immediately upon learning that plaintiff was under the fender.

4. In an action for personal injuries sustained in a collision with a street car, an instruction that the burden of proving contributory negligence rested on defendant was misleading, as causing the jury to believe that contributory negligence could only be proven by defendant's own witness, instead of by the whole evidence.

5. Acts 1899, p. 58 (Burns' Rev. St. 1901, section 359), providing that contributory negligence in actions for personal injuries shall be a matter of defense, and may be proved under a general denial, is constitutional.—(Indianapolis St. Ry. Co. vs. Taylor, 63 N. E. Rep., 456.)

INDIANA.—Street Railway—Negligence—Complaint—Contributory Negligence—Assumption of Risk—Judgment Non Obstante Veredicto—Motion.

1. Where, after judgment had been entered on the general verdict in favor of plaintiff, defendant moved for judgment on the special findings notwithstanding the general verdict, such motion should be denied.

2. The complaint, in an action against an electric street railway company, alleged that it had double tracks, with poles between, which, where the accident occurred, were only three inches from the cars, and that the track was there very rough; that it was the duty of the company to, and on most of its cars it did, have gates at the sides of the front platform to protect the employees thereon, and such gates were required by its rules; that deceased was an employee of the company, and when riding on the cars it was his duty to ride on the front platform; that in the line of his duty he boarded a car at night and passed through to the front platform; that the car had no gate, and he was thrown against one of such poles and killed; that he did not know that there was no gate at the side of such platform, and was free from fault or negligence contributing to the accident. Held, that the complaint does not show contributory negligence on the part of the deceased.

3. The complaint did not show that the decedent had assumed the risk created by the absence of a safety gate.—(Citizens' St. R. Co. vs. Reed, 63 N. E. Rep., 770.)

MICHIGAN.—Corporations—Street Railways—Consolidation—Validity—Estoppel—Creditors—Assumption of Debts.

1. Where a street railway company was composed of an actual consolidation of other companies, and has received and retains all their properties, it cannot deny its liability on a debt due by one of such former companies, on the ground that such consolidation was illegal.

2. Where a street railway company transfers all its property and business to another company, in consideration of stock and bonds of the latter issued to the stockholders and bondholders of the former to replace its stock and bonds which were surrendered and canceled, no money being paid, such transaction, as to the creditors of the former company, should be considered a consolidation of the companies, by which the latter becomes liable for the debts of the former.

3. Where a street railway company is composed of a consolidation of former companies, it assumes the debts of such companies, and in an action against it to recover a debt due by one of such companies, it cannot contend that the original debtor was insolvent, and that therefore plaintiff was not injured by the consolidation.—(Shadford vs. Detroit, Y. & A. A. Railway, 89 N. W. Rep., 960.)

MICHIGAN.—Carriers—Assault by Conductor on Passenger—Costs.

1. The rule relieving the master from liability for a malicious injury inflicted by a servant when not acting within the scope of his employment does not apply between carriers and passengers, so as to relieve a carrier from liability to a passenger for assault of the conductor.

2. 3 Comp. Laws 1897, section 11,258, finding that in an action for assault and battery, if the recovery is less than $50, plaintiff shall recover no more costs than damages, applies where the action is against the master of the servant committing the assault.—(Johnson vs. Detroit, Y. & A. A. Ry., 90 N. W. Rep., 274.)

MICHIGAN.—Carriers—Mistake of Conductor—Ejecting Passenger—Refusal to Pay Fare—Damages.

Plaintiff purchased a return-trip ticket of defendant railway. The ticket was in eight coupons, four for the outward and four for the return trip, each containing a notice that it was void if detached from the signature coupon. On the outward trip the first two conductors tore off coupons from the wrong end of the ticket. The third conductor told plaintiff of the mistake, and delivered to him the coupons which should have been first taken, stating that he could use them in place of those taken. On the return trip the conductor refused to take the detached coupons, and on plaintiff's refusal to pay fare put him off the car. Plaintiff boarded the next car, paid the fare, 40 cents, and rode to his destination, and sued for breach of contract, with aggravated damages. Held, that he was entitled to recover only the 40 cents which he was compelled to pay for the extra fare.—(Brown vs. Rapid Ry. Co., 90 N. W. Rep., 290.)

NEW HAMPSHIRE.—Courts—Jurisdiction—Question of Fact.

Where it is within the discretion of the superior court whether it will take jurisdiction of a cause, the question is one of fact, to be determined by the Superior Court.—(Driscoll vs. Portmouth, K. & Y. St. Ry., 51 Atlantic Rep., 898.)

NEW YORK.—Electric Street Railways—Abutting Owners—Compensation—Additional Burden—Injunction—Eminent Domain—Appeal—Review.

1. The use of a city street for a surface railway operated by

electricity is an additional burden on the property rights of the owners of the fee, subject to the easement of the highway.

2. The question whether an injunction restraining the construction of an electric street railway on a street, the fee of which is in abutting owners, shall restrict the construction of the railway until the payment of compensation, and denying a perpetual injunction if such damages are paid, or whether the injunction shall be made perpetual, leaving the railway company to its proceedings to condemn, is in the discretion of the court; and an order of the special term granting a perpetual injunction, affirmed by the appellate division, is not reviewable, as a question of law, by the court of appeals.

3. The trial court granted an injunction perpetually restraining an electric street railway from constructing its road on a street the fee of which was in the abutting owners. The judgment was affirmed by the appellate division. Held, that the court of appeals could modify such judgment so as to provide that it should not prevent the railway company from bringing condemnation proceedings, and that if the rights of the abutting owners were acquired, and compensation paid, it should not be prevented from entering on the premises for operating its road.—(Peck et al. vs. Schenectady Ry. Co., 63 N. E. Rep., 358.)

NEW YORK.—Street Railways—Personal Injuries—Contributory Negligence.

Where, in an action against a street railway for injuries received while attempting to cross the track, it appeared that plaintiff stepped on the track when the car was but a short distance from him, and that the driver shouted, and attempted to stop the car, and the negligence was principally predicated on the failure to equip the car with a suitable brake, it was error to instruct that notwithstanding negligence on plaintiff's part he could recover if the company, by exercising care, could have avoided the accident.—(Csatlos vs. Metropolitan St. Ry. Co., 75 N. Y. Rep., 583.)

NEW YORK.—Opinion Evidence—Harmless Error.

Allowing a physician to testify, "This asthmatic condition, in hy opinion, could have been the result of some violence," in answer to question whether the asthma which plaintiff had after the accident "could have been caused" by such an injury as she received, is harmless; another physician having given substantially the same answer to a question substantially the same, except that it included the words "reasonable certainty," and it appearing that plaintiff never before had asthma, and did have it immediately after the injury to her chest.—(Hedges vs. Metropolitan St. Ry. Co., 75 N. Y. Supp., 532.)

NEW YORK.—Personal Injuries—Trial—Conduct of Plaintiff.

On the first day of a trial for personal injuries, after adjournment, and in the presence of one or more of the jurors, the plaintiff became prostrated in the court room, and was attended by physicians, and after about twenty minutes was removed from the room. There was evidence that his physical condition at the trial was the result of the injuries alleged. It was not alleged that the attack was simulated, or symptoms intentionally manifested before the jury, and the court asked any of the jury so affected by the event that they could not decide the case as if it had not occurred to rise, but no one rose, and a juror who saw the occurrence stated that it would not affect his decision. Held, that the court's refusal to grant a new trial would not be disturbed.—(McGloin vs. Metropolitan St. Ry. Co., 75 N. Y. Supp., 593.)

NEW YORK.—Privileged Communication—Waiver—Admission of Evidence—Prejudicial Error.

1. Statement of plaintiff to physician, who treated him after an accident, as to physical trouble he had years before, being privileged, admission of it over objection, notwithstanding plaintiff had been treated by such physician for such trouble some years before, and the physician had written an article as to such trouble, which was published in a magazine, is error; Code Civ. Proc. section 836, requiring the waiver of privilege to be on or at the time of the trial.

2. There being a sharp conflict in the evidence as to how the accident occurred, erroneous admission of statement by plaintiff as to his condition before the accident is prejudicial, as affecting his credibility.—(Seher vs. Metropolitan St. Ry. Co., 75 N. Y. Supp., 625.)

NEW YORK.—Corporations—Liability of Directors—Failure to File Reports—Action—Defenses.

1. It is no defense to an action under the stock corporation law (Laws 1899, c. 354, section 34), declaring that no director shall be liable to a corporate creditor for failure to file an annual report unless notice of an intent to hold him responsible is given within three years of the default, but providing that any such liability because of default "now existing" may be enforced by action within the year 1899, or thereafter, if within such year written notice of intent is given, that no notice was given the director of a corporation within the year 1899 of an intent to hold him liable for defaults in not filing annual reports, the first of which occurred in the preceding year, and less than three years before action brought.

2. Laws 1899, c. 354, relating to liability of director of company for failure to file annual report, is applicable to foreign as well as domestic corporations.

3. In an action against the director of a corporation to enforce his personal liability for failure to file an annual report as provided by statute, a defense alleging that the debts were paid by a third party, and, if paid by plaintiff, were paid by him as agent therefor, is sufficient.—(Staten Island Midland R. Co. vs. Hinchliffe, 63 N. E. Rep., 545.)

NEW YORK.—Street Railroads—Assault by Employee—Company's Liability—Punitive Damages—Rules as to Employees—Evidence—Reasonableness.

1. In an action against a street railway company by a passenger to recover for an assault by one of its employees, it did not appear that defendant had employed an improper servant, or ever authorized him directly or indirectly to assault plaintiff, or participated in the act, or ratified or approved it. Held, that it was error to allow the jury to award punitive damages, and that it required a reversal of the judgment, where the award much exceeded the actual damages incurred.

2. On the trial of an action by an employee of a street railroad for an assault by an inspector in compelling him to leave the front seat of a car on which he was riding when off duty clad in uniform, the court refused to hold the trial to permit the defendant to send for its book of rules, and thereupon plaintiff's counsel stated that he was ready to consent that the rules "forbade motormen or conductors in uniform from riding on the front seats of these open cars to the exclusion of passengers." Defendant's counsel, though objecting that it was incorrectly stated, finally said he would accept the offer, so that he might comment on the rule. Held sufficient to establish the existence of the rule in the terms stated.

3. A rule of a street railroad company that no employee when off duty in uniform shall sit on the front seat of an open car in operation is reasonable, even when applied to an employee paying fare as a passenger, as promoting the safety of passengers by preventing the motorman's attention from being diverted from his work by the opportunity for conversation which might otherwise be occasioned.—(Rowe vs. Brooklyn Heights R. Co., 75 N. Y. Supp., 893.)

NEW YORK.—Carriers—Injuries to Passenger—Evidence—Sufficiency.

Where, in an action against a street car company for injuries, defendant's evidence clearly shows that plaintiff received her injuries in attempting to alight from a moving car, and plaintiff's case rests on her unsupported testimony, partially contradicted by her own witnesses and by the circumstances of the case, a verdict in her favor cannot be sustained.—(Hogan vs. Metropolitan St. Ry. Co., 75 N. Y. Supp., 845.)

NEW YORK.—Street Railroads—Excessive Fares—Refusal to Accept Transfer—Penalty—Defense—Construction of Statutes—Statutory Defense—Sufficiency of Evidence.

1. Laws 1890, c. 565, section 39, provided that any railroad company which shall charge more than the lawful rate of fares shall forfeit a penalty, unless such overcharge was made through inadvertence or mistake, not amounting to gross negligence; and section 105 prescribes the same penalty for refusal by a street railway to give a passenger a continuous trip over its various lines to any point thereon for a single fare, by means of transfers furnished without extra charge. Held that, the two sections being in pari materia as to excessive fares, the defense provided for by section 39 for violation thereof was available in an action under section 105 for requiring a passenger who had a valid transfer to pay additional fare.

2. Under Laws 1890, c. 565, sections 39, 105, imposing a penalty upon street railways for charging excessive fares or for refusing to furnish passengers with a continuous trip, by means of transfers, for one fare, where a street car conductor wrongfully refused to accept a valid transfer tendered by a passenger some minutes after he boarded the car, and required him to pay additional fare, but before he left the car offered to return the fare and accept the transfer, the circumstances were sufficient to show that the overcharge was due to "mistake not amounting to gross negligence," which, as provided by section 39, relieved the company from liability.—(Tullis vs. Brooklyn Heights R. Co., 75 N. Y. Supp., 863.)

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, July 12, 1902.

The development of conditions favorable again to gold exports is due to three distinct causes—the decline in commodity exports, the selling of American securities by foreign speculative holders, and the urgent need for a large cash surplus in Paris, where conversion of a large section of the French Government debt from a 3½ per cent to a 3 per cent bond, is about to be financed. Of these three influences the last-named is of most immediate consequence. The deficiency in our agricultural shipments may be easily made up if this summer's crops turn out well. The foreign security liquidation cannot be taken very seriously where the supply of American stocks in speculative hands abroad is known to be exceedingly small. But the French requirements are something which have had to be met at once by actual remittances of capital. Paris money-lenders have called for the part return of their credits both in this country and in England. London, with its own resources pretty low, is utilizing its own American credit balance to help meet the call. Consequently the chief pressure of the French demands falls upon the local market. It is not likely, however, that we shall see any very heavy outflow of gold at this time. When the special operations at Paris are over, the sterling rate at that center will doubtless recover far enough to render export engagements at New York no longer profitable. The more pertinent questions for the present are how far the "Treasury drain" will be relieved by the recent abolition of internal revenue taxes, how soon the interior will begin to draw upon the East for the crop-moving currency, and in which way, whether for gain or loss in surplus reserve, will the immediate movement of loans be directed. No visible relief from the tax reduction has yet appeared in the Treasury operations. The local banks have gained something, and will gain considerably more, by arrivals of new gold from the Klondike, but they have already begun to feel the first demands from the interior. Finally the loan account was expanded last week by over $17,000,000. These incidents of the recent money market are not encouraging; still, they by no means indicate that the rise in surplus reserve which usually occurs in July and the early part of August will not take place this year. The principal hope of avoiding a pinch later on is to build up the reserve now and depend upon our crop surplus to draw gold from abroad in the autumn.

Call money is showing the usual stiffness at the semi-annual settlement period, ranging between 4 per cent and 6 per cent. Time money is firmer at 4½ per cent for all dates.

The Stock Market

The stock market during the last fortnight has moved leisurely upward, without any real outburst of activity or any other decided change from the characteristics which have been displayed for some time past. Genuine investment buying is at a minimum, and the speculative public seems no more inclined than ever to renew their ventures. The dealings orginate mainly with the pools and cliques which are working for higher prices, partly because they have stocks for sale, and partly because they have found that a market where holdings are so concentrated as in the present instance, can be put up easier than it can be put down. Professional Wall Street is "bullish," because the larger operators are working on the long side. If it were a matter of deciding between the extremely high level of prices and the generally favorable conditions underlying values, sentiment would no doubt be greatly divided. But in this case sentiment takes its cue from the fact that all the important leadership is directed toward a rise. The various outside influences seem to have resolved themselves pretty well into two—the outcome of the crops and the future position of bank reserves. Upon the first depends to a very large extent the future of railway traffic, and of general business. Upon the second depends more directly the future of the market's speculative position. The progress of the corn crop, which is of the first concern this season, has been exceptionally good. Cotton and wheat, on the other hand, have deteriorated considerably during the last month. But as a whole the promising agricultural outlook is a logical incentive to operations for an advance at this time. The money situation, as already described, is still quite uncertain, and with the approach of the period when currency is in active demand from the crop centers, there is naturally some misgivings as to whether the time is fitting for a revival of active speculation. It certainly looks, however, as if the speculative interests which have lately taken hold of the market so vigorously will, for the present, continue their efforts irrespective of whether from a future standpoint their operations may seem ill advised.

The trading of the past two weeks has been confined almost wholly to the railroad list, and to one or two of the favorite industrials. The local traction shares have played an inconspicuous part in the dealings. Whatever there has been to the market in Manhattan has indicated further accumulation of the stock from excellent sources. The pool in Brooklyn Rapid Transit has manifested some activity at times, but is evidently biding its time before seeking to draw speculative attention more energetically to its specialty. Metropolitan, meanwhile, has been almost entirely neglected.

Philadelphia

With the opening of the new fiscal year the lease of Union Traction to the new Philadelphia Rapid Transit Company formally went into effect. It is expected now that Union Traction will be gradually removed from the speculative field, and the prominent place it has heretofore held in the dealings, taken by the Rapid Transit stock. This shifting of interest has in fact already begun to be noticed during the last two weeks. Trading in Union Traction has fallen off substantially, yet in spite of this the stock has slowly risen to 45, which, taking the value of the rights at 1½ per cent on a fifty-share par, would be equal to 46½. This is the highest price for the shares on record. The dealings in the new Philadelphia Rapid Transit, while fairly large in volume, have resulted in no noteworthy change in quotation. All the sales recorded have been made at 9 and 9⅛. In sympathy with the movement in Union Traction, Philadelphia Traction advanced a half point to 98¾. A little fresh buying in American Railways resulted in some business around 45¾. The bidding-in of the scant outstanding supply of Indianapolis Street Railway continued, a few scattered lots bringing as high as 87, and the rest 85. Other transactions during the fortnight comprised Easton Electric at 19⅞, Reading Traction at 32½ and Consolidated of New Jersey at 68¼. Bond sales included United Railways 4s at 87½ up to 88¼, Electric People's Traction 4s at 99¼ and 99½, Consolidated of New Jersey 5s at 110, and Indianapolis 4s at 87 down to 86¾.

Chicago

The feature of the Chicago traction share dealings during the last two weeks has been the heavy liquidation in Lake Street Elevated, which has sunk to the exceptionally low figure of 9⅝. Talk of a receivership has, of course, been renewed, but as yet lacks authoritative confirmation. It is said, however, that the so-called Allerton pool in the stock would be willing to stand an assessment, and it is probable that a meeting of the principal interests will be called at an early date to consider plans for rehabilitating the property. Union Traction issues have shown considerable weakness, the common falling as low as 14⅝, and the preferred to 51. Scattering sales of City Railway are reported at a decline to 205. The reaction in these stocks is obviously connected with the threatened strike of the street car employees who demand an increase of from 35 per cent to 40 per cent in wages. West Chicago, on light transactions, held relatively steady around 98. A few odd sales have occurred in Northwestern Elevated common at 37¼ and 37, and in Metropolitan common at 38 and 38¼. Business of the latter road is expected to gain a good deal from the Garfield Park extension, and its connection with the Aurora-Wheaton electric line. The new arrangement went into effect on the first of the month.

Other Traction Securities

The Boston market of the past two weeks has been singularly devoid of interest so far as the traction stocks were concerned. Dealings in Massachusetts Electric have been very much the lightest of the season, the common ranging between 42½ and 42¾, and the preferred selling at 97½. Odd lots of Boston Elevated sold at 164, West End common at 85¼ and the preferred at 113¼. In Baltimore the United Railway issues have been duller than usual, but firm at 70 for the income bonds, 96¾ for the general 4s, and 16 to 16¼ for the stock. On encouraging advices of improvement in its local investment position Nashville Railway bonds advanced sharply from 63 to 71. Anacostia and Potomac 5s have also been exceptionally strong at an advance from 99½ to 102. Other Baltimore transactions included Lexington Railway 5s at 103½, City and Suburban (Washington) 5s at 101, Atlanta Street Railways 5s at 105½, City and Suburban (Baltimore) 5s at 114½, North Baltimore Traction 5s at 120¼, Norfolk Railway 5s at 113, Norfolk Railway & Lighting 5s at 96, Charleston Consolidated 5s at 94½ and Nashville Railway stock at 3. The accumulation of North Jersey Traction, noted for some time past, has again been a conspicuous feature. The stock, which sold at 28½ three weeks ago, is now up to 31, and the bonds have risen a half point from 83½ to 84. The

sequel to the spurious corner in San Francisco bonds on the New York curb was very tame. Apparently efforts to enforce delivery were relaxed, and the price fell between sales from 102½ to the normal quotation of 91½. The new stock of the New Orleans Railways Company is attracting some interest on the New York curb, a few odd lots of the common selling yesterday at 10, and of the preferred at 52. A fractional lot of Washington Traction at 15½ was also reported. St. Louis securities are inactive, and lower, the bonds selling at 87, while the preferred stock is quoted at 82. Columbus common fell a point to 51, and the bid was subsequently lowered to 50. Nothing of importance has been done in Louisville Street Railway issues.

The traction stocks were fairly active in Cleveland last week, the total sales numbering 2038 shares. Toledo Railways & Light sold early at 30¾, and ended at 30¼. Western Ohio opened at 25¼ and closed at 26, 320 shares selling. Detroit United improved late in the week, 110 shares selling at 75¼ to 76. Northern Ohio Traction preferred sold at 98½, Elgin, Aurora & Southern sold at 43 for 160 shares. Monday 200 Western Ohio sold at 25½, 200 Toledo Railways & Light at 30¼; 15 Elgin, Aurora & Southern at 43, and 65 Northern Ohio Traction common at 41. Several bids of 10 and 10½ were made on Lake Shore Electric stock, but 20 was the best it was offered at. A few days ago Henry Everett and a party of Cleveland capitalists made an inspection of this property, with a view of financing it and taking it out of the receiver's hands. The plans call for the issue of $5,000,000 bonds, $2,670,000 of which will go to retire the underlying bonds on the four companies consolidated to form the road. The through service on this road will shortly be instituted, when it is figured the net earnings will increase to a basis of $300,000 per year.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with two weeks ago:

	Closing Bid June 24	Closing Bid July 8
American Railways Company	45¼	45½
Boston Elevated	a166	164
Brooklyn R. T.	66⅝	67⅞
Chicago City	205	205
Chicago Union Tr. (common)	17½	15
Chicago Union Tr. (preferred)	53	50½
Cleveland & Eastern	31	..
Cleveland Electric	85	..
Columbus (common)	52½	50½
Columbus (preferred)	107¾	107
Consolidated Traction of N. J.	69½	68½
Consolidated Traction of N. J. 5s	112⅝	*110
Detroit United	79⅛	76¼
Electric People's Traction (Philadelphia) 4s	99¼	99¼
Elgin, Aurora & Southern	43	41
Indianapolis Street Railway 4s	88⅝	86⅜
Lake Street Elevated	10½	9⅞
Manhattan Railway	130⅞	132
Massachusetts Elec. Cos. (common)	43	42¾
Massachusetts Elec. Cos. (preferred)	a96	97½
Metropolitan Elevated, Chicago (common)	38	38
Metropolitan Elevated, Chicago	89½	89
Metropolitan Street	148	148⅝
New Orleans (common)	31¼	34
New Orleans (preferred)	112½	112½
North American	121	121½
Northern Ohio Traction (common)	43	41
Northern Ohio Traction (preferred)	98	98¼
North Jersey	28½	30¾
Northwestern Elevated, Chicago (common)	31	35½
Northwestern Elevated, Chicago (preferred)	80	80
Philadelphia Rapid Transit	..	9
Philadelphia Traction	98½	98½
St. Louis Transit Co. (common)	30⅝	30⅛
South Side Elevated (Chicago)	109	108
Southern Ohio Traction	67¼	64
Syracuse Rapid Transit	..	26
Syracuse Rapid Transit (preferred)	..	a70
Third Avenue	130	131
Toledo Railway & Light	30	30¼
Twin City, Minneapolis (common)	119	119¼
United Railways, St. Louis (preferred)	83½	82
United Railways, St. Louis, 4s	87¼	87
Union Traction (Philadelphia)	43¾	44⅞
Western Ohio Railway	22¾	25

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

The position of the iron market, with reference to deficient supplies, continues to be rendered increasingly difficult by the stacking of furnaces resulting from the coal strike. Reports are constantly coming in of more furnaces shutting down. The exigency of the situation is naturally being met by increased imports of iron from abroad, and contracts with English and German firms are being considered for quite large amounts. The finished branches of the industry do not seem to have been bothered much so far by the shortage of raw material. The striking feature in this quarter continues to be the taking of larger orders for structural material and steel rails, for delivery in 1903. Quotations are unchanged, as follows. Bessemer pig iron, $21.50; steel billets, $33; steel rails, $28.

Metal

Quotations for the leading metals are as follows: Copper, 12¼ cents; tin, 28 cents; lead, 4⅛ cents, and spelter, 5⅛ cents.

WILLIMANTIC, CONN.—The Willimantic & Southbridge Electric Railway, which is to build between Willimantic, Chaplin and Southbridge, will apply for permission to increase its capital stock from $50,000 to $250,000.

FORT DODGE, IA.—The controlling interest in the Fort Dodge Light & Power Company, including the Fort Dodge Street Railway, has been sold by A. F. Meservey and S. T. Meservey to Healy Bros. & Kelleher, a prominent legal firm of this city. The transaction involves the transfer of $67,000 of stock in a total issue of $125,000. The new management announces that important improvements are contemplated in the way of extensions of street railway lines.

NEW ORLEANS, LA.—The New Orleans Railway Company has acquired the rights of the New Orleans & Pontchartrain Railway, which was incorporated in July, 1901, with $250,000 capital stock, to build a 10-mile electric railway between New Orleans, West End and Lake City.

NEW ORLEANS, LA.—The New Orleans Railways Company has amended its charter by filing with the Secretary of State of New Jersey notice of an increase in its capital from $5,000,000 to $40,000,000. Of the 400,000 shares of stock, 300,000 are common or general stock, and 100,000 are preferred, drawing 4 per cent cumulative dividends. There is already outstanding 50,000 shares of the stock.

SPRINGFIELD, MASS.—A $60,000 mortgage given by the Springfield & Eastern Street Railway Company to the Hampden Trust Company, of Springfield, was filed for record a few days ago with the Register of Deeds of Hampden County.

HUDSON, MASS.—The Concord, Maynard & Hudson Street Railway Company has asked approval of an issue of $175,000 bonds.

HAVERHILL, MASS.—The Haverhill & Southern New Hampshire Street Railway Company has asked approval of an issue of original stock to the amount of $30,000.

LAWRENCE, MASS.—The Lawrence & Methuen Street Railway Company has asked the Railroad Commissioners to approve an issue of $270,000 original stock.

MILFORD, MASS.—The Railroad Commissioners have issued an order approving the purchase of the Upton Street Railway by the Grafton & Upton Railroad, a steam road, under the provisions of a special act passed by the last Legislature. This is the first case in the State of the absorption of a street railway by a steam road. The act also permitted the purchase of the Milford & Uxbridge and the Milford, Holliston & Framingham roads, but no petition for approval of this action has yet been filed. The board has, however, issued an order, under an old petition, approving the purchase of the latter road by the former, and the issue of $252,000 for payment in exchange, share for share.

CLAREMONT, N. H.—The Railroad Commissioners have granted the application of the Claremont Electric Light & Railway Company for permission to issue $100,000 of stock and $25,000 of bonds.

JERSEY CITY, N. J.—The directors of the Consolidated Traction Company have declared a dividend of 1¾ per cent, payable July 15.

MINEOLA, N. Y.—The Mineola, Hempstead & Freeport Traction Company has applied to the Railroad Commissioners for permission to issue $1,000,000 bonds and increase its capital stock from $125,000 to $1,000,000. The increases are asked to provide means for carrying out the extensive extensions planned by the company, which were noted in the STREET RAILWAY JOURNAL for June 28, 1902.

NEWARK, OHIO.—It is reported that the Newark & Granville Railway will be formally transferred to Tucker, Anthony & Company, of Boston, some time this month.

HUNTINGTON, W. VA.—The Camden Interstate Railway Company is reported to have sold to a Pennsylvania syndicate all its electric lines in this city, Central City, Ceredo and Kenova, W. Va., Catlettsburg and Ashland, Ky., and Ironton, Ohio. The deal also will embrace electric-light plants in Ironton, Ashland and Huntington. The consideration is said to be about $2,000,000. John Graham and Edmund McCandish, of Newville, and John J. Henry and William North, of Philadelphia, are reported to be the leaders in the syndicate.

OTTAWA, ONT.—The Ottawa Electric Railway Company is about to lease the Hull Electric Railway, which runs from Hull to Aylmer, Quebec. This road came into the possession of the Canadian Pacific Railway through its purchase of the Ottawa, Northern & Western Railway, which company had an option of purchase on the Hull Electric Railway. Although the Canadian Pacific Railway took advantage of the option on the Hull Electric Railway, it deems it advantageous to lease it to the Ottawa Electric Company.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., May '02	60,747	33,911	26,836	12,957	13,879
	1 " " '01	48,505	28,301	20,204	11,382	8,821
	5 " " '02	251,308	148,773	102,533	......	......
	5 " " '01	210,776	132,335	78,441	......	......
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,722	*317,473	196,249	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., May '02	131,871	90,393	40,977	23,476	17,501
	1 " " '01	74,735	60,900	12,730	19,901	†7,170
	11 " " '02	1,347,142	928,150	418,993	239,299	179,694
	11 " " '01	1,214,749	836,460	378,289	219,334	158,955
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,075	......	......
	1 " " '01	15,678	9,341	6,337	......	......
	10 " " '02	187,658	103,986	83,672	......	......
	10 " " '01	169,756	94,355	75,401	......	......
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,336,597	3,532,900	2,806,356	686,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,486	1,862,648	957,206	905,442
	12 " " '00	5,518,937	3,650,337	1,859,300	994,294	865,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., May '02	1,156,845	*730,152	426,192	......	......
	1 " " '01	1,075,576	*715,161	360,415	......	......
	11 " " '02	11,624,417	*8220062	3,404,355	......	......
	11 " " '01	10,920,174	*7237894	3,682,280	......	......
	12 " June '01	12,135,359	*7216008	4,919,351	4,341,708	577,643
	12 " " '00	11,766,550	*7103373	4,662,177	4,155,405	506,772
BUFFALO, N. Y. International Tr. Co	1 m., May '02	264,184	146,787	117,398	97,330	20,068
	1 " " '01	291,666	161,077	130,589	98,030	32,559
	1 " " '00	209,969	115,497	94,823	78,251	15,572
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., May '02	16,441	7,353	9,088	......	......
	1 " " '01	11,167	5,504	5,573	......	......
	5 " " '02	61,190	30,966	30,234	......	......
	5 " " '01	46,300	26,307	20,001	......	......
Lake Street Elevated	12 m., Dec. '01	786,462	388,790	397,663	......	......
	12 " " '00	757,954	378,661	379,293	......	......
CLEVELAND, O. Cleveland & Chagrin Falls	1 m., Feb. '02	2,454	2,255	1,199	......	......
	1 " " '01	2,435	3,016	†581	......	......
	12 " Dec. '01	47,976	*32,002	15,974	16,028	2,931
	12 " " '00	49,646	*33,272	16,374	13,294	3,080
Cleveland & Eastern	1 m., Feb '02	4,916	3,616	1,300	......	......
	1 " " '01	3,525	4,037	†512	......	......
	12 " Dec. '01	90,390	52,082	38,308	43,678	†4,310
	12 " " '00	64,866	36,676	28,221	36,148	†9,907
Cleveland El. Ry. Co.	1 m., May '02	217,565	......	......	......	......
	1 " " '01	187,049	......	......	......	......
	5 " " '02	962,891	......	......	......	......
	5 " " '01	854,594	......	......	......	......
	12 " Dec. '01	2,296,898	1,265,951	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., May '02	25,045	13,311	11,735	......	......
	1 " " '01	20,707	11,141	9,566	......	......
	5 " " '02	103,194	64,702	38,492	......	......
	5 " " '01	84,791	54,583	30,207	......	......
	12 " Dec. '01	249,200	136,856	112,344	57,063	55,271
	12 " " '00	179,604	102,391	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., May '02	17,198	9,090	8,088	......	......
	1 " " '01	13,498	6,583	6,915	......	......
	5 " " '02	61,810	35,180	26,630	......	......
	5 " " '01	49,700	28,193	21,507	......	......
	12 " Dec. '01	164,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*69,582	71,530	72,500	†980
DENVER, COL. Denver City Tramway Co.	1 m., Apl. '02	134,516	66,533	67,983	32,865	35,119
	1 " " '01	116,857	62,866	54,491	31,304	23,186
	4 " " '02	481,348	261,118	220,230	131,259	88,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,507,293	818,821	688,965	383,180	305,785
	12 " " '00	1,352,280	722,450	579,830	374,291	205,548
DETROIT, MICH. Detroit United Ry.	1 m., May '02	292,415	161,336	131,079	67,752	63,327
	1 " " '01	243,447	138,304	105,142	57,360	47,782
	5 " " '02	1,307,822	747,710	560,112	327,507	232,305
	5 " " '01	1,122,312	635,934	486,377	286,785	199,592
	12 " Dec. '01	2,919,171	*1606785	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " '01	28,877	18,062	10,816	9,692	1,124

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
DULUTH, MINN. Duluth-Superior Tr.	1 m., May '02	44,475	20,288	24,187	9,745	14,442
	1 " " '01	37,205	19,628	17,576	9,158	8,418
	5 " " '02	196,910	110,278	86,632	48,189	38,443
	5 " " '01	160,074	90,227	69,847	45,877	23,969
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., May '02	35,118	20,343	14,775	8,298	6,479
	1 " " '01	29,616	16,097	13,519	8,333	5,186
	12 " " '02	379,252	216,017	163,235	100,000	63,235
	12 " " '01	330,578	208,823	121,755	100,000	21,755
HAMILTON, O. Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	2,125	7,500	1,625
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT. London St. Ry. Co.	1 m., May '02	12,251	7,906	4,346	2,410	1,936
	1 " " '01	10,004	6,818	3,185	2,079	1,107
	5 " " '02	51,421	34,609	16,812	11,306	5,507
	5 " " '01	46,195	31,904	14,241	9,896	4,355
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co	1 m., May '02	218,682	103,885	114,797	65,668	49,130
	1 " " '01	192,667	94,506	98,163	61,380	36,783
	5 " " '02	1,052,179	505,111	547,068	323,539	223,549
	5 " " '01	921,349	492,033	429,316	262,544	166,772
	12 " Dec. '01	2,442,342	1,185,554	1,256,808	755,189	501,669
	12 " " '00	2,230,698	1,129,787	1,090,911	884,065	206,847
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., May '02	296,901	136,964	160,028	58,733	101,304
	1 " " '01	251,946	114,340	137,606	56,635	80,971
	5 " " '02	1,356,554	649,003	707,252	292,811	414,732
	5 " " '01	1,178,257	568,064	614,500	273,063	211,466
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., May '02	178,408	86,780	91,628	18,672	72,956
	1 " " '01	161,286	90,766	70,516	11,623	58,895
	8 " " '02	1,257,518	766,258	491,290	134,917	306,373
	8 " " '01	1,174,089	743,667	430,412	75,995	354,417
NEW YORK CITY. Manhattan Ry. Co.	4 m., Dec. '01	3,088,485	1,404,971	1,683,665	758,185	880,229
	3 " " '00	2,738,538	1,340,696	1,387,902	749,857	638,046
	12 " Sept. '01	10,465,872	5,328,649	5,127,223	3,682,182	1,444,041
	12 " " '00	9,960,785	5,195,312	4,765,423	2,658,644	2,096,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,986	1,783,978	2,143,984	1,151,140	992,894
	3 " " '00	3,766,030	1,699,649	2,066,381	1,138,467	217,911
	12 " June '01	14,790,767	6,755,121	7,965,636	4,584,068	3,481,567
	12 " " '00	14,437,184	6,631,354	7,805,860	4,445,720	3,360,140
OLEAN, N. Y. Olean St. Ry. Co.	1 m., Mar. '02	3,904	2,411	1,584	1,146	438
	9 " " '01	3,865	2,048	1,797	1,187	604
	9 " " '02	41,735	21,611	20,124	12,343	7,781
	9 " " '01	39,270	19,376	19,904	11,069	8,935
PHILADELPHIA, PA. American Railways	1 m., May '02	97,701	......	......	......	......
	1 " " '01	78,406	......	......	......	......
	11 " " '02	908,356	......	......	......	......
	11 " " '01	764,860	......	......	......	......
RICHMOND, VA. Richmond Trac. Co.	1 m., Sept. '01	20,901	15,669	5,232	3,196	2,136
	1 " " '00	20,727	10,770	9,957	3,843	2,115
	12 " " '01	218,569	139,542	79,027	38,618	40,410
	12 " " '00	203,057	108,198	94,860	37,006	57,220
ROCHESTER, N. Y. Rochester Ry.	1 m., May '02	88,164	47,773	40,391	24,749	15,642
	1 " " '01	81,016	47,471	33,545	24,185	9,360
	5 " " '02	438,909	241,199	197,311	123,854	73,457
	5 " " '01	409,848	261,259	148,590	120,453	28,137
SCHENECTADY, N. Y. Schenectady Ry. Co	3 m., Dec. '01	84,061	46,949	37,112	13,434	23,658
	3 " " '00	30,876	14,517	16,359	6,087	10,274
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., May '02	57,769	32,558	25,211	19,095	6,116
	1 " " '01	51,958	28,982	22,976	18,083	4,893
	11 " " '02	632,420	349,406	282,905	209,221	74,784
	11 " " '01	564,347	309,889	254,458	204,971	49,487
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., May '02	117,006	*60,246	56,760	......	......
	1 " " '01	101,255	*56,037	45,218	......	......
	5 " " '02	548,601	*288,224	260,377	......	......
	5 " " '01	486,027	*249,479	236,548	......	......
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,162,517	*216,945	565,572	409,051	156,521
W. NEW BRIGHTON, S. I. Staten Island Ry.	3 m., Mar. '02	38,189	46,906	†8,717	8,778	†17,495
	1 " " '01	35,667	38,298	†2,391	8,217	†10,608

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Cost of Operation

The Cleveland street railway companies have agreed to permit a committee appointed by the United Trades and Labor Council to inspect their books and ascertain exactly what it costs to operate the road and carry a passenger. The railway officials say that this is the first time they have ever been approached by a non-partisan committee looking for facts. It is believed that such an investigation will effectually stop the agitation for 3-cent fares, and it is therefore believed that it will prove a boon to the street railway companies that have been hampered because of the general ignorance on the subject. No doubt a thorough and intelligent investigation would produce results that would prove a revelation to honest inquirers.

Storage Batteries on Street Cars

Public opinion is a fickle jade, as has been frequently demonstrated, but nowhere more effectively than in the change of attitude upon the employment of storage batteries upon street cars. Time was when there was great clamor for this form of equipment, and traction managers were denounced as parsimonious because of their refusal to adopt this method of propulsion; yet, to-day, the only storage battery line in New York has been pronounced a public nuisance by the Board of Health, and the people who patronize the road are ready at an hour's notice to hold an indignation meeting and demand the substitution of the underground trolley for the present equipment. Complaint is made that sulphuric acid fumes escape from the storage batteries, and are not only unpleasant, but sometimes cause throat troubles of serious nature. The company has tried several methods to overcome the trouble caused by the fumes, and, it was believed, had succeeded, but the opposition continues just the same; all of which goes to show how difficult it is to satisfy the public.

The Overhead Trolley in Favor in England

It is gratifying to receive assurances that our English cousins—brothers, we might now almost call them—are growing quite enthusiastic over the trolley. Mr. Balfour lately emphasized the fact that it was the trolley system which made possible the present development of electric traction in England, and he might have added that it was the failure of the municipal authorities to recognize earlier the value of this improvement that placed such a handicap upon the British manufacturers and gave Continental, as well as American, rivals such a lead. Mr. Rider, whose opinion should be accepted as authoritative, said, in his address at the Municipal Electrical Association, that if there was anything disagreeable to the eye in the overhead trolley construction it was the fault of the designer and not of the system itself. He admitted that examples of overhead construction were to be found in the United Kingdom that were not pretty; in fact some of them were decidedly ugly, in spite of the fact that it was easy and practicable to design and erect an overhead line that would look well in any locality. Mr. Rider does not favor the combination systems in which both overhead and underground trolleys are employed; in fact, his experience leads him to endorse, unqualifiedly, the overhead trolley for ordinary city service.

Conditions Favorable to Trolley Wheel Wear

Few stop to think of the very severe mechanical requirements of the ordinary electric car trolley wheel in high speed service. In the first place, the diameter of the wheel is very small, considering the speed of the car in miles per hour. A 6-in. wheel, for instance, on a car running at a speed of 30 m. p. h., makes 1740 r. p. m. This in itself is a notable mechanical performance for the wheel on the end of a trolley pole where lubrication and attention is necessarily not of the best. But added to all this there is the requirement that the trolley wheel carry a large volume of current through two moving contacts; first, from the trolley wire to the wheel; and second, from the wheel to the bearing or harp. One assumption, perhaps too commonly made, is that the kind of a bearing put on

a trolley for high speed service is a matter which does not affect the mileage of the wheel metal exclusive of the bearing. Those who are familiar with the subject know very well, however, that the less friction there is introduced in a trolley wheel bearing the greater is the chance for a long life wheel. In the first place a trolley wheel bearing with the minimum amount of friction causes the least dragging effect between the trolley wheel groove and the trolley wire. A trolley wheel which runs hard has a tendency to drag constantly along the trolley wire, and consequently its groove wears faster than if it turned more easily. The improvement of the trolley wheel and its bearing is being worked upon by plenty of good talent, and it is not too much to expect that this investigation will result in marked improvement. It is the common experience that whatever tends to make a larger and more perfect bearing is very conducive to improvement in the mileage secured from the trolley wheel. In this connection the elimination of heavy or stiff contact springs, which tend to make the trolley wheel run hard, should be considered. Another point often overlooked is that the trolley wheel, which must run at such enormously high speeds as are required on the fastest interurbans, should be well balanced. A little different weight at different parts of the circumference of a wheel will cause a vibration which tends to make poor contact and arcing between the trolley wheel and wire, and which soon magnifies the trouble because of the pitting which will soon be found on the wheel as a result of this constant, though minute arcing. The remedy for this unbalancing simply consists in turning off the rough outside of the wheel flange as well as the inside, so that there will be no greater weight of metal on one point on the flange than on another. The trolley wear on high-speed interurban roads is at best very great, and it is only by careful attention to details that it can be kept within reasonable bounds. It is a matter to be thankful for that the third rail is a possible alternative on interurban roads using their own right of way. The admirable working of the third-rail roads already installed will tend to encourage this kind of construction.

A Question for the Traffic Manager

The relation of traffic to frequency of service is a topic which is often discussed, but upon which there are no very useful data from actual experience. In general terms it is very well understood that if the frequency of service upon a given route is increased the total amount of traffic is also increased, but to what extent and under what conditions this proposition is true is only vaguely guessed at. We are a bit suspicious that there is a serious fallacy in the chain of reasoning usually followed, and that while increased service does make traffic it does not continue to do so without limit, and, in fact, depends on many contingent circumstances. For example, a street railway passes from a twenty-minute schedule to a ten-minute schedule, and the next fiscal year shows materially increased gross receipts. The statistician immediately whips out his pencil and note book and shows you with a proud smile the percentage of increase due to doubling the frequency of the service. The early logicians were very familiar with this course of alleged reasoning, and dubbed it the "Post hoc, ergo propter hoc" fallacy, meaning thereby that if one wakes to find his hat eight sizes too small some morning this condition is not necessarily due to the hair cut he had the day before, which may have stimulated the growth of his hirsute adornment. In the concrete case in hand the twenty-minute service may have been hopelessly irregular, while the quickened service had to keep up more sharply to hit the turnouts, or the change may have resulted in great improvement in the cars, or the cars may have been at first outrageously overcrowded, or an amusement park may have been opened, or half a dozen other things may have incidentally happened to increase the receipts upon that particular line. As a rule the schedule is improved only to meet a popular demand which can no longer be put off, and which is the direct cause of traffic improvements.

The really important experiment to try would be to take a well-established suburban line, well-equipped and operated, say, on a twenty-minute schedule with ample accommodation for the normal traffic and rigid regard for punctuality, and then to pass suddenly to an equally well-kept up ten-minute service. We have no doubt whatever that the traffic receipts would be materially increased, yet nothing like the extent which is often claimed. A crowded and irregular twenty-minute service undoubtedly scares off a considerable amount of short-distance riding, which is the most profitable kind, but this would be regained to no small extent by the use of long and capacious cars and invariable punctuality in the service. A certain other amount of short-distance riding can be saved only by more frequent service, and the increase of traffic usually found on improving the schedule is due to both causes in uncertain degree. Until the service becomes so frequent as practically to abolish waiting for a car, we are inclined to think that comfortable accommodations and punctuality are of more importance than the question of the next car being due at 10:40 or 10:50 o'clock. The ordinary citizen who depends upon trolley service either plans to hit the 10:40 car or goes out at about that time in the certainty that a car will be along in two or three minutes anyhow. Certainly a twenty-minute service which lives up to its reputed schedule is vastly more convenient than a ten-minute service at haphazard.

We have in mind numerous places where the total number of daily cars is very large, and which still would be much better served by half the number run on a sharp schedule. In ordinary service the cause and amount of increased traffic following a shortened schedule is of comparatively small moment, for the service is guided by the demands of the public, and generally has to hustle to keep up with it, but the philosophy of the matter is of real importance in much suburban and interurban work, and the need of data is very great.

Take, for example, the case of a long interurban road with fairly heavy traffic. Will it be advisable to run hourly trains for the through service or single cars every twenty minutes? It has generally been tacitly assumed that the latter procedure would win out in the matter of traffic, and doubtless it sometimes would, but upon what definite facts can we base such a conclusion? If the trains and the single cars ran at the same speed and had the same passenger capacity in the aggregate there might or might not be a difference in traffic. A fast electric line between, say, New York and Philadelphia, would be a case in point. If the running time were the same for hourly trains and for single cars we very much doubt whether the total number of passengers carried would be materially changed by passage from one schedule to the other. A short distance suburban service on the contrary would probably show a considerable difference in favor of single cars if the trains were as infrequent as one an hour, but this would be greatly diminished in comparing a half-hourly train service with single cars every ten minutes.

Broadly, the longer the running time the less difference will a change of schedule make, since it will then make but a small variation in the total time taken up in travel. But on the whole we suspect that change in schedule alone has a very much smaller effect than is popularly supposed. Change from a crowded and irregular service to a prompt one, with ample accommodations for the public, undoubtedly does bring a large increase of traffic, and this is the whole point of the matter. In ordinary urban traffic, where the cars are already comfortable and capacious, passing to a shorter schedule, is the only simple way of giving the added accommodations if the service is already punctual. Hence the result so often observed. In classes of service where trains can be used it seems doubtful whether extra trains, save at the rush hours, will win much traffic over longer trains. During the crowded hours every feasible means of increasing the accommodations have to be taken, and many electric lines both add cars and run more trains. But general data on the effect produced by running more frequent cars where those in use are punctual and not uncomfortably crowded are very meagre, and we should welcome an addition to them.

Pennsylvania Railway Terminal Assured

At the hearing before the Railroad Committee of the New York Board of Aldermen last week, it was evident that an attempt would be made to hold up the Pennsylvania Railroad tunnel franchise, on the ground that adequate compensation had not been secured for the city; that the proposed frachise was perpetual, and therefore antagonistic to the spirit of the new charter, and that the responsibility of the railway company for damages had not been fixed with sufficient clearness. To the first objection the most effective reply that can be made is the fact that the rate of compensation and the total amount provided for are far greater than have ever before been secured by the city for any privilege, and this is all the more noteworthy, because the franchise granted the railroad company does not entail any additional burdens on the city, nor will the improvement obstruct highways or take anything from the municipality or property owners; but, on the contrary, the building of the tunnel will directly benefit the entire community, and particularly property owners in the neighborhood of the route, as is shown by the advance that has already been made in prices of real estate in that section. The objection raised to the provision that the franchise be a perpetual one is met by the terms of the contract, which call for revaluation and adjustment of the rate of compensation at specified periods, and provide other safeguards of the city's interest which will always ensure for the municipality a supervisory control over the property. On the other hand it is pointed out that the perpetual character of the franchise will enable the company to make an improvement that will be permanent in every respect. It could not be expected of any corporation that it would make such an investment if its concession were for a limited period and liable to be canceled at the whim of an irresponsible city board. The railroad company meets the last objection by offering to give whatever reasonable guarantee may be required to meet all claims that may be established for damages of whatever nature growing out of the tunnel construction. Thus all legitimate ground for criticism is removed, yet opposition remains. The aldermen are still jealous of the powers of the Rapid Transit Commission, and will probably resort to every possible device to thwart the present movement. It is gratifying, however, to have definite assurance that the delay will only be of short duration and that the present plan will certainly be approved and the contract executed by the city.

Street Railway Exhibits at St. Louis

A circular lately issued by the department of transportation exhibits of the St. Louis World's Fair shows that street railway apparatus has been assigned space in the building devoted to transportation, under the official classification known as group 74, and comprising classes 462, 463 and 464, as follows:

Class 462.—Other railway systems. Rack, cable, elevated, aerial, sliding railways; movable platforms, permanent way; motive power or motors; rolling stock.

Class 463.—Traction railways, intramural, suburban, industrial, etc. Various types of tracks upon different kinds of roads; switches and crossings; turntables; implements for track-laying, cleaning, etc.

Class 464.—Cars drawn by animals; locomotives and automobile vehicles; rolling stock for street railways operated by mechanical traction; braking appliances; equipment for using stored power (hot water, compressed air, electricity, etc.)

It will be seen at once that this is neither comprehensive nor complete, and, therefore, must of necessity be unsatisfactory to the street railway interests. Electric railroading is deserving of much more prominence in an industrial exhibition than that assigned it by the management of the St. Louis Fair, and a great mistake will be made if the present plans are followed. The most important features of electric railroading to-day are not provided for here; the power plant, the transmission and distribution system, the practical working of modern car equipments are all overlooked in this classification. No doubt apparatus for these purposes will be provided for elsewhere, in the electricity department, may be, or in the service plant; but this will not be satisfactory to street railway men, as it will make a very inconvenient division and distribution among several departments. The place for all apparatus pertaining to electric railway operation is in the transportation division, and any plan that does not make adequate provision for a complete and comprehensive exhibit will not be satisfactory to the electric railway interests. They will demand, too, as is their right, that proper recognition be given this feature of modern life in which such marvelous advancement has been made, and in which American engineers and manufacturers have distinguished themselves perhaps more than in any other branch of industrial activity.

Some difficulty may be experienced by the management in revising its plans so as to make proper provision for the electric railway, and the tendency to subordinate it to the steam railway will doubtless be hard to overcome; but justice and policy both demand the change. Everything considered, we do not hesitate to say that electricity is deserving of the greater prominence in the exhibition, both because of the popular interest which it excites, and the commanding position it now occupies. The recent advancement in suburban and interurban work alone should lead the Fair managers to adopt a liberal policy toward electricity in this respect. Electrical engineers welcome a comparison between steam and electrical equipment, in mechanical design and construction, as well as accomplishment, and for this reason the logical place to make the exhibit is in the transportation building, but they do object and most earnestly protest against subordinating their interests to those of the steam railway.

Brooklyn Bridge Plans

The action of the Rapid Transit Commissioners at their last meeting, in reconsidering their approval of Mr. Parsons's plan for relieving the conditions at Brooklyn Bridge, seem, on closer inspection, to amount practically to the side-tracking of the entire scheme. Mr. Parsons did not expect to put his plan into immediate operation, and that feature of it to which Bridge Commissioner Lindenthal took exception might have been put aside temporarily until immediate demands had been satisfied; but the objection to this part appears to have been taken merely as a pretext for shelving the entire plan. Mr. Lindenthal now comes forward with his moving sidewalk plan as a substitute really, instead of a modification of the Parsons subway, for with no cars on the Bridge there would be no need of a subway; but, it is not entirely clear that the present nuisance would be abated by such a measure. It is more likely that if it were adopted and proved as successful as Mr. Lindenthal predicts in handling the crowds on the bridge, it would merely transfer the seat of trouble from Manhattan to Brooklyn, and instead of the crush and confusion now witnessed daily opposite City Hall, there would be a wild scramble for cars at the Brooklyn plaza.

Mr. Lindenthal's plea on behalf of the moving sidewalk is an attractive one—on paper. He offers to carry 65,000 seated passengers an hour, whereas at present both the train and trolley car service, with fearful crowding, carry only 38,000 an hour. There are drawbacks, however, and one of them is the necessity of change for all passengers at the Brooklyn end of the bridge, and the difficulty of operating the platform in conjunction with any system of through cars. The train passengers who now have to change do so without extra cost, and as they can only thus connect with the elevated lines in Brooklyn, a portion of the traffic is diverted to the trains, though the chief crush is on the trolley cars. Passengers on the platform would be required, not merely to change cars, but to pay an extra cent, and the tendency would be strong to crowd the trolley cars worse than ever if they were left on the bridge.

If the cars were removed from the bridge adequate terminal facilities would have to be provided, and the Brooklyn Rapid Transit Company would not feel inclined to pay the bill for these changes, as the conditions which these improvements are intended to meet would not be of their making. Altogether we fear that Mr. Lindenthal's desire to ride his pet hobby has mixed matters badly, and that instead of a far-reaching and comprehensive scheme, such as Mr. Parsons proposed, we are again condemned to go through the ordeal of listening to a repetition of arguments that have already been threshed out on rejected plans.

New Power House of the Peekskill Lighting & Railroad Company

While the equipments of large undertakings naturally attract the greatest attention they rank little higher in general interest than the design of more modest installations. Among electrical plants intended to meet the traction and lighting requirements

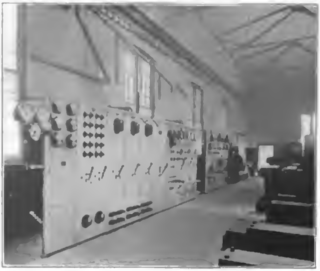
GENERAL VIEW OF ENGINE ROOM

of cities of small size the new power house of the Peekskill Lighting & Railroad Company, of Peekskill, N. Y., is of peculiar interest as illustrating a small, modern equipment in which effective provision has been made for expansion and for marked changes in the loads on either lighting or street railway service, the plant being also especially designed to permit of carrying heavy overloads with safety and with the greatest possible economy. The new

STORAGE BATTERY BOOSTER

station described and illustrated herewith is owned and operated by the combined gas, electric light, and street railway interests of the town of Peekskill, situated on the Hudson River, about 41 miles from New York city. Temporarily, or until the increased demand for electric current necessitates a change, there will be used in the new plant a part of the equipment of the company's old station, which was located on the hillside, near the center of the town, and to which it was very expensive to haul coal for fuel, the cost of carting amounting to 50 cents per ton. This expense is entirely obviated in the new plant, which, being located on the water front, is admirably situated for the cheap reception and handling of coal in bulk, as well as for the disposal of ashes.

The power house, which is 77 ft. wide by 100 ft. long, is of the most approved type, well-lighted and ventilated; its proportions, as well as the general character of the plant throughout, having been determined with reference to the prospective as well as the present load. The building proper is of fireproof construction, with brick walls, steel columns and steel roof trusses. It stands close to the tracks of the New York Central Railroad, parallel with and facing the Hudson River. The concrete foundations with capping timbers rest on piling driven to bedrock, a method of construction made necessary by the soft, unstable character of the soil. Otherwise the building might have been caused to settle and move outward toward the railroad embankment by the weight of the power house walls, machinery foundations and equipment, and by the constant jarring of passing trains. The piles were spaced 2 ft. and 3 ft. apart, center to center, and were cut off and capped below low water level, to insure practically unlimited life of the piles and timber caps by having them always submerged. The inshore wall of the power house is built upon a concrete footing that rests on the bedrock, to which the foundations for the engines and dynamos are carried, as indicated in the accompanying sketch. In order to guard against any movement of the heads of the piles adjoining the railroad tracks, the caps resting on the piles were of 12-in. x 12-in. timber, laid parallel with the river and secured to the piles by mortises which fitted tenons on the pile-heads, while at right angles to the caps, at intervals governed by the spacing of the piles, there were placed pieces of 12-in. x 12-in. timber long enough to support the concrete pier footings carrying the wall above. To insure still greater stability the piles were further secured by splicing long capping timbers, so as to form practically continuous ties which extend inshore and are anchored to the heavy, buttressed foundations of the inshore wall. These tie timbers



ALTERNATING CURRENT AND RAILWAY SWITCHBOARD

were boxed or notched over the caps and spliced by heavily bolted ship joints.

The equipment of the boiler room, which is 44 ft. x 98½ ft. in size, consists at present of four 6-ft. x 18-ft. Bigelow return tubular boilers, each of 150 hp and built to carry 150 lbs. pressure. Provision has been made for the future addition of two more boilers of the same size. The boilers are fitted with Roney mechanical stokers, to which coal is delivered by gravity from an overhead,

concrete and steel coal storage bunker through weighing hoppers of approximately one-ton capacity each, the two delivery outlets of each hopper being closed by slides to permit of weighing the fuel before it passes to the stoker. The arrangement of the scales, which are located on the wall opposite the stokers, and also of the weighing hopper, is shown in one of the illustrations. Combustion is regulated by means of mechanical induced draft, the boiler uptakes being connected to a flue 5½ ft. in diameter, through which the products of combustion are drawn by either one of the two 120-in. Buffalo fans shown in the accompanying elevation of the power house. Provision has also been made for the future installation of a fuel economizer. The mechanical stokers and mechanical draft apparatus were furnished by Westinghouse, Church, Kerr & Company, New York. Coal is delivered to the storage bunker by means of an overhead steel bridge spanning the New York Central Railroad tracks and connecting the company's dock on the river channel with the power house coal yard by an automatic railway. The dock carries a coal hoisting tower with electrically operated tub hoist, mast, hopper and weighing scales. The machinery used for unloading soft or low grade coal from scows at the dock is also utilized to handle the hard coal for the company's gas works adjacent to the electric power house. This arrangement insures cheap water transportation rates for coal, and also permits cheap delivery of Texas oil for fuel if desired.

The feed water for the boilers is supplied by the town waterworks, under an average pressure of 120 lbs. and, after passing through Blake feed pumps, is measured by an extra heavy Worthington water meter. For heating the feed water a Harrisburg primary horizontal feed water heater of 500-hp capacity, arranged eccentrically to drip at the lower end, is provided, and also an auxiliary vertical heater of the same make and capacity. Both heaters are made by the Harrisburg Pipe and Pipe Bending Company, of Harrisburg, Pa. As indicated by the accompanying view of the feed water piping, a system of by-passing permits the use of either heater separately or both in combination, so that possible injury to any part of the feeding system would not affect the continuous operation of the plant; and also in case of a failure of the town water supply connection can immediately be had with the river, which at that point in the Hudson contains on the average about seventy-five grains of salt per gallon. Provision has been made at one end of the boiler room for the installation of a compression refrigerating system for the manufacture of ice and for cold storage business. The outlines of this apparatus are shown by dotted lines in the plan of the building. A Kipp hydraulic elevator is provided at the south end of the boiler room for raising the hand cars by which the coal is transported from the yard to the overhead coal storage bunker, a corner of the north end of the boiler room serving for toilet rooms and shower bath for engineers, firemen and attendants. Steam from the power house boilers is also supplied to the gas house for power and gas making purposes, while electric current is supplied to the coal hoist on the deck and to a stone crusher near the power house which provides macadam ballast for maintaining the roadbed of the trolley system.


BUILDING FOUNDATIONS FOR POWER STATION

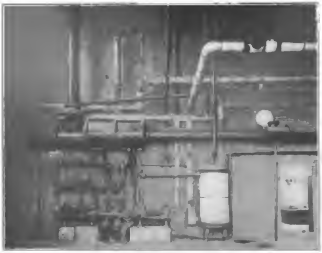
The main steam and exhaust headers are carried on the boiler room side of the brick fire wall between the engine and boiler rooms, the supply and exhaust pipes for the engines passing through openings in the wall. The 10-in. live steam header is supported by brackets and I-beams and is anchored to the separating wall practically at the center of its length, expansion taking place both ways from that point. It is divided into three sections, provided with


THE STORAGE BATTERY INSTALLATION

gate valves, so that any given section may be shut off from another, in case repairs or changes are necessary. The exhaust header, varying from 18 ins. outside diameter to 14 ins. inside diameter, is supported throughout its length by pipe columns resting on the floor. The live steam and blow-off fittings are extra heavy, all material throughout the plant being of the best obtainable.

The live steam piping is designed to carry a regular working pressure of 150 lbs., and straight-way, self-packing, gate valves are in general use to permit a free flow of steam. Corrugated copper gaskets, well smeared with a thick mixture of red and white lead and linseed oil, are used in live steam piping. The exhaust piping is also provided with gate valves. Flanged valves are used throughout down to three inches to readily permit removal if worn or defective.

The extra heavy blow-off header, 4 ins. in diameter, back of the boilers is also cross-connected, so as to be used as an emergency feed line. Steam header drips run to a 2-in. drip header, which is connected with an Anderson trap, thence venting into the sewer. This drip header has an independent connection with the sewer through a by-pass

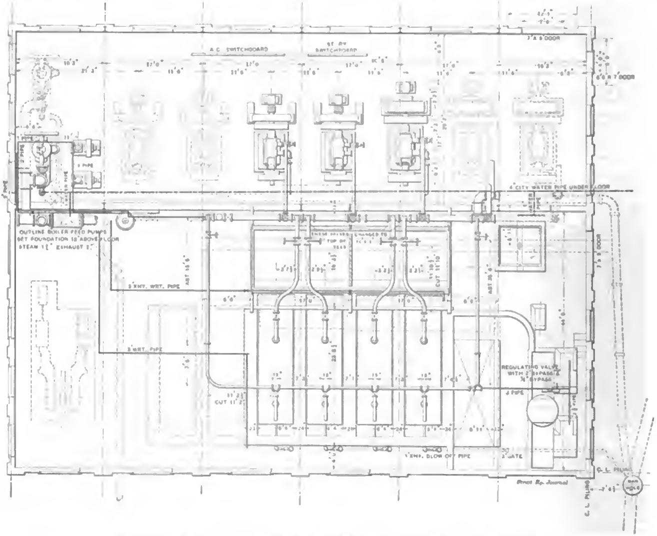

FEED-WATER HEATERS AND PUMPS

around the trap; in fact, all traps are by-passed and each is provided with a three-way cock on the outlet of the

trap, so that leakage through the trap may be detected by opening the three-way cock into the room. The low pressure drips, as well as all drips from throttle valves and high-pressure cylinders, are run through the engine room floor, venting into the space below. Exhaust drips containing cylinder oil from exciter engines, feed pumps, heaters, etc., are piped to an oil separating tank under the boiler room, where the oil is separated from the water.

The live steam piping throughout the plant is covered with a 2-in. thickness of 85 per cent magnesia covering, neatly finished with canvas, and painted with fireproof paint, the exhaust piping being uncovered. Fire protection is secured by direct connection with the town water supply. Standpipes rise through the power house floor to a height of about 5 ft., where hose attachment is made. Two of these pipes are located in the engine room, one at each end, and one in the boiler room.

The engine room, which is separated from the boiler room by a 12-in. brick wall, is about 29 ft. wide x 98⅓ ft. long. It contains a small portion of the generating apparatus of the old station. The old station equipment comprised one horizontal Armington & Sims simple engine, belted to a 550-volt direct current Edison bi-polar 60-kw generator, supplying current to the trolley system, the engine being also belted, in tandem with the Edison dynamo, to a four-pole Western Electric differential booster, supplying current to a storage battery installation of 264 cells, having a capacity of 240 amps. and connected through main trolley line with the generators; one Westinghouse standard engine, 11 ins. x 10 ins., belted to an old style Westinghouse alternator and No. 2 exciter; one Westinghouse standard engine, 11 ins. x 10 ins., used as a reserve, belted to a 750-light old style Westinghouse alternator; one Westinghouse compound engine, 11 ins. and 19 ins. x 11 ins. stroke, belted to a 60-kw Stanley inductor alternator and Westinghouse No. 2 exciter; and one Westinghouse compound engine, 14-in. and 24-in. cylinders, by 14-in. stroke, belted to a 150-kw Stanley inductor alternator, with a 3-kw C. & C. exciter and also to a 120-kw Westinghouse direct-current, 550-volt generator. Of this equipment the two last-named compound engines, and the 120-kw railway generator form a part of the new plant, in addition to which there are installed three new Westinghouse, direct-coupled, compound engines and generators, making a total in the present plant of five compound engines, the largest of which, with cylinders 16 ins. and 27 ins. in diameter, by 16-in. stroke, has a rated capacity of 300 hp at 125 lbs. steam pressure, when running condensing at a speed of 250 revolutions per minute. This engine is direct-connected to a 550-volt direct-current, eight-pole Westinghouse generator of 150-kw capacity. The other two new compound engines have cylinders, 14 ins. and 24 ins. in diameter by 14-in. stroke, and similarly rate at 250 hp each. These engines are direct-connected to Westinghouse, 2200-volt, two-phase, 60-cycle, alternating-current generators, each of 150-kw capacity. The 14-in. Westinghouse compound engine from the old station is belted to the 120-kw direct-current railway generator from the old station, while the 11-in. compound engine from the old station is belted to a 75-kw Westinghouse alternating-current generator similar to those above described. The alternating current is used for general commercial lighting, for series incandescent street lighting, and also for motors on power circuits for commercial purposes, the direct current being used for operating the electric road. Provision has also been made and foundations furnished for the additional later installation of two 16-in. and two 14-in. engines, with generators of the above direct-connected type, so that the ultimate equipment of the station will comprise three 16-in. and four 14-in. Westinghouse compound engines, having an aggregate capacity of nearly 2000 hp under 150 lbs. steam pressure.



PLAN OF STATION. DOTTED LINES SHOW POSITION OF APPARATUS NOT YET INSTALLED

When the demand for current warrants it, one of the new 14-in. compound engines to be installed will replace the old 11-in. compound engine, while the other 14-in. engine will occupy the foundation of the dynamo at present belt-driven from the 11-in. engine. At the other end of the power house the two new 16-in. compound

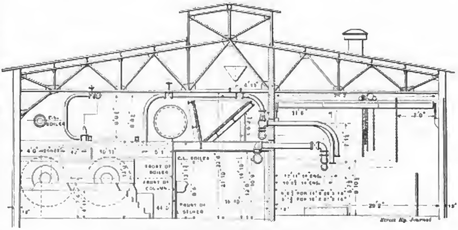
engines will take the place of the old 14-in. engine and its belt-driven railway generator, now temporarily mounted on one of the 16-in. engine foundations. The engines were furnished by Westinghouse, Church, Kerr & Company.

As shown by the accompanying plan, the exciter sets, made by the General Electric Company, consisting of two 15-kw generators, direct-connected to 8-in. x 6-in. engines, are located at one end of the engine room. The extreme corner of the room is occupied by a Conover jet condenser, river water being used for condensing purposes. The exciter engines are operated at less than boiler pressure, steam being taken to a low pressure receiver through an adjustable reducing valve, by which the steam pressure is reduced from 125 lbs. or 150 lbs. to 80 lbs. per square inch. The piping is so arranged that in case of injury to the reducing valve the exciter engines may be operated by taking steam through a 1-in. pipe, by which the steam is throttled sufficiently to reduce its pressure to the required amount. The steam supply to a Westinghouse air pump, which is used to furnish compressed air at about 30 lbs. pressure for blowing out dust and dirt from the electrical machinery, is taken from the exciter engine steam supply line between the reducing valve and the exciter engines.

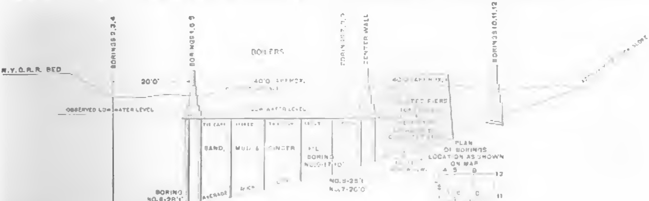
The lighting and railway switchboards are of Westinghouse make. The usual measuring instruments, switches, pilot lamps, rheostats, circuit breakers, etc., are mounted thereon, the panels being of 2-in. blue Vermont marble, and all metal work copper finished. To facilitate handling and repairing of apparatus, the engine room is spanned by a 5-ton traveling crane made by the Reading (Pa.) Crane & Hoist Works.

The construction of the engine room floor is worthy of note. A smooth false work of 2-in. plank was closely laid, hard up under the top flange of the floor I-beams, this false work being supported by blocks resting on the top of the bottom I-beam flange. The top of the false work was thus brought about an inch below the top of the I-beams. On the false work so constructed, and raised from it about an inch, expanded metal sheets were laid with the long axis of the diamond at right angles to the floor beams, the I-beams, and to avoid general surface cracking the floor was kept wet for two weeks after laying.

One feature of the equipment of both the old and new stations that deserves special mention is the use of a storage battery for leveling the load, the character of which would otherwise at times be indicated on the load diagram by extremely high peaks, due to the demand for current when cars are ascending the hills. The character of the road is such, and it is necessary to so arrange the schedule, that at certain times during the day the majority of the cars are on the up-grade. The road is an unusually hilly one, so much so that fairly level portions are the exception and are never more than 1000 ft. in length, the heaviest grade being about 9 per cent. The storage battery consists of 264 chloride accumulator cells, made by the Electric Storage Battery Company, Philadelphia. Each cell was originally composed of fifteen plates 10½ ins. square, suspended in glass jars, and mounted upon a wooden tray filled with sand to insure an even foundation for the jar. These trays rest in turn upon glass insulators supported by a wooden rack. On full charge the battery had a maximum rated capacity of about 160 amps. More plates have been added recently, and the capacity is now 240 amps. As a matter of fact, however, it is often called upon to discharge at even a higher rate than this.



SECTIONAL ELEVATION OF POWER STATION



SECTION THROUGH FOUNDATION, SHOWING METHOD OF CONSTRUCTION

sheets lapping 6 ins. on the ends and 3 ins. on the sides. The tensile strain coming on the ends only, it was necessary to lap the sheets 6 ins. in order that the concrete might bind the sheets together. The concrete was thoroughly worked under the metal sheets, which were thus protected from rusting by moisture on the under side. Five inches of concrete were laid, and above this a 1-in. finishing cement floor, composed of a mixture of the proportion of 4 lbs. excelsior carbon black, 1 bbl. Atlas Portland cement, 1 bbl. sand, and 1 bbl. extra fine quality 3-16-in. crushed granite. This made a smooth, glossy, slate-colored floor of extreme hardness and fine wearing qualities. It was divided into squares about 3½ ft. on a side. Expanded metal sheets were placed just below the top of the concrete over each of the I-beams, so as to prevent any tendency of the floor to settle in the center and crack over the

The value of the storage battery was well illustrated in the old station in the operation of both lighting and railway generators from the same engine, an arrangement which ordinarily would produce serious flickering in the lights, but with the battery in use it was impossible to detect the slightest change in the brilliancy of the lamps, although the railway load might be fluctuating between its widest limits. While no tests have yet been made to determine the saving of coal through the use of the storage battery, it is believed that such saving is sufficient to pay a good return on the battery investment, over and above the interest and depreciation charges. This belief is largely based on the increased economy of a unit operating at a constant load approximating its rated capacity, as contrasted with one of, say, three times the size, but doing the same work under widely fluctuating load conditions. The

battery prevents all sudden overloads from the generating machinery, and the strain thus removed from the minds of those in charge is a valuable consideration as well. The battery is also valuable in other ways, as in case of a mishap necessitating temporary generator shutdowns. At times it is also desirable to run a car for some special occasion very late at night, when the generators are shut down, and by throwing on the battery the necessary current is then immediately available. The battery is located in

BOILER ROOM

a detached brick building a short distance from the power house. The storage battery booster mentioned in connection with the equipment of the old station is utilized in the new plant, where it is driven by direct connection to a Westinghouse, 30-hp, 550-volt, direct-current motor.

On account of the change from 133 cycles in the old, to 60 cycles in the new station, the transformers and meters on the system were replaced by new apparatus of Westinghouse make. For the use

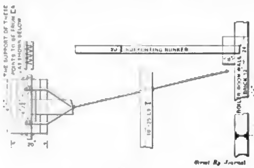
CONDENSERS AND EXCITER SETS

in connection with the series street incandescent lighting system, there are provided in one corner of the engine room six General Electric automatic reactive coils for controlling and regulating the voltage on the several street lighting circuits.

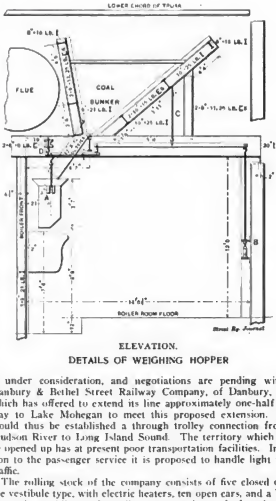
The electric railway was put in operation in July, 1899, the tracks extending from the New York Central & Hudson River Railroad station in a practically straight line through the main streets of the town to Lake Mohegan, a distance of about 5 miles, with a ¾-mile branch to the State Camp Ferry.

Leaving the town proper the road to Lake Mohegan traverses a beautiful rolling country dotted with the summer residences of wealthy New Yorkers. There is also a line of track, about 6 miles long, running through the residential section of Peekskill, thence through Centerville and Buchanans to Verplanck Point, where there is a popular pleasure resort. This branch of the trolley line serves a population of about 2500 people, who would otherwise have no means of reaching Peekskill except by stage.

An extension of the trolley system from Lake Mohegan eastward



PLAN.



ELEVATION.

DETAILS OF WEIGHING HOPPER

is under consideration, and negotiations are pending with the Danbury & Bethel Street Railway Company, of Danbury, Conn., which has offered to extend its line approximately one-half of the way to Lake Mohegan to meet this proposed extension. There would thus be established a through trolley connection from the Hudson River to Long Island Sound. The territory which would be opened up has at present poor transportation facilities. In addition to the passenger service it is proposed to handle light freight traffic.

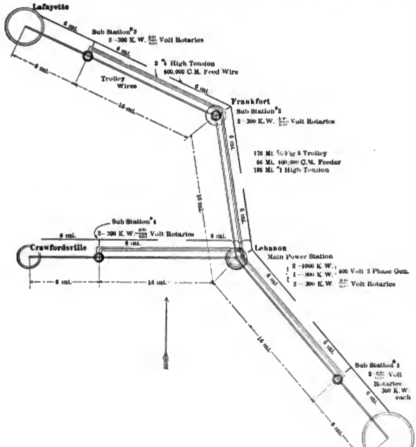
The rolling stock of the company consists of five closed cars of the vestibule type, with electric heaters, ten open cars, and a Wason snow plow. All are of excellent construction and of modern type. The car motor equipments are of Westinghouse make. The car house, to which an addition has just been made, is a substantial fireproof brick building with a capacity for twenty-five cars. Yards are provided for the storage of rails, ties and other materials.

The overhead construction of the system is simple, consisting of 00 trolley wire throughout, with 0000 feeder wire, tapped in at regular intervals and extending to within a half-mile of Lake Mohegan and within 1000 ft. of the power-house end of the road. The State Camp branch has no feeder. The entire line, representing 10 miles of single track, with 5 turn-outs, is constructed of 56-lb. T-rails, which are laid in the usual manner. The plant was designed and installed by Sanderson & Porter, engineers and contractors, New York.

High-Speed Electric Railway for Indiana

The Indianapolis, Lebanon & Frankfort Railway is another important high-speed line now being built out of Indianapolis, and will be second only to the Union Traction Company of Indiana in mileage. One peculiarity of this road will be that it passes through very few small towns, and will depend for most of its business on high-speed through service between Indianapolis, Lebanon, Crawfordsville, Frankfort and LaFayette.

The accompanying diagram of the road, which shows the electrical distribution and distances between towns gives a good idea of the actual route of the road, although only a diagram, because the route between cities, except from Indianapolis to Lebanon, will be practically straight. Running northwest from Indianapolis, the line parallels that of the Big Four Railroad as far as Lebanon, where the road branches, one line going to Crawfordsville, 24 miles west, the other north to Frankfort, 16 miles, and then 24 miles northwest to LaFayette. The road is to be single track with 70-lb.



MAP OF INDIANAPOLIS, LEBANON & FRANKFORT RAILWAY

T-rails on oak ties, well ballasted. There will be no grades to exceed 2 per cent, and very few of those.

In order to secure passenger business between these towns and Indianapolis, in spite of the competition of steam roads, high speed will be a necessity. The maximum speed figured on is something over 60 miles per hour. The cars will be equipped with four 75-hp motors. Cars are to be 50 ft. in length, of standard construction and with very fine finish and furnishings. The power house, as indicated on the map, will be located at Lebanon, and will contain two 1000-kw, and one 800-kw 400-volt three-phase generators, and two 300-kw rotary converters, taking 400 volts on the alternating current end, and delivering 650 volts to the trolley wire on the direct-current end. There are to be four sub-stations fed from the main power house by three-phase high-tension lines. Feed wires extend 6 miles each way from a sub-station as auxiliaries to the trolley wire.

It is the expectation to make the run from Lafayette to Indianapolis, 70 miles, in two hours. The time from Crawfordsville to Indianapolis, 54 miles, is to be one and one-half hours. There will be but very few stops between the towns. The schedule will be as high, or higher, than anything now being maintained in electric railway operation in the United States. All the principal towns connected by this road are county seats, and when it is completed it will connect five county seats and run through as fine a farming country as can be found in the State of Indiana.

Townsend, Reed & Company, railway builders, who now have headquarters at Indianapolis, are the contractors and financiers of the road. The officers of the Indianapolis, Lebanon & Frankfort Railway are: George Townsend, president; Pierre Gray, vice-president; Robert P. Woods, treasurer, and W. S. Reed, secretary.

Atlantic Avenue Improvement

The Atlantic Avenue, Brooklyn, improvement will be continued in spite of the attempt to stop the work by injunction. The application of the Brooklyn Rapid Transit Company for a restraining order to stop the depression of the tracks of the Long Island Railroad in Atlantic Avenue has been denied by Supreme Court Justice Smith. The work of tunneling and track depression had made considerable headway before the Brooklyn Rapid Transit Company applied for the injunction. The fight, it is said, grew out of the denial of the right of the Brooklyn Rapid Transit Company to run a trolley line through the avenue after the steam cars have been removed.

Justice Smith says that the delay of the Rapid Transit Company in beginning this action and making the claim that the Atlantic Avenue improvement is illegal and violative of its rights as landlord of the Long Island Railroad Company is inexcusable and unexplained, and furnishes a sufficient and conclusive reason why the preliminary injunction ought not to be granted. The court refers to the public agitation for years for the removal of steam cars from the surface of Atlantic Avenue, and the final appointment of a commission by the State Legislature to put the improvement through, all of which was known to the Rapid Transit Company, which made no move in the matter until work had begun under the several contracts.

Electrical Industries of Pittsburgh

At the recent annual meeting of the American Association for the Advancement of Science, which was held at Pittsburgh, Pa., and at which 400 members were present, an interesting address was given by George H. Gibson, of the Westinghouse Companies' Publishing Department, on the "Electrical Industries of Pittsburgh and Their Economic Influence." Mr. Gibson spoke of the rapid growth and present extensive dimensions of the Westinghouse Electric & Manufacturing Company's plant, and pointed out that this immense installation is shortly to be duplicated. Continuing, he said: "The modern industrial age began with the advent of the steam engine, but, in order to utilize its power, some means of transmission was necessary. The agent par excellence for power distribution is electricity. Electricity has furnished also the most useful means of lighting, and electro-chemistry has opened up a new but rapidly developing branch of industries." Mr. Gibson spoke of electric traction as an important factor in developing cities, redistributing populations, building up suburban districts, and affording convenient transportation to farming communities. He also referred to the use of electricity in the modern factory, and of the possibilities of electricity in mining. He said that electro-chemistry has not only made aluminum a rival of copper as an electric conductor, but nearly all the copper is now electrically refined. He said that mechanical and engineering development is a measure of a country's civilization, and showed that the power plants of the United States generated 60 per cent of all the electricity used in the world, 76 per cent of all that portion available for traction, 76½ per cent of all the electric railway mileage, and 83⅓ per cent of all the trolley cars.

An Obstacle to Rapid Transit

BY HOWARD S. KNOWLTON

Rapid transit in cities is to-day a complex function of four important variables—right of way, equipment, operators and passengers. The transportation efficiency of any system is vitally dependent upon each one of these factors. This efficiency may be expressed as a percentage by dividing the safe running time of any equipment between two or more points by the actual time made in practice. The best that the equipment can do in accelerating from standstill upon a tangent level track in good condition, reaching maximum speed at normal voltage, maintaining this speed over unrestricted right of way until a quick braking stop ends the run, is the measure of minimum time possible between two points with the car brought to rest at each. Such a speed-time characteristic is ideal from the kinematic standpoint alone, and entirely neglects economy of power, judicious coasting, making up lost time on schedules, and, to some degree, comfort of passengers. Such a percentage is merely suggestive of possibilities, and is important to the maker of schedules in much the same way in which the electrical efficiency of a generator is of interest to the dynamo designer. The figure which most concerns the progressive manager is what might be called the "commercial efficiency of transportation," or the ratio of schedule time to actual time in the same units.

The relative importance of the four factors mentioned depends largely upon the system examined. Neither acceleration nor station stops are of prime interest on an interurban road from fifteen to twenty miles long or upward. Maximum speed of equipment and right of way are here in the front rank, while in a congested city street or on an elevated or underground line, acceleration and stops are of the utmost importance.

In perfecting the machinery of transportation remarkable progress has been made in all of these factors, with the exception of the last. The average passenger's inability to realize that he is to do his own part if he is to obtain and conserve rapid transit is most apparent on elevated railways and in subways through the crowded districts of large cities. Money spent for quick acceleration to high maximum speed is largely thrown away when station stops become prolonged to two-thirds of the running time between stopping points through the inability of the passengers to perceive the consequences of each second of delay. Multiple-unit control and 100 per cent weight on drivers can do little for the transportation efficiency if passengers fail to recognize the helplessness of the entire service against their own dallying. An excellent example of the importance of station stops in their influence upon the schedule is found in the operation of trains northbound through the Boston subway. From Pleasant Street to Haymarket Square, inclusive, a distance of about 1.13 miles, with 15-second stops at Pleasant Street, Boylston Street, Park Street, Scollay Square and Adams Square, the running time is easily made in 6 minutes, with a schedule speed of 11.3 miles per hour and an average speed of 14.5 miles per hour. Increasing the stops to seconds at each station brings the time to 6 minutes and 50 seconds, and lowers the schedule speed to 9.9 miles per hour, a reduction of nearly 12½ per cent. With stops averaging 35 seconds, a frequent rush hour condition, the trip is readily made in 7 minutes 40 seconds, schedule speed 8.8 miles per hour. The reduction from normal is over 22 per cent. The average distance between these stations is about 1195 ft., and the effect of stops would be still more pronounced if the alignment and grade were less severe. Adding 20 seconds to each of the stops on the Brookline circuit of the Boston & Albany Railroad, at present operated by steam, would lengthen the running time by about 11 per cent on a line 22.9 miles long with twenty-one stations averaging 1.09 miles apart.

On crowded city streets delays in passengers boarding or leaving cars are likewise pernicious, although to a less degree in the majority of instances. In spite of the fact that stopping points are fast becoming regularly designated in the best street railway practice by marked poles or signs, the average duration of stops does not bear as high a proportionate relation to running time as does that on a strictly rapid transit road, in view of the fewer number of passengers ordinarily encountered.

The remedy for such delays lies of course with the passenger and railway company jointly. It behooves every manager who has to meet the criticism of "slow service" to look well into the stops of his cars and trains. When a passenger is brought to realize that the aggregate delay to sixty of his fellow beings on a car or train is one minute for each second of time which he uses up in getting on or off, a step in the right direction has been taken. In America few men will intentionally delay others on a car in the face of the amount of public sentiment which can be produced by an impatient body of passengers. The company owes it to the public to see that its individual members realize the importance of each doing his part in making transportation safe and swift, and the passenger needs to be informed by open and fair illustration that, although the equipment may be well designed, the track level and straight, the operating personnel well trained, without his co-operation rapid transit on short, quick runs cannot be obtained.

Hearing on Pennsylvania Tunnel Franchise

The public hearing before the committee on railroads of the New York Board of Aldermen upon the Pennsylvania tunnel contract proved to be an interesting event, as it disclosed the policy of the opponents of the measure and the plan they propose to follow. Alderman Whittaker read a protest, in which he said in part:

"In my judgment the city should never grant perpetual franchises. The action of the Board of Rapid Transit, approved by the Mayor, is in its nature a usurpation of power. It is absolutely impossible to foresee all the conditions which should be provided against in behalf of the city. Hundreds of contingencies exist; thousands of possibilities lie dormant, most of which cannot be solved at this time; and the attempt to solve them by a contract which binds the city perpetually is to attempt the impossible."

Alderman Doull wanted to know why the commission had not required bonds from the company as in the case of the contract for the subway. Comptroller Grout answered that the company intended to spend about $50,000,000 in building the tunnel, and that the city would have a lien on its property for the proper execution of the work and to protect the city against damage claims. Mr. Grout added that the proposed railroad, while it would prove of great benefit to New York, would not only not cost the city a penny, but would be a profitable source of revenue. "If every railroad company owning franchises in the city paid as much for their trackage as the Pennsylvania will pay," said the Comptroller, "our revenue would be increased by about $10,000,000 a year."

Alderman Doull wanted to know what was the real purpose of the Pennsylvania Company in seeking the franchise. He was sure there was "something hidden behind the whole thing," and the aldermen ought to know all about it and they would before the franchise was granted, said he.

"It is well known," responded Mr. Boardman, "that the Pennsylvania Company has acquired control of the Long Island Railroad. The Pennsylvania Company is desirous of competing with the New York Central Company, and for that purpose it wants an entrance into New York. The Pennsylvania also wants a large share of the competitive passenger business of Long Island. Therefore, it wants to connect its main system with the Long Island system. Then they are interested in the freight traffic, and I suppose they also have some views with regard to the future."

For the closing up of Thirty-Second Street between Seventh and Ninth Avenues, the Pennsylvania will pay $788,000. This amount, Mr. Doull said, was a pittance and did not represent the value of the property. The eight corners to be taken over were worth at least $100,000 each, he said.

Then the real animus of the opposition was revealed, and, as had been expected, proved to be the jealousy of the aldermen because of the great powers vested in the Rapid Transit Commission. The alderman then attacked the Rapid Transit Commission. It was a self-perpetuating body, he said; was not responsible to the people, and therefore should not be empowered to have any control over the granting of public franchises. Then other aldermen protested that the franchise was a perpetual one, that the readjustment clause did not sufficiently protect the city, and that the contract contained no eight-day clause. Mr. Doull called into question the sincerity of the Rapid Transit Commission. He said it seemed to him that the commission had sought only to safeguard the interests of the Pennsylvania Company.

Mr. Orr resented the imputation. So far from giving the company any advantage, he said, Mr. Cassatt and other officers of the company had charged that the commission was trying to keep them out of the city by making the terms prohibitive and had pointed out that in no other city in this country or in Europe had a railroad company been charged for sub-surface privileges.

Controller Grout then said he wished to impress on the committee that this was not a case in which municipal ownership could be considered, as the railroad was not for citizens within city limits, but for travelers from distant parts. Referring to the eight-hour labor law, the controller said he sympathized with the Central Federated Union, but at no time did it occur to the members of the commission that it could be inserted in this franchise, as it was dealing with a corporation.

At the conclusion of the hearing it was generally believed that

some delay would be experienced and that the contract between the city and the railroad could not be executed before the fall, but there seems to be no doubt that the franchise will be granted on the present terms. It was announced that the better element of the Board of Aldermen was convinced that the building of the tunnel would be a good thing for the city, and the leaders of the Republican party in the various boroughs have promised that they will exert their influence to have the plan pushed through without delay. The franchise will be approved by the aldermen early in September. A majority vote for the contract has already been assured.

In speaking against the approval of the suggested contract on Friday Alderman Doull said that he lived in the region where the terminal is to be built, and that the property owners of that district were opposed to the Pennsylvania project for the reason mainly that the city had not insisted on the company paying more money than was stipulated in the contract for the closing of that street. When the resolution to approve the franchise comes up before the aldermen a petition will be presented wherein it will be shown that over 90 per cent of the property owners are in favor of the Pennsylvania tunnel scheme, and facts will also be brought forward to demonstrate that since the plan of the company has become known the value of property in the district has increased considerably.

Car for the Distribution of the Chicago Tribune

The Chicago Tribune recently put in operation, on the Chicago City Railway, a special car for the early morning delivery of its papers. This car, which is shown in the accompanying engraving, was rebuilt by the Chicago City Railway Company from one of its single truck box cars, the main change being the removal of the ordinary seats and cutting of doors in the sides, through which large bundles of newspapers can be passed. This car leaves the

TROLLEY CAR FOR NEWSPAPER DISTRIBUTION

corner of Clark and Washington Streets at 3.45 a. m., and runs down Clark Street and Wentworth Avenue as far as Englewood, about seven miles. At points along the line distributing wagons meet the car and relieve it of its load of newspapers. There would seem to be no good reason why a similar practice could not be carried out in many other cities and in other parts of Chicago. This is the first move made by any of the Chicago street railway lines towards carrying anything but passengers and the United States mail.

Baltimore Company to Insure Employees' Lives

The United Railways & Electric Company, of Baltimore, has arranged to insure the lives of the motormen and conductors in its employ. In the case of fatal accident while in the service of the company the sum of $1000 will be paid to the family of the victim.

This arrangement has been entered into with State Insurance Commissioner Wilkinson, who is designated by a law passed by the last Legislature to act as agent for such a plan. This is known as the "Employers and Employees' Co-operative Insurance and Liability law."

It permits the employer to deduct one-half of the cost of this insurance from the wages of the employee. It has been decided by the management of the United Railways that the company will pay the entire amount and will make no deduction from the wages of the men. It will cost 60 cents for each employee so protected, and the aggregate to be paid by the United Railways will be about $1800 a year. The insurance is to be accepted as settlement for any claim against the company, and in this sense is a mutual arrangement between employer and employee.

What is Meant by a Grade Stated in Per Cent?

BY CARL HERING.

It has become customary in this country, and the custom is a good one, of stating grades in per cent, meaning the vertical rise in feet for every 100 ft. of distance. In France the expression "0/00" instead of "%", is often used in a similar way for very slight grades, and it then means per thousand instead of per hundred. In England the reciprocal value of the per cent is used, that is, instead of referring to the rise per hundred feet distance, the slope is indicated by the distance in which the rise is 1 ft. What the advantages are in the English system is not apparent, but as neither the French nor the English system is used in this country neither need be discussed here; it suffices merely to know what they mean when we read foreign literature.

In stating grades in per cent, the question arises, "What is meant by the distance of 100 ft.? "Is it the horizontal distance, as would be measured on a map, or is it the sloping distance as would be measured by the length of rail or track? Or, in mathematical terms, does the term per cent refer to the tangent of the angle of the slope, or to its sine? Reference books of the "shears and paste" order use the term per cent without defining it, while others do not use the term, but give grades in other terms, which involve no ambiguity, leaving one in the dark, however, as to what is meant by per cent.

Before preparing a table which involved this question, the writer obtained the opinions of a number of experts, and from these it was found that practice was decidedly different among different engineers; some say the tangent is invariably meant, others say the same of the sine; some were more cautious and said that a certain one was "usually" meant. Owing to this discrepancy, the matter was considered to be of sufficient interest to warrant calling attention to the ambiguity and to the lack of any uniform practice. This ambiguity is not without due cause, however, as there are good reasons for sometimes referring to the horizontal distance and sometimes to the inclined distance, and it is therefore improbable that uniformity will ever be established, much as it may be desired. When maps are used the horizontal distance is invariably referred to, as that is the one directly measurable on maps; the tangent is then meant in stating grades in per cent. On the other hand, in using the usual formulas or diagrams for calculating the tractive effort or resistance on grades, the sloping distance or length of track seems to be invariably meant, as the part of the tractive effort due to the grade then bears the same relation to the total weight of a car or train as the rise bears to the sloping distance; or, in other words, on a 3 per cent grade, for instance, this tractive effort will be 3 per cent of the weight; this calculation, therefore, becomes very simple. In the latter case the term percentage refers to the sine and not to the tangent. This difference in the use of the term "per cent," when referring to grades, shows the necessity of stating what one means when one uses this term. In existing literature, in which an author did not explain what he meant, the probabilities are that if he is a civil engineer or steam railroad engineer he meant the tangent, and if he is an electrical or mechanical engineer and referred to the tractive force, he meant the sine.

It can readily be shown that in the usual engineering calculations involving grades, there is really no material difference whether the tangent or the sine is used. In the usual steam railroad practice, involving only very small grades, the difference would hardly be measurable, and either the tangent or sine may be used in calculations, depending upon which is the most convenient. In electric traction, grades on adhesion roads rarely amount to 14 per cent or over, and it will be found that for a grade of 14 per cent (about 8 degs.) the difference between the tangent and sine is almost exactly 1 per cent, from which it follows that in most engineering calculations involving grades not over 14 per cent the question of whether the tangent or sine was meant is of no great importance unless great accuracy is required. It is in tables which are intended to be accurate, and in calculations involving steep-grade cable roads, inclined plane roads or rack and pinion roads, that it becomes important to state clearly whether it is the horizontal distance or the slope distance that is referred to when the grade is stated in per cent or per thousand or by the English method. As these cases are by no means infrequent, however, it is very desirable that one of the two methods be made standard, so that it may be clearly understood whether the tangent or the sine of the angle of slope is involved in denoting the grade in per cent.

Brooklyn Bridge Plans

Mr. Parsons' plan for relieving the crush at the Manhattan terminal of the Brooklyn Bridge, and providing adequate facilities for future developments, seems destined to meet the same fate as its predecessors. As announced last week the Parsons plan was received with favor by the Rapid Transit Commissioners, and a resolution approving it was passed unanimously; but at the next meeting this action was reconsidered after Bridge Commissioner Lindenthal had had his innings, and the approval was withdrawn so far as it related to the Nassau Street plans. Mr. Lindenthal's communication reviewed the plan proposed by Mr. Parsons, and revived the agitation for a moving sidewalk. He said in substance:

MR. LINDENTHAL'S PLAN

The connection of the bridge with the Williamsburg bridge by tunnel road under Centre Street offers decided advantages, for the reasons so convincingly stated by Mr. Parsons, and which must be obvious to any one who had studied the situation. My former recommendation of connecting the Manhattan end of these two bridges by means of an addition to the present elevated railroad along Park Row and the Bowery had for its principal reason the avoidance of disfigurement of Centre Street.

While the elevated railroad which I had proposed for the connection of the bridge termini offered easier grades and would have been less costly to build and to operate, it carried with it the complication of a necessary combination with the Manhattan Elevated Railroad Company, whose structure is now on Park Row and the Bowery.

A tunnel from the Manhattan terminus of the Williamsburg bridge, along Delancey Street to Centre Street, can be built independently of the Manhattan Elevated Railroad, but there is little question that this company will find it to its interest to join the city in the construction of a suitable station at City Hall Park. The bridge terminal would be under the street level, and the Manhattan Elevated Railroad above the street level, and over the same land.

If, however, no arrangement could be made with the Manhattan Elevated Railroad Company for a station in common at this point, the city will still be able to go ahead with its own improvements.

The Williamsburg bridge will be of very little use unless provided with a direct approach to the City Hall region of Manhattan; therefore, the connecting link from the Williamsburg bridge down town should be commenced at the earliest practicable moment. The present indications are that the Williamsburg bridge will be completed Oct. 1, 1903.

The tunnel under Delancey Street and Centre Street can be built, if necessary for financial reasons and to save time, in two installments; the first being from the Williamsburg bridge to the intersection of the proposed extension of Delancey Street and Centre Street. At that point, which is near the Spring Street station of the subway, passengers could be temporarily transferred from the Williamsburg bridge to the subway under Elm Street, until such time as the second installment of the tunnel, under Centre Street to the terminal at the Brooklyn Bridge, shall have been completed.

To this end it would be advisable at once to carry out the plans now before the local Board of Public Works in regard to widening Delancey Street, from Clinton Street to the Bowery.

The continuation of the tunnel tracks on Centre Street to the Manhattan end of the Brooklyn Bridge, and the underground station there, could be done while the Williamsburg bridge is in use, with its tunnel approach temporarily ending at Elm and Spring Streets.

In regard to depressing the trolley tracks from the Brooklyn Bridge to a tunnel in Nassau Street, it is my opinion that the work should not be considered until the proposed tunnel under Maiden Lane shall have been authorized.

In the meanwhile, the traffic over the Brooklyn Bridge is certain to grow, notwithstanding the relief which the Williamsburg bridge will afford, and it is absolutely necessary to increase the transportation facilities over that bridge, without waiting for the completion of the Williamsburg bridge, or the Whitehall Street tunnel, or the Maiden Lane tunnel.

Permanent relief over the Brooklyn Bridge can best and quickest be given by a moving platform. I have pointed out before that the transportation capacity of the moving platform is several times as great as that of a string of trolley cars crowded to the utmost, which is the rule now on the bridge during rush hours. It would at once more than double the capacity of the present structure, which must be relied upon for several years as the principal outlet to the Borough of Brooklyn.

The safety of the bridge and its durability will be enhanced by substituting for the present concentrated trainloads the uniformly distributed and much lighter load of a moving platform—until such future time when the antiquated stiffening system can be replaced with a modern construction of two decks, carrying at least six tracks. Then it will be an easy matter to change the moving platform from one set of tracks to another, and thus in the end the Brooklyn Bridge may accommodate elevated trains, trolley cars, and the moving platform—all on the same structure.

A moving platform can be placed upon the Brooklyn Bridge in nine months' period, in connection with an orderly and systematic trolley terminal at the Brooklyn end of the bridge—for which there is ample room on the bridge plaza owned by the city—can be readily built. The Brooklyn Rapid Transit Company, with the same number of cars which it owns now, will be able to accommodate the traffic more efficiently at that point and throughout Brooklyn.

I beg, therefore, to recommend: First, that the tunnel line be built from the Williamsburg bridge to Centre Street and down Centre Street to the City Hall terminus, and that accurate plans and estimates of cost be prepared therefor; second, that simultaneously a moving platform be installed on the Brooklyn Bridge, and that the necessary legal steps be authorized therefor; third, that all further improvements be taken up later, and in a systematic manner, so as to fit into a general scheme of rapid transit connection between the East River bridges and rapid transit lines on both sides of the East River.

CONDITION OF BRIDGE

In the discussion which followed the reading of this report Mayor Low stated that he was now satisfied that so much of Mr. Parsons plan as related to the Centre Street subway met with the approval of the majority of citizens He therefore asked the commission to authorize him to ask Mr Parsons to co-operate with the Bridge Commissioner in the preparation of detailed plans. As to that part of the Chief Engineer's plan which referred to Nassau Street, he had reached the conclusion that this was a matter which required careful study, and therefore he would withdraw that portion of the resolution offered by him at the last meeting of the board, which referred to the Nassau Street plans.

The board having agreed without discussion to the proposal that Mr. Parsons should discuss the details of the Centre Street plan with Mr. Lindenthal, an informal discussion arose concerning the merits of the movable platform system as it might be applied to Brooklyn Bridge.

George S. Morison, a civil engineer, explained the advantages of the system, and was seconded in his efforts by the Bridge Commissioner. Mr. Morison and Mr. Lindenthal agreed that the moving platform would travel at the rate of from 2½ to 10 miles an hour. They admitted, however, that if the bridge trains were used in addition to the platforms it would be necessary to build a new suspended superstructure. This, Commissioner Lindenthal remarked, could be done at a cost of about $2,000,000, and he added: "The Bridge is not adapted to the trolley car traffic it is now mostly used for. The capacity of the bridge has now reached its utmost limit, and although the anchorages, cables and piers are all right yet, it is only by keeping a large staff of men at work inspecting the already overstrained stiffening trusses and in looking out for the starting of rivets that it is possible to insure safety under the present conditions of traffic." This statement was corroborated by William Barclay Parsons and George S. Morison, another engineer of prominence.

Increase in Passengers Carried in St. Louis

According to the statement of the St. Louis Transit Company, filed with the City Register on July 9, the business of the company for the quarter ended in June has surpassed the record of any quarter since the organization of the company. In the three months 33,229,842 passengers were carried in 1,296,544 trips. In the same period last year 30,210,677 passengers were carried in 1,262,436 trips. In April, May and June, this year, 34,108 more trips were made than in the same quarter of last year, and 2,019,165 more passengers were carried. A large increase over the same period of 1901 was also made in the first quarter of this year. The half-year closing June 30, was, judging from returns on file, most prosperous that the St. Louis Transit Company has ever had. In January, February and March of this year 31,575,192 passengers were carried in 1,145,634 trips. In the same months in 1901, 25,713,910 passengers were carried in 1,268,952 trips. In the first quarter of this year 123,318 less trips were made than in 1901, but 5,861,281 more passengers were carried. In this half year the company carried 64,805,033 "revenue passengers" in 2,442,178 trips, as compared to 55,924,587 passengers in 2,531,388 trips in the first six months of 1901. The passenger patronage shows an increase for the six months of 8,880,446 fares, and a decrease of 89,210 in the

number of trips, though, in the record-breaking second quarter, there was an increase in trips.

A comparative statement follows:

	Passengers	Trips
First quarter, 1901	25,713,910	1,268,952
Second quarter, 1901	30,210,677	1,262,436
Totals	55,924,587	2,531,388
First quarter, 1902	31,575,191	1,145,634
Second quarter, 1902	33,229,842	1,296,544
Totals	64,805,033	2,442,178

An Interesting Organization Chart

The chart illustrated on this page has recently been prepared in the office of President J. L. Greatsinger, of the Brooklyn Rapid Transit Company, and shows the relation borne by the various officers of that company to each other. There have recently been a number of changes made in the personnel of the company, and during the process some of the offices have been abolished and new ones created. That no confusion might arise, the accompanying chart has been drawn up, which shows effectively the several positions and the interdependence and relation of each to the others. A number of the offices indicated on the chart have not yet been filled, this being especially true in the rank of assistant. It will be noted that each principal of a department has an assistant, which greatly facilitates the performance of routine duties, as well as preventing confusion and delay should the chief be occupied when called upon for information, etc. Below is given a list of the principal officials, and those familiar with the former personnel of the company will notice a number of new names:

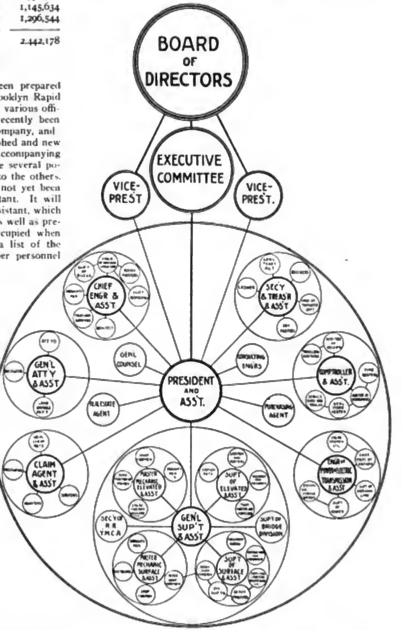
OFFICERS OF THE B. R. T.

President, J. L. Greatsinger.
Asst. to President, J. F. Calderwood.
Vice-president, H. C. Du Val.
Vice-president, Col. T. S. Williams.
Secretary and Treasurer, C. D. Meneely.
Comptroller, W. B. Longyear.
Auditor of Disbursements, W. M. Barnaby.
Auditor of Receipts, C. F. Wells.
General Superintendent, D. S. Smith.
Superintendent, Surface Lines, W. W. Wheatly.
Superintendent, Elevated Lines, G. W. Edwards.
Asst. Supt., Elevated Lines, F. L. Morse.
Superintendent, Bridge Divs., E. F. Reeves.
Master Mechanic, Surface, H. H. Williams.
Master Mechanic, Elevated, A. J. Wilson.
Asst. Master Mechanic, Elevated, J. D. Keiley.
General Counsel, Sheehan & Collin.
General Attorney, G. D. Yeomans.
Purchasing Agent, L. Van Cott.
Chief Engineer, J. C. Brackenridge.
Engineer of Way and Structures, E. H. Packe.
Architect, D. R. Collin.
Engineer P. and E. Transmission, C. E. Roehl.
Asst. Eng. P. and E. Transmission, C. B. Martin.
General Storekeeper, W. J. O'Connor.
Claim Agent, I. Isaacsen.
Chief of Transfer and Ticket Dept., H. A. Crowe.
General Ticket Agent, I. P. Devereaux.
Real Estate Agent, O. Harriman.
Pay Master, J. J. Bryers.

The chart was completed a week or two ago and has worked very satisfactorily. The careful manner in which the details have been worked out show the hand of an expert in organization, both from the financial and operating standpoint in the development of the system, and the harmonious condition which already exists in the relations of the various officials indicates a speedy improvement in the service as well as a more economical showing for running expenses.

Colorado Rate War Settled

Rate wars are commercial disasters, and their effect upon the value of securities is always deplorable. An example of this is found in the controversy between the Denver & Southwestern and the Colorado Springs and Cripple Creek District Railway, which has just terminated. For six months the Denver & Southwestern, and the so-called "Short Line," operating roads between Cripple Creek and Colorado Springs, have been engaged in a rate war. Passenger rates between Cripple Creek and Colorado Springs have been cut from \$2.75 to 25 cents, and merchandise has been carried as low as 5 cents per ton weight, and radical reductions made in rates for the transportation of ore. Previous to the rate war the Denver & Southwestern was showing earnings of 14 per cent upon its common stock, but when the fight was fiercest the company was not earning its dividends. It was strong in treasury assets, however, and in a position to meet its fixed charges for some time to come. Dividends of 5 per cent and 6 per cent respectively were paid upon the preferred and common stock up to February of this year, but payment of the quarterly dividend due in May was passed on account of the rate war.



ORGANIZATION OF BROOKLYN RAPID TRANSIT COMPANY

Before the misunderstanding with the Short Line the Denver & Southwestern Company's bonds sold at par, the preferred stock at 80, and the common stock at 82. During the rate war the bonds sold as low as 84½ and the nominal quotations for the stock were in the thirties. The bonds are now quoted at 91, the preferred stock at 55 and 60, and the common stock at 45 and 60.

The following official statement of settlement of the rate war has been issued:

"The rate war between the Denver & Southwestern and the Cripple Creek Short Line was ended forever by the rate schedule which went into effect June 30 at 12 o'clock at night. An arbiter arranged the schedule, and the roads will hereafter run on the basis of a close pool, and in perfect harmony. The basis of settlement

was practically a return to the old schedule, some items being a little higher, and some a little lower. It is supposed that the arbitrator arrived at a settlement by taking the actual figures of operation of both roads, and allowing each the same proportion of business it has been handling, the balance of earnings to be pooled and later divided."

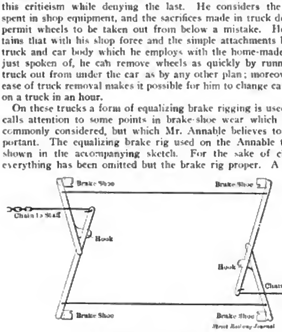
A return to anything like the old schedule of rates gives a very excellent prospect for substantial returns from operation.

Equalizing Brake Rigs and Wheel Wear—Changing Wheels and Car Bodies

For several years the Grand Rapids Railway Company has had a number of single trucks in operation which were designed and constructed by W. W. Annable, the master mechanic of the system. These trucks are exceedingly simple in construction, consisting simply of a rectangular frame made of two thicknesses of bar steel ⅞ in. x 7 ins. hung from the journal boxes. The car body is supported by elliptic springs on the four corners of the truck frame and spiral springs are placed over each journal box.

The construction is extremely simple and does not entail many repairs, but the criticism which most railway men have to offer against this design is that there is no way of getting the wheels out from below, and that to take the car body off the truck consumes too much time. Mr. Annable admits the first part of this criticism while denying the last. He considers the money spent in shop equipment, and the sacrifices made in truck design to permit wheels to be taken out from below a mistake. He maintains that with his shop force and the simple attachments between truck and car body which he employs with the home-made trucks just spoken of, he can remove wheels as quickly by running the truck out from under the car as by any other plan; moreover, this ease of truck removal makes it possible for him to change car bodies on a truck in an hour.

On these trucks a form of equalizing brake rigging is used which calls attention to some points in brake-shoe wear which are not commonly considered, but which Mr. Annable believes to be important. The equalizing brake rig used on the Annable truck is shown in the accompanying sketch. For the sake of clearness everything has been omitted but the brake rig proper. A pull on



EQUALIZING BRAKE RIGGING

either brake chain shortens the distance between brake-shoes, and since the brake beams are connected by rods as usual, the brakes are set. The brake beams are each in two parts, which form the brake levers. The hooks shown on the levers are for preventing the rear levers from loosening when the power is applied at the brake chain in front. With this rigging, which applies an equal pressure to all the wheels, Mr. Annable says he is able to obtain a very even brake-shoe wear on all four wheels, and consequently an even wheel wear, while with some other riggings this is not true. On a very common form of brake rig it is necessary to put the pivotal point which does the equalizing between the opposite wheels on a brake beam a little to one side of the center of the beam, and there is consequently uneven wheel wear. This, Mr. Annable thinks, is the reason for many cases of mysterious uneven wheel wear, since wear on wheels by brake-shoes in street railway service is an important factor in determining the total wear on a wheel. When once one wheel has worn smaller than the other the tendency is to make that wheel flange crowd the rail and cause a sharp flange. This suggests another cause of sharp flanges that may be worth considering.

Robbing the Toronto Street Railway

The Toronto Street Railway Company, impressed with the belief that it was being systematically robbed by its employees, put the matter in the hands of a detective agency. An employee of this agency, applying for a position, was given a place as an extra conductor, and, associating with the men, soon ingratiated himself with the other employees. As a result of this he gained their confidence, and finally he had disclosed to him the systematic plan of stealing that was being operated among the men. Fare boxes are used in Toronto, and out of these boxes the employees were extracting tickets by an ingenious but simple device. A strip of metal, about 8 ins. long, just wide enough to go through the slot of a fare box, was used. Some 2 ins. or 3 ins. of one end of this was doubled over a lead pencil, thus forming a spring, and pressed together the ends were pushed into the slot in the box, the shorter end being secured by the springs of the box. With the box held upside down, the contents pass down the longer end, out of the slot, into the rounded portion formed over the pencil and into the conductor's hand. As a result of these discoveries nine conductors were arrested on June 5 while operating their cars. Out of this, it is said, grew the demand of the men for the recognition of the union, and also for a uniform rate of wages of 25 cents an hour for all motormen and conductors, with nine hours to constitute a day's work.

Consolidation of Lines at Trenton

The Trenton, Lawrenceville & Princeton Railroad, the Trenton, Lawrenceville & Princeton Extension Railroad, the Princeton Street Railway, the Yardley, Morrisville & Trenton Street Railway, and the Newtown & Yardley Street Railway have been consolidated with the New Jersey & Pennsylvania Traction Company, although each of the individual charters will be preserved. The meeting at which the consolidation was effected was held in Trenton on July 10, and the officials of all the roads were represented. Robert E. Wright, of Allentown, Pa., president of the Lehigh Valley Traction Company, which is the dominant power in the movement, was present, and it was decided to purchase the stocks and bonds of each of the roads in the name of the New Jersey & Pennsylvania Traction Company. The Trenton, Lawrenceville & Princeton and Trenton, Lawrenceville & Princeton Extension Railroad Companies have steam railroad charters, the Princeton Company has a street railway charter, each of the other companies, which operate across the river in Pennsylvania, also have street railway charters, while the New Jersey & Pennsylvania Company has a traction charter, embodying all the privileges of a steam railroad charter in New Jersey, except the carrying of freight. A steam locomotive and freight cars are run on the Princeton line, so far as the two steam charters cover the route.

The capital of the New Jersey & Pennsylvania Traction Company, was increased from $1,000,000 to $1,500,000, and this will be increased later to $3,000,000 or more. The new company was chartered last fall, and Jilson J. Coleman is its president. John B. Hoefgen, to whom the three-cent fare ordinances in Cleveland, Ohio, were awarded, is president of all the companies in the combination excepting the Princeton Street Railway Company, which is headed by T. C. DuPont, of Wilmington, Del. C. M. Bates, secretary and treasurer of the Philadelphia & Lehigh Valley Traction Company and the Lehigh Valley Traction Company, is secretary and treasurer of the companies at Trenton.

The New Jersey & Pennsylvania Traction Company now owns more than $1,000,000 worth of property in this vicinity. The line to Princeton is 11.6 miles long, and the one to Yardley, 5.5 miles. The former is to be extended to the center of Trenton, adding another mile to its length, and the Yardley line is to be extended to Newtown, Pa., an additional distance of 5.5 miles, or 11 miles altogether. The first of the roads is built entirely upon private right of way, except in Princeton Borough. The Yardley line runs entirely upon streets or alongside a public road. The company also owns the upper Delaware bridge between this city and Morrisville, and thus possesses the only means of bringing an electric railway into Trenton from the Pennsylvania side.

It is the intention of the New Jersey & Pennsylvania Traction Company to extend the Yardley line to Newhope, 10 miles further up the river, as well as to Newtown, and much business is expected from both of these extensions. An elaborate local system is planned, upon which the fares shall be but 3 cents, with free and unlimited transfers within the city limits, and a minimum wage scale of 20 cents per hour is to be maintained. Franchises for this system will soon be asked for, and work will be commenced soon after the privileges are secured.

Jilson J. Coleman, who was at one time connected with the St. Louis Car Company, and who assisted the late Albert L. Johnson in carrying out many of his schemes, will look after the company's interests in Trenton, while J. A. Barry, the superintendent of the Trenton lines, will have charge of the extensions, as well as the construction work upon these extensions. Mr. Barry was connected with the Johnson interests when they were operating the Nassau Electric Railroad, of Brooklyn.

Robert E. Wright, president of the Lehigh Valley Traction Company, in which position he succeeded the late A. L. Johnson, says that the Philadelphia & Lehigh Valley line, being completed between Philadelphia and Allentown, the company is in a position to push the work to Trenton. It is generally understood that the Princeton line will eventually be extended to Bound Brook, and probably from there into the North Jersey territory.

Work has just been commenced upon the extension from Yardley to Newtown, and the other lines will be pushed later on. An effort will probably be made within the next two or three weeks to secure a more convenient terminal in Trenton for the Princeton line, and abolish the local stage line transfers which the company is operating, and which proves very expensive and more or less unsatisfactory.

New Interurban at Richmond, Indiana

The Richmond Street & Interurban Railway Company, which operates the Richmond, Ind., city lines, will soon open its interurban line between Richmond, Cambridge City and Dublin. This line will be entirely free from curves, and the grades are very light, as 3½ per cent will be the heaviest grade on the road. It is intended to make the distance from Richmond to Dublin, eighteen miles, in fifty minutes.

The rails are 70-lb., laid on ties 2 ft. between centers. The ties are 6 ins. x 8 ins. x 8 ft. long, of white oak. The poles are 35 ft. chestnut. The trolley wire is No. 00 single wire, on brackets, with a second similar hard drawn wire on the pole line as a feeder. All the bridges are steel, and built independently of the highway bridges. They are 12 ft. wide in the clear, and were furnished by the Lafayette Engineering Company.

The power station is at Richmond, and contains two 450-hp Edgemoor water tube boilers, equipped with Roney stokers. There are two 500-hp Buckeye tandem compound engines, each direct-connected to Siemens & Halske generators of 350-kw capacity. These supply both the local and interurban lines of the company. For transmission over the interurban line a 150-kw inverted rotary converter and step-up transformer will be used for transmitting at 13,000 volts, to a sub-station at Cambridge City, where a step-down transformer and rotary converter of similar capacity will be put in operation. The interurban line will make connections at Dublin with the Indianapolis & Eastern Traction Company, so that some day through service can be maintained from Richmond to Indianapolis. A branch line will be run south from Cambridge City to Milton, two miles, and possibly also to Connersville, eight miles.

E. B. Gunn, superintendent, is now actively pushing the business of securing excursion parties to Glen Miller Park, at Richmond. This park is owned by the city of Richmond. Mr. Gunn is advertising it extensively for the sake of the excursion business which it attracts from other towns, and has issued a handsome booklet entitled "Scenes from Glen Miller Park," which is well illustrated with fine half-tone engravings, and most effectively sets forth the attractiveness of this beautiful tract of over 200 acres. The park being large and well appointed, and offering a great diversity in the way of scenery and amusement, is the favorite place for picnic parties and excursions from neighboring cities. Mr. Gunn is sending out these booklets to prominent members of churches, societies, colleges and business enterprises, which are likely to have a picnic or outing some time during the season. Mr. Gunn says that two or three excursions a week come to Richmond from outside towns. Richmond is 40 miles west of Dayton, 68 miles east of Indianapolis, and 70 miles from Cincinnati. Mr. Gunn has always been active in pushing this class of business. He did much in that line at Lafayette before going to Richmond.

Holiday Accidents

The record of holiday accidents is a startling one, and again must call attention to the necessity of more care in the operation of cars, especially cars on suburban and interurban lines, where high speed is made. From Gloversville, N. Y., New Castle, Pa., and Boulder, Col., come tales of terrible accidents in which many lives were lost and scores of people were injured.

At Gloversville a wreck, which occurred on the Mountain Lake Railroad, resulted in the death of thirteen persons, while some thirty-three persons are known to have been injured. In this accident the bodies of many of the victims were crushed and maimed beyond recognition. The accident, it is said, was caused by a combination baggage and passenger car, returning from a summer resort four miles away, getting away from the motorman and rushing down the mountain side at terrific speed. The brakes are said to have refused to work, and at the end of the grade the heavy car crashed into a loaded open car also descending the mountain. The latter was hurled from the track and turned on its side, more than 50 per cent of the passengers being injured. Those who were pinned directly under the cars were crushed to death. The combination car also left the track and turned on its side.

The accident at New Castle happened on the Pennsylvania & Mahoning Valley Railway, and one man was killed, one fatally injured and more than a score were seriously injured. In this accident two cars, each carrying about 100 persons, crashed together on a curve near Edinburg, four miles west of New Castle.

In an accident at Boulder one woman was killed and twenty persons injured. In this accident two heavily loaded cars, running as a train, rushed down a hill with tremendous velocity, overturning at a bend in the track.

A Cheap and Durable Cattle Guard

Cattle guards are becoming a subject of increasing interest to electric interurban lines which are now generally built on a private right of way. Since the abandonment by steam roads of the old style pit cattle guard, which was expensive to construct and maintain, and introduced an objectionable break in the continuity of the roadbed, many patented forms of guards, intended to lie on top of the ties, have been introduced, one of which combining simplicity and cheapness is the "Climax" guard, which is made of sections of vitrified clay. A photograph of one of these guards is reproduced herewith. The sections from which a guard is made up are 24 ins. long, 8½ ins. wide and 1½ ins. high. Each piece is of inverted

CATTLE GUARD FOR INTERURBAN AND SUBURBAN ROADS

W form, the walls of which are 1¼ ins. thick. The sections are made 2 ft. long to exactly bridge the space between two ties, and they rest directly on the ties. For each 8 ft. x 8 ft. guard there are 40 blocks or sections. A wood strip is laid around the guard to hold the sections in place, and their weight is sufficient to hold them down without other fastening. Among the numerous advantages urged for this guard are that it is made of a material that the weather has no effect upon, it is handsome in appearance, never needs painting, cannot burn, is free from accumulations of snow and dirt, allows no weeds to grow through it; it cannot injure employees crossing over it, and stands the chance of least financial damage from low brake beams or wrecks. This is a comparatively new guard, but is finding ready adoption upon both steam and electric roads. The new Aurora, Elgin & Chicago Railway is using these exclusively, having ordered over 700. They have also been adopted by the Western Ohio Traction Company, the Cleveland, Elyria & Western, and the Chicago & Milwaukee Electric Railroad. This guard is made by the Climax Stock Guard Company, of Marquette Building, Chicago.

For computing the heating surface required in feed-water heaters one of the manufacturers of such apparatus says that, knowing the amount of feed-water and assuming that there is sufficient steam for the work, a quick rule is to divide the number of pounds of feed-water used per hour by 100 for copper, 90 for brass, and 60 for iron coils. The quotient will represent the required number of square feet of heating surface. This method of calculation applies particularly to the coil type of heater, and it gives sufficiently accurate results within the limits of ordinary practice. In other types of heaters, where the circulation of the water may be less rapid, a larger amount of heating surface must be employed in order to obtain the same results. This rule is given in some recent literature on the subject issued by the Whitlock Coil Pipe Company, Hartford, Conn.

Topics of the Week

The Cleveland, Elyria & Western Railway is affording the means for carrying on an interesting trade war between the merchants of the thriving towns of Wellington and Oberlin. The towns are 9 miles apart, and before the building of the road there was little rivalry between them. Now, the competition is intense. Oberlin merchants started the fight by buying car tickets and offering them to the Wellington shoppers on Saturday evenings for 10 cents a round trip. Last week Wellington merchants retaliated by furnishing free transportation to all Oberlin residents who would come to Wellington for their Saturday evening trading. Now the Oberlin people have gone one better and have placarded Wellington with posters, announcing free transportation, free ice-cream and free band concert for Saturday evening. The railway company is offering inducements to both parties to continue the fight.

It is a matter of common knowledge that the United States Navy has furnished many brilliant engineers for the street railway field, and now it seems as if the trolley companies were getting many good men from the forecastle for the front platform. It is explained that the training of the ordinary sailor of to-day makes him familiar with the use of simple electrical apparatus, and his drilling is of utmost importance in the matter of discipline and subordination. He knows how to obey orders—often a difficult thing to teach the ordinary landsman—he does not get "rattled" in emergencies, and he is respectful in his demeanor towards his superiors and the public. The inducements to stay in the navy, it is explained, cannot compete with the opportunities of advancement presented to the street car employee which enable him to marry and settle down and enjoy a home with living wages to keep it going.

A certain street railway company operating in one of the large cities in the West has offered, in order that it may "get out of politics"—that is, in order that it may escape the octopus-like grasp and harassments of ambitious office-holders—to guarantee the city in which it operates $90,000 for the first year, and $100,000 each year thereafter during the life of a twenty-year renewal of its franchises. The direct offer is 8 per cent of its gross receipts in return for a renewal of its franchise and an abatement of all State, county and city taxes. However, the company guarantees that the payments shall not be less than the amounts named. The company in question has for a long time desired to make extensions to better its service, and to enlarge its earning capacity as well as its usefulness and convenience to the public. But it has been unable to do this, for on every hand and at every turn it has been confronted by the boodlers who have thus far thwarted advancement. Tired of appealing to the city authorities for the privileges that would alike result in benefit to the city and the company, it has laid its case before the people, with all the evidence. The politicians, we are told, are panic-stricken and distressed.

The recent remarkable mortality among the children of Brooklyn has attracted the attention of the physicians of that city, as the death rate among those under four years of age has been for some time about double that of children of the same age in New York. As might have been expected such a striking disproportion as this, showing, as it does, some local cause, should result in an investigation by a committee of physicians of the city; but of the three separate causes contributing to this excessive mortality, who would have expected to find among them the trolley car? Such is the case, though. Bad water, impure milk and long rides in open trolley cars are the causes mentioned in the committee's report. It would seem that Brooklyn mothers, clad in the diaphanous waists that have become so popular for summer wear, have forgotten that this kind of clothing is not the proper thing for a child sensitive to the cool breezes that are created by the rapidly moving car, and the physicians say that when thus scantily clad and taken for a trolley ride the child's body cools off too rapidly, and with disastrous effects. The practice of trolley-riding is particularly pleasant in summer, and is beneficial to all, but the children should be properly protected, however scantily clad the mothers may desire to go about.

Down in South Africa street railway matters have been in a bad way for some time, but now the prospects are greatly improved, and it is quite probable that considerable construction work will be undertaken as soon as normal conditions are restored. The situation in Pretoria, as outlined by an officer of the local traction company in a letter to the STREET RAILWAY JOURNAL, may be taken as a fair example of the general condition that prevails. "Owing to the war and the restrictions of martial law," says this correspondent, "we have been unable to resume working operations. The trams were kept running until the British occupation of Pretoria, when the Boers seized all our horses, and since then the company's premises have been occupied by the military and police. We trust, however, now that peace has been declared, that operations will soon be resumed, though as the government has not yet made any intimation as to the result of the Concessions Commissions report, no definite decision has been reached by our board. No additions to the line have been made, and it is still only fitted for animal traction, though at the time of construction the road itself was laid for electric working. Heavy rails, 81 lbs., were used and were electrically bonded. If our concession is confirmed by the government there is no doubt that the system will speedily be converted to an electric one. We are gathering information so as to enable us to make the change with as little delay as possible and to ensure the use of the best and latest improvements, though in all probability we shall again restart with the old horse service, pending the arrival of the necessary plant."

Trolley Conductor an Aid to Justice

The telegraph, submarine cable and telephone have long been recognized as marvelously efficient aids to justice, but these agencies were rivalled in Boston last week by an electric car, which, combined with the coolness of a conductor, Ernest S. Johnson, of the East Milton line of the Old Colony Street Railway Company, resulted in the capture of an escaping murderer. The man was wanted for shooting his mother and sister, and had fled to the Lawrence Woods in Dorchester after committing the crime with a posse of about 150 men on his trail, thoroughly scouring Franklin Park and adjacent territory. Conductor Johnson is a college student, who runs a car in the summer. On the run from East Milton to Milton Lower Mills the conductor saw a man run out of a swamp on Reedsdale Road and jump on the car while it was going at full speed. Johnson went forward to point out the danger of boarding a car at such high speed, and the passenger held out a $2 bill, requesting the conductor to keep the change and remain quiet, as he had no more use for the money, because he was going to buy poison and end his life. With the exercise of tact and coolness the conductor kept the man on the car until a drug store at Pierce Square was reached, to which he directed the murderer as a good place to buy the poison. Johnson then stopped the car and ran around the corner for a patrolman, but none was in sight, and as the murderer came out of the drug store, having been refused poison, the plucky conductor walked with him to the Dorchester Avenue car house of the Boston Elevated Railway Company, and there turned him over to a police officer. The conductor's coolness in emergency furnishes one more example of the ability of street railway employees to keep their heads in the face of sudden and trying situations.

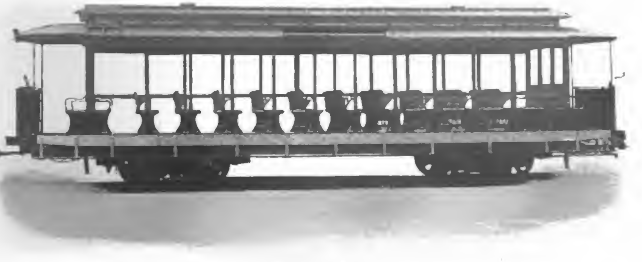
New Publications

Alternating-Current Machines, by Samuel Sheldon, A.M., Ph.D., and Hobart Mason, B.S., E.E., 265 pages. Illustrated. Price $2.50. Published by D. Van Nostrand Company, New York, 1902.

This volume is a companion to "Direct-Current Machines" and forms the second part of the series on "Dynamo Electric Machinery, Its Construction, Design and Operation," which the authors have written. While primarily intended as a text book to be used in connection with class room instruction, the logical arrangement and clear explanations make the text readily understood by all who have a grounding in the ordinary mathematics essential to engineering calculations. This feature of the book renders it of particular service to electrical, civil, mechanical or hydraulic engineers, who, while familiar with direct-current work, have not that proficiency in alternating-current calculations that is at present necessary in almost all undertakings, and the first four chapters give many of the simpler ways of explaining alternating-current phenomena and solving problems resulting therefrom. The remainder of the book describes the principles, construction, operation and testing of the various types of alternators, transformers, motors, rotary-converters, etc., as well as giving one chapter to high tension work as found in modern power transmission. While the subject of alternating-currents can, by no means, be thoroughly covered in a book of this size, the condensed, lucid explanations which are given has enabled the authors to compile most of the more useful data required in ordinary practice, and the brevity of the text enables the reader to refer to exactly what he wants without having to search for it among a mass of irrelevant or elementary matter.

Some New Open Cars

The St. Lawrence International Electric Railway & Land Company of Redwood, New York, has recently purchased from the John Stephenson Company, Elizabeth, N. J., a number of fourteen-bench open cars, one of which is shown in the illustration accompanying this article. The cars measure about 41 ft. over the buffers. They are 7 ft. 7 ins. wide at the posts, and the height is 9 ft. There are bulkheads at each end with three drop sash, which are protected on the outside by three-bar window guards of bronze. The floor frame of the car is strong and stiff, the side sills being of yellow pine and plated with ¾-in. steel. The other portions are of oak, as are the crown pieces. The bolsters are of iron, of the steam car type. The monitor or raised deck has eleven ventilator sash on each side and two at the ends. The bonnets are of the standard street car form, with iron supports and iron moldings and trolley-rope guides. The brackets are of malleable iron.



A HANDSOME OPEN CAR.

The cars have ten reversible back seats and four stationary seats placed against the bulkheads. All the seats are of ash slats, the reversible seats having spindle backs. The car will easily seat seventy persons, the width being somewhat more than usual. With a little crowding it would not be difficult to find space for eighty-four persons on the seats. The seats are finished with the Stephenson patent diagonal corner seat end panels. This panel makes a neat seat end, and a very strong post connection. Furthermore, the diagonal corner gives a wide space at entrance, greatly reducing accidents, while it increases the comfort of the passengers. All the openings are furnished with spring roller curtains, which come all the way to the floor. The form of the panels is such as to prevent any sticking or catching at the ends of the seats, thus preventing wear. As the posts of the car are somewhat straighter than usual, panels in this construction make a particularly stiff connection. A guard rail is provided on both sides of the car sliding within the hickory grab handles.

One unusual feature found in these cars is the placing of the register cord under the water table. The bell cord is placed inside. The cars are mounted on the Stephenson No. 20 trucks, having a 4-ft. 10-in. wheel base and 33-in. wheels. The trucks are spaced 21 ft. from center to center. These trucks were adopted on account of the ease with which they ride, and their strength as well as the small amount of power which they require for propulsion. The folding steps extend the whole length of the cars and are carried on an improved style of hanger. The toe board is so carried as to give ¾ in. additional width to the step, while at the same time it is flush with the hangers.

The cars are handsomely painted in yellow and dark green, relieved by gold striping. They have box signs on the sides of the roof and on the hoods. Taken all together they are neat and stylish cars, extremely well adapted to the service in which they are to be placed.

The employees of the Virginia Passenger & Power Company, controlling all the street railway lines of Richmond, went on strike on July 16. The trouble between the men and the company is over the question of wages. The original proposition of the men was for 20 cents an hour and a nine-hour day, but this has been modified to 20 cents an hour for motormen and 19 cents for conductors.

Elevated Railway Car Built by the Brooklyn Rapid Transit Company.

The accompanying illustrations show a car which has recently been constructed at the East New York shops of the Brooklyn Rapid Transit Company. This car is one of the standard elevated trail cars used in the elevated service in Brooklyn, and was built entirely with the facilities at the disposal of employees in the company's shops. The car was built on the remains of one of the cars destroyed in the fire which occurred at the Thirty-Sixth Street yards last February, when everything was destroyed except the trucks and some other metal portions of the construction. As will be seen from the illustrations, both the interior and exterior of the car are fully up to the standard of finish to any cars in use on the road. The car is 47 ft. 9 ins. over all, the body being 39 ft. 5 ins. long. The height from the head of the rail to the roof of the car is 12 ft. 5½ ins., and the height of the platform is 3 ft. 7½ ins. The width of the car over all is 8 ft. 10 ins.

INTERIOR BROOKLYN ELEVATED CAR.

The car is fitted with Hale & Kilburn longitudinal cane seats. All the interior woodwork is of cherry, which gives a fine finish to the car, and the brass trimmings are all new. The racks for advertising signs, as seen, are placed more out of the way than is customary, although the advertisments are as clearly read as when extending further down on the sides of the car. The appearance of the car is greatly improved by the arrangement shown, as it gives a much richer appearance above the windows.

The shops in which this car was constructed, and which are in

charge of Master Mechanic A. J. Wilson, are situated near the East New York Loop. A number of new tools have recently been added to their equipment, and while the facilities are not yet as great as the requirements of the service might indicate, the work done in the shops is of the very highest order. Under the former policy of the company, this was one of the auxiliary shops, which were under the control of the superintendent of equipment, whose office was located in the main surface shops at Fifty-Second Street and Second Avenue, but since recent changes have been made in the organization the elevated shops are now distinct. It is possible, therefore, that many additions may be made to them in the near future. A striking feature of the department is the traveling crane shown in the accompanying illustration. This crane was constructed at the shops from designs made by Master Mechanic Wilson, and it has proved of great value in handling the heavy materials which are shipped to the yard. The illustration shows it supporting a Brill 27-E truck, and a 150-hp Westinghouse motor, and indicates the ease with which these heavy parts of the rolling stock can be unloaded from the cars used in transporting them to the shops. The crane is about 18 ft. high, and it is 22 ft. wide

ELEVATED CAR BUILT IN REPAIR SHOPS

TRAVELING OVERHEAD CRANE IN YARD

The wheels upon which it is mounted are old elevated car wheels which have been pressed upon short axles and trued up in the lathe. The journals are carried on the under side of the lower beam of the crane. The uprights are of wood, mortised into the lower beam and strengthened by half-inch plates bent at an angle to fit the joint, and bolted to both pieces. The top of the uprights which support the horizontal I-beam are mortised so that they support the beam on both the top and bottom flanges. The entire construction, therefore, is very rigid, although it is light enough to be easily pushed along on the track by the workmen. The differential pulley blocks which are used for hoisting the apparatus to be moved, have a capacity of 8,000 lbs. each. Since the construction of this crane, ten 5000-lb. motors have been unloaded in one hour with ease, whereas previously it was not only a very lengthy, but a very difficult operation to receive heavy apparatus of this kind at the shop.

London Letter

(From Our Regular Correspondent.)

The scheme of the London County Council for tramways on the embankment was vigorously attacked this month in the House of Commons, but managed to emerge from the ordeal successfully. It is proposed to connect with the shallow underground tramway from Theobald's Road under the new Holborn and Strand thoroughfare, passing under the Strand and emerging on the embankment at Waterloo Bridge. It is generally believed, also, that this scheme will connect the southern tramways by means of the bridges, although no powers to that effect have yet been sought by the London County Council.

The London United Tramways Company has at present a bill in Parliament by which power is sought to construct tramways in Richmond, Barnes, Mortlake, Hammersmith, Malden, Wimbledon and other places by which their already extensive system in the west of London will be very much increased. As this company has thrown in its lot with the Morgan group of underground tubes, it will be seen that the ramifications of the whole system, from the extreme northeast of London to the extreme southwest, will be most thorough and complete.

A company is being promoted for the purpose of building an electric railway from the city to Reigate and Redhill, and it is understood that it intends to have its terminus at the monument. The route which will be followed will pass Brixton, Streatham, Norbury, Croydon, Worlingham and Caterham.

The new Stewart Street station of the Manchester Corporation has now been formally opened, though much of the machinery has yet to be installed. The present installation in this building consists of about 15,000 hp, for which Dr. Kennedy was the consulting engineer, and a further 12,000 hp will soon be installed under the scheme promoted by G. F. Metger, the corporation electrical engineer. The service of electric cars to Stockport and Belle Vue has now been opened. This marks another stage toward the completion of the vast scheme which the committee has formulated and intends to carry out. Both Belle Vue and Stockport will be reached in about half the time taken by the horse cars, and by business men especially the change will be welcomed.

The Halifax Town Council has sanctioned the construction of

an extension of their lines to the outlying town of Sowerby Bridge. The work has already been commenced. The Town Council endeavored to proceed with this branch of their system more than two years ago, but were vigorously opposed by the shopkeepers of Sowerby Bridge. Now the inhabitants of Sowerby Bridge have petitioned the corporation to carry out the extension as soon as possible, and the necessary powers were included in the Halifax Parliamentary bill which recently passed the House of Commons committee. This will undoubtedly be a valuable branch line both for Halifax and Sowerby Bridge, and shows conclusively the usefulness of foolish opposition to such an extension by a few interested people.

After a delay of about two years the Board of Trade has at last confirmed the Swansea Light Railway order, and we presume there will now be no further obstacle raised to the carrying out of the needed tramway extensions in the town and district. The object of the order is to effect extensions (1) to Brynmill, (2) up Walter Road to Sketty, (3) to Ynisforgan from Morriston, (4) to Fforestfach from Cwmbwrla, (5) from Quay Parade to St. Thomas, while there are various connections also authorized.

The financial year of the Aberdeen Corporation tramway, just closed, shows very satisfactory results. The total receipts for the twelve months amounted to about £37,000, an increase of nearly £2225 over the returns for the preceding year. The actual expenditure is not yet known, but it is believed that there will be a substantial credit balance. The whole of the routes have now been electrically equipped, the last of the horse cars having been recently withdrawn.

James Ross, of Montreal, chairman of the City of Birmingham Tramways Company, has sold his interest in that concern to the British Electric Traction Company. Mr. Ross held, in conjunction with his son, 32,727 ordinary shares out of a total of 60,000, so that the Electric Traction Company acquire a controlling interest. The company already own a network of lines in the back country, and the purchase of the Birmingham tramways will complete their system. The corporation was pledged to municipalization on the expiring of the lease, but it is stated that an effort will be made to get them to depart from that policy on the basis of the Electric Traction Company paying an annual sum toward the rates.

The scheme for connecting Burton and Ashby de la Zouch and the intermediate and populous villages with a light railway is being revived. The Midland Railway Company has stepped in again as promoters of an almost identical scheme. The gage of the proposed railway is to be 3 ft. 6 ins. and the motive power optional, but it is believed electricity will be used.

The St. Helens Electricity Works, which supply current for lighting and power and also for the electric tramways, last year produced electricity at the lowest cost in the kingdom, but have even done better this year, due in some measure to the fact that a considerable portion of power is obtained from the refuse destructor. The works cost for the production of electricity is this year .65d. per unit, against .82d., a reduction of 20 per cent, and the total cost 1.04d. per unit, against 1.18d., a reduction of 10 per cent.

A special meeting of the Heywood Town Council was held recently for the purpose of sealing the agreement with regard to the purchase of the Bury, Rochdale & Heywood tramway undertaking. The agreement related to a joint contract being entered into between Heywood, Bury, Rochdale, Littleborough, Royton and Unsworth for the acquisition of the tramways on a common date, and appointing James Moore, Jr., of Edinburgh, valuer. It was urged that joint acquisition would be more advantageous than separate action. The agreement was sealed.

At a special meeting of the Maidstone Urban District Council a formal resolution authorizing application being made to the Light Railway Commissioners under the light railways act of 1896 for a provisional order for the construction of a system of tramways from High Street to Barming, in accordance with the scheme of Mr. Sellon, approved some few weeks ago, was unanimously passed.

At Hastings, the Town Council has conditionally approved a scheme to construct an electric tramway system connecting the island suburbs with the center of the borough and providing for the laying of lines on the sea front.

The financial year of the Glasgow Corporation tramway department ended the last day of May, and with the advent of June the new table of cheaper fares was inaugurated. Four half-penny stations is now the penny limit—an arrangement the advantage of which will be seen when it is stated that from Argyle Street to the center of populous Govan, from Queen Street right into Partick, from Charing Cross to Queen's Park or Pollokshields and from Argyle Street to Alexandra Park or to Ibrox one can travel for one penny, while to go directly across the city from Scotstoun in the far west to Rutherglen in the east cost only three-pence. During the year ended May 31 163,600,000 passengers were carried, as compared with 132,557,724 last year. The increase is therefore 31,042,276. The revenue for the same period totals £612,794, as against £484,872 last year, an increase of £127,922.

The Yorkshire Electric Power Company will soon start work on its big power and distributing system. This company has an area of 1800 square miles to serve and is the largest of the power companies in Great Britain which has been formed to supply electricity in bulk to local authorities, factories, coal mines, etc., and for which H. F. Parshall is acting as consulting engineer. The area broadly includes a larger population to the square mile than any similar area. The idea underlying the formation of the company is that electric energy can be generated very cheaply, owing to the magnitude of the undertaking, and owing also to the convenient location of the generating station in regard to the supply of coal and water. Four sites have been scheduled for power houses, each of which is advantageously situated for coal and water facilities. Work will very shortly be commenced upon the generating stations and transmitting system and sub-stations. Arrangements have already been made for supplying a large number of consumers, and it is expected that in a very short time the total power required will amount to 250,000 kw. The company's prospectus says that it is estimated that the net profits will amount to 8 per cent on the total outlay after paying all expenses, including maintenance, and providing for a depreciation fund; and it is further estimated that this profit will be attained as soon as the capacity of the plant reaches 50,000 kw.

There is not much news to report regarding the several tube schemes for London, as comparatively little progress has been made in Parliament since the decision which we published last month. Meantime the District Railway Company is making rapid progress with its enormous power house which is to be situated on the banks of the Thames at Chelsea, though naturally somewhat delayed by the novelty of design. Each of the four smoke stacks which, by the way, will be even larger than those used for the Manhattan Railway in New York, will have an internal diameter of 19 ft. It has now been definitely decided also to increase the size of the steam turbo-generators to 5500 kw instead of 5000 kw as originally intended, and while it is difficult to ascertain what guarantee of coal consumption has been given it is understood that it will be well under two pounds per electrical hp. The space occupied by each of the eight turbo-generator units will be about 12 ft. by 50 ft. The condensers for this power house will all be of the vertical type and have involved a very interesting and difficult problem in engineering, owing to there being a 24-ft. rise and fall of tide, particulars of which we hope to give in a later issue. Regarding the rolling stock it has now been definitely decided that each carriage of the trains will have three doors, one at each end and one in the middle to assist in the quick change of passengers at stations so as to reduce the necessary stop to a minimum. The Brompton and Picadilly tube which is part of the Yerkes group has now been definitely commenced. It will be remembered that the short section from Picadilly Circus to Charing Cross was refused by the Lords Committee as also the short connecting link from the southern end of the Great Northern and Strand Railway from the Strand to the Temple. These little pieces, however, will not militate against the success of the whole system, as the tube from Picadilly Circus to High Holborn has been granted

A very important concession has also been granted to the Yerkes group of tubes in the extension of the Charing Cross, Euston and Hampstead Railway from Hampstead to Golders Green which will enable this tube to come to the surface at Golders Green, thereby allowing them to have extensive car sheds and shunting facilities. Had the tube been arranged to stop at Hampstead it would have been most inconvenient, as at that point it would have been at a great depth under the level of the streets. With the two smaller exceptions mentioned, all of the Yerkes schemes will go through. The whole of the Morgan group has received the sanction of the Lords Committee with the exception of the loop line from Shepherd's Bush to Hammersmith. They have also received the approval of the Lords Committee for the tube which is to run by exactly the same route as the Brompton and Picadilly Circus tube from Hyde Park Corner at least as far as Picadilly Circus or to Charing Cross. As the Brompton and Picadilly tube before mentioned was sanctioned years ago and is now in progress of construction, it will be an extremely interesting problem if this second tube passes the House of Commons to find out whether it will be possible to construct it under the one which is now being made. The vibration question would also be an extremely interesting one, as it will be difficult for any committee to judge as to which of the tube railways was causing any possible vibration troubles on the surface, and adjudicate damages. A. C. S.

New Equipment and Improved Schedule of the Liverpool Overhead Railway

The importance of increased acceleration on electric railways, is well shown by what is being done on the Liverpool Overhead Railway by means of a new type of equipment supplied by Dick, Kerr & Co., Ltd., of London. It will be remembered that the Liverpool Overhead Railway was one of the first elevated lines in the world operated by electricity, and was equipped some ten years ago. The total length of the line is a little over 6½ miles, with double track and a third-rail feed, and a special rail return operated by 500 volts direct current. The trains are made up of two or three cars, the larger trains weighing about fifty-five tons. With the old equipment the entire distance was run in 32 minutes including 16 stops, or practically at a scheduled speed of 12½ miles per hour. This requires a minimum of 14 trains running at five-minute intervals to handle the traffic

About twelve months ago, however, it was decided to experiment with a new equipment in order to ascertain what acceleration could be obtained, and Dick, Kerr & Company, Ltd., entered into a guarantee to run the whole distance—including 16 stops of 12 seconds—in 20.9 minutes; in other words, to improve the scheduled speed from 12½ miles to nearly 19 miles per hour. The weight of the train, including 154 passengers, was 55 tons. A most careful series of elaborate tests and trial runs were made by Mr. Cotterell, the engineer-in-chief of the Liverpool Railway, assisted by Mr. Mallock, and it was clearly demonstrated that the new train would make the journey easily under 20½ minutes. Acceleration curves obtained from these trials are given on the following page. From these it will be seen that the acceleration reached 42 ft. per second per second, or nearly three miles per hour per second, the average acceleration being well over one mile per hour per second, thus enabling the train to cover the 2,110 ft. between the stations in little over one minute, including starting and stopping. This rapid acceleration is possible owing to the excellent commutation of the motors, which will not spark when carrying 300 amps. or 400 amps.; that is, three or four times their normal current. During the acceleration of the train in the series position of the controller, each motor is carrying 300 amps. of current, as shown by the curve. The curves also show the perfect action of the brakes during the retardation of the train. The negative acceleration reached 4.8 ft. per second per second recorded, which is probably near the practical limit in actual service. The diagrams of current in pressure at the motors are recorded and are of interest in determining the power consumption at different parts of the run.

The frequent stopping of trains running at high schedule speed will consume from 120 watts to 150 watts per ton mile. If, however, the stops are far apart, the watts required are from 90 to 100 per ton mile. In the experiments recorded the watts consumed were 137 per ton mile, or about 6.35 kw per train mile run. The results of the new accelerated service are shown in the following table. In consequence of the successful issue of these tests, the Liverpool Overhead Railway have instructed Dick, Kerr & Company to re-equip the whole of the rolling stock.

ELECTRIC TRAIN ON LIVERPOOL OVERHEAD RAILWAY

Each of the new trains is to be fitted with four 100-hp railway motors, which are designed by S. H. Short and built at the works of the English Electric Manufacturing Company, Preston.

RESULTS OF TESTS ON THE LIVERPOOL OVERHEAD RAILWAY

	Old System	Accelerated Service
Mean speed	12½ miles (20 k. m.)	19½ miles (31 k. m.)
No. of stops	16	16
Mean time at stations	11 seconds	11 seconds
Mean distance between stations	729 yards (666 m.)	729 yards
Watts per ton mile	110	137
Acceleration	1.6 ft. (0.44 m.) per second per second.	3 ft. (0.91 m.) per second per second
Retardation	3 ft. (0.91 m.) per second per second.	4.8 ft. (1.46 m.) per second per second

The performance of these motors is shown in the efficiency curves herewith, these having been made from actual measurements taken from one of the motors during the experimental run. The efficiency is unusually high, being practically 93 per cent at the full load of 75 kw. Their weight is 4,200 lbs., or only 42 lbs. per hp, which is a point of considerable importance in keeping down the dead weight of the train.

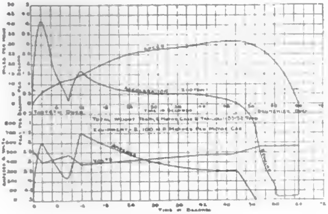
The new motors, in use on the Liverpool Overhead Railway, are completely enclosed in a cast-steel shell, forming a fire and waterproof casing; this shell also serves to form the magnetic

circuit of the fields and to support the armature and axle bearings. The only opening in the motor casing is over the commutator and brushes; this is, however, securely closed by a hinged lid fitted with fastenings. The motor frame is divided on the horizontal plane, the upper half being removable, leaving the lower half supported on the car axles and the nose suspension. In this way the armature and fields can be easily uncovered for inspection and repair, without entirely dismantling the motor. This method of opening the motor is just the reverse of the tram-car motor, where the lower half of the frame is let down

LIVERPOOL RAILWAY MOTOR

into a pit for inspection of the interior, which would not be practical with motors of such great size.

The interior of the motor frame is provided with four laminated steel pole pieces, each with its own field spool, held in place by large bolts passing through the outer shell. The field spools are made of copper ribbon, about two inches wide, wound with asbestos and mica strip, between layers, and insulated outside with mica and asbestos combination boxes, held in position by means of heavy braided tape. The complete coils are treated with a water-proofing insulating compound and thoroughly baked. The same number of turns of copper ribbon is put on each pole, so that a perfectly symmetrical field is produced, in which the armature revolves. The armature is iron-clad, the copper bars with which it is wound being let into deep slots. Each coil in the armature is made with only one turn, and without joints, except at the commutator. The insulation of these coils is also composed largely of mica and asbestos, treated with a special insulat-



ACCELERATION CURVES

ing varnish, taped and baked. The coils are all alike and interchangeable, so that injured ones may be replaced with ease. Ample ventilation is provided for the interior of the armature core, and air ducts leading to the surface aid in keeping up a good circulation. The high-grade steel from which these cores are made insures low hysteresis losses, and the thorough insulating of the laminæ from each other prevents the formation of eddy currents. The commutator is very large and has many bars, rendering the commutation perfect, even with an extra heavy load on the motor. The brushes are in two sets at the top of the commutator, with two brushes in each set. No sliding contacts are permitted to carry current, each brush being fitted with a brass clamp which moves with it, and a flexible braided ribbon of copper, connecting it directly with the brush holder supports and main cables from the controllers.

The efficiency of the motor is well over 90 per cent, as shown by the characteristic curves of the machine. The temperature rise, after one hour's run at full load, is far below the standard of 75 degs. C., being as follows:

Commutator	55 degs. C
Armature	39 degs. C.
Fields	57 degs. C
Pinion bearing	14 degs. C.
Commutator bearing	9 degs. C.

The bearings are all made of the best bronze and provided with both oil and grease lubrication. Special provision is made to

ARMATURE OF MOTOR

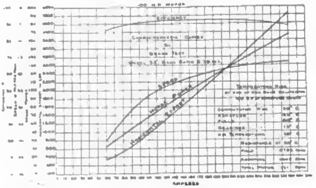
catch all the oil from the ends of the bearings and to return it to the wells, so that it will not be dropping on the permanent way. The gears are of cast steel, with the teeth cut out of the solid casting. The pinion is of hammered machine steel The gear housing is of malleable iron, made oil tight.

The complete motor weighs as follows:

Motor	3,945 lbs.
Gear	260 "
Housing	140 "
Links	40 "
Key	2 "
Total	4,387 lbs.

Thus including gears, gear housing, etc., complete, the motor weighs only 43.8 lbs. per hp.

The motors are journaled at one end to the driving axle and spring supported on the truck frame at the other side. The method of suspension relieves the permanent way of severe



EFFICIENCY CURVES

shocks at the rear joints and cross-overs. The motors are carried on each of the two end cars of the train. The controlling mechanism is in many respects similar to the series-parallel method of control adopted by Dick, Kerr & Company, and is fitted with a new blow-out device which renders it perfectly proof against fire.

The effect of this improved equipment will be very important upon the service of the Liverpool Overhead Railway. The twelve trains of the new type will replace fourteen of the old, and it is a matter of interest that these new trains will accommodate exactly the same number of passengers as the old ones.

As a comparison, the following table, furnished by Dick, Kerr & Company, is of interest as showing the scheduled speeds with

the new Liverpool equipments, and those obtaining on other lines:

Railway System.	Miles per Hour, Including Stops.
Liverpool Overhead Railway	19
Manhattan Elevated Railway	13½
Metropolitan Elevated Railway	14.1
South Side Elevated Railway (Chicago)	14.6
Lake Street Elevated Railway (Chicago)	12⅓
City and South London	12½
Central London	14

With the previous equipment the trains ran 144 train miles per hour, while in the new method they will run 216 train miles per hour. There was a five-minute headway between the old trains, but under the new regime this will be reduced to 3⅓ minutes. In other words, the journey from one end of the line to the other will be made in two-thirds of the time taken on the old method, and what is of supreme importance, the load on the power station will be more uniform, and, as a consequence, the machinery will be running under more efficient conditions.

English Municipal Railways.*

BY J. H. RIDER

It is no small thing to be president of a body which is now representative of nearly 150 municipalities in the United Kingdom. Taking, as I did, some little part in the formation of the Association, it has been a matter of great personal gratification to me to watch its gradual growth from 1895, when some twenty-five engineers modestly formed themselves into the Municipal Electrical Association, up to the present, when we number not only about 210 municipal electrical engineers, but also 120 municipalities themselves, among our members.

One of the subjects with which the municipal electrical engineer of to-day has to deal, and which has developed in this country almost within the life of this Association, is that of electric street tramways. In 1895 there were but five at work, and, with the solitary exception of Blackpool, they were all owned and operated by companies. At our 1896 convention I read a paper in which the possibilities of a combined tramway and lighting load were pointed out and in which attention was drawn to the economies which were likely to result from such an arrangement. To-day there are thirty-six electric street tramways in operation, which are owned by municipalities, and sixteen others in progress of construction. Of the former twenty-eight are, and of the latter eleven will be, supplied with current from a municipal combined lighting and tramway station. There are also four instances in which the municipal station is supplying current to tramways owned by companies.

With about three exceptions, the whole electric tramways in this country are worked by the trolley system, and it is worthy of note that no company, whose first aim, after all, is to pay a dividend, has adopted any other. The Wolverhampton Corporation is experimenting with a surface contact system, the Bournemouth Corporation is putting down a short length of underground side-slot conduit, as part of a general scheme of overhead traction, and the London County Council has adopted the centre-slot conduit for practically the whole of its lines. The costs of the road construction for these three distinctive types of electric traction vary largely according to the local conditions, but are generally somewhat as follows:

Overhead construction	£5,000	per mile of single track, including rails and paving in each case.
Surface contact construction	10,500	
Conduit construction	13,500	

In the face of the very great saving in capital expenditure, which can be made by adopting the overhead system, what are the conditions which would warrant the use of the conduit system? In the first place, in my opinion it is not warranted, unless a car service can be maintained with not greater than a two-minutes' headway. The capital charges on the road construction are so heavy, that the only way to bring down the cost per car-mile is to increase the number of car-miles as much as possible, by working the lines for all they are worth. Several corporations have recently been considering the use of the conduit in a similar manner to Bournemouth, namely, for a small portion in the center of the town, with the overhead system outside. I do not think the conduit is warranted under such circumstances. Certainly the additional cost, for such a short length, may be very small, when compared with the cost of the whole scheme. But is it worth while burdening the undertaking with a combined system, merely for æsthetic considerations?

It may be argued that such combined systems are working satisfactorily in Washington, Paris, Berlin and other places, and that the change from the conduit to the overhead wire, and vice versa, can be made in a very few seconds. That is quite true, but they mean (1) the constant additional labor of at least one man at each changing place, (2) the carrying of the idle trolley over the conduit section and (3) either separate machines and feeders for the conduit conductor bars, or the permanent earthing of the negative bar, because of the rail return of the overhead section.

The abandonment of the overhead for any other system, merely for æsthetic reasons, is, in my opinion, not justifiable. The examples of overhead construction, to be seen in several towns in the United Kingdom, are anything but pretty. Some of them are even ugly. But that is the fault of the designer, and not of the system. It is perfectly easy and practicable to design and erect an overhead line which shall look well in almost any locality. Neat, and even artistic, work costs very little more than rough and unsightly work. When, then, are we justified in adopting the conduit system? When the traffic over the lines is so great that the heavy capital charges do not make any serious addition to the costs per car-mile. This is a condition of things only met with in metropolitan cities, and, after all, is no reason why the overhead system should not be used. Again, when powers for the tramway can only be obtained on the condition that the conduit is used, or when the system of lines is so complicated that the overhead construction becomes cumbersome and dangerous.

One of the principal difficulties in designing neat overhead construction is that of guard wires. Many an otherwise neat line is entirely spoiled by them. Acting apparently with a view to the safety of the public, but really to protect the telegraph and telephone interests, the Board of Trade has recently issued a new set of regulations based practically upon those adopted by the Post Office. In order to hear the views of the various tramway authorities upon these regulations, a conference was held a week or two ago, at the offices of the Board of Trade. On the advice of the officials of the Post Office, and of the National Telephone Company, the Board of Trade refused to allow the principles of guard-wire protection to be discussed, and would only permit remarks on the various regulations which were proposed.

As is well known to those with the largest experience in overhead traction work, guard wires may be a protection in some few cases, but in the large majority they are the means of causing the very accidents which they are intended to avoid. Being of necessity only small wires, they are a constant trouble to maintain. They are very liable to break when heavy telegraph or telephone wires fall upon them. A number of automatic devices have recently been placed upon the market, with the object of cutting off the current should any other wire fall across the trolley wire. But neither guard wires nor any of these devices strike at the root of the matter, which is to prohibit entirely uninsulated wires of any kind crossing the trolley wires. If telegraph and telephone wires must be erected overhead they should only be allowed to cross the streets at right angles, the spans should be kept exceedingly short, and the wires carried as high as possible, in order that a broken wire may not reach the street. They should be insulated at such crossings, and, if guards are insisted upon, in addition to the above, they should be provided by a netting or similar arrangement under the telephone wires, and not over the trolley wires. The recent accidents, which have happened in Liverpool and other towns, have been caused just as much by the telephone wires as by the trolley wires, but, in the mind of the public, they are called trolley-wire accidents, and nothing else. If local authorities would insist on all telephone wires being placed underground, there would be no necessity for guard wires, or such like unsatisfactory half measures.

Before bringing these somewhat rambling remarks to a conclusion, perhaps I may be permitted to say a few other words, more particularly to our younger engineer members. A visit to a number of electricity works in this country leads one to the conclusion that, in too many cases, plant of too small a size has been put in. By this I do not mean not enough plant, but generating sets for too small an output. Those responsible for the design of the works did not seem to have been very sanguine as to the future of the undertaking, and so they put in sets for as small as 50-kw output, and in some cases even smaller. In the course of a few years, when the station has grown, these sets have become too small, and are either never used or are sold at a loss. Surely, if we expect the business of electricity supply ever to approach the extent of gas supply, we should lay out our power stations on generous lines, and put in plant with an idea to its future economical use, rather than to its suitability for just the number of customers we may have for the first year or two.

* Abstract of presidential address before the Incorporated Municipal Electrical Association's seventh annual convention at London.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JULY 8, 1902

704,044. Side Bearing for Railway Cars; C. F. Huntoon, Chicago, Ill. App. filed April 23, 1902. The special feature of this invention is the provision of rollers in the upper face of the bearing for supporting the load combined with other rollers arranged to take the lateral thrust.

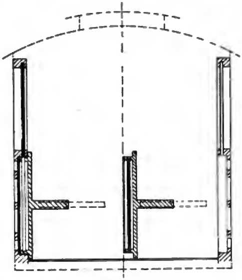
704,067. Tramway Car; A. Maurer, Ehrenfeld, Cologne, Germany. App. filed March 3, 1902. A convertible car in which the seats run lengthwise and are pivoted at the ends of the car; the back of the seat is vertical and extends to the floor, the back and seat being secured together. To convert into an open car, one seat is thrown over until the back rests along the center of the car, both seats then facing in the same direction. The side windows are then removed.

704,088. Side Bearing for Railway Cars; S. Northrop and A. G. Steinbrenner, St. Louis, Mo. App. filed Nov. 21, 1901. Details.

704,092. Contact System for Electric Railways; T. B. Patch, North Cambridge, Mass. App. filed Nov. 29, 1901. Standards arranged alongside the track carry insulated contacts with which the collector makes under contact.

704,093. Contact System for Electric Railways; T. B. Patch, North Cambridge, Mass. App. filed April 4, 1902. A modification of the preceding system in which the contact shoe extends from one truck to another.

704,141. Street Car Fender; C. T. Stoelting, St. Louis, Mo. App. filed Dec. 9, 1901. The fender is adjusted to the car to have a bodily motion in both a vertical and lateral direction, springs being arranged to cushion the movement in each direction.



PATENT NO. 704,067

704,143. Hand Strap for Street Railway Cars; M. Straus, Denver, Col. App. filed Oct. 28, 1901. The regular loop is provided with a series of cross-straps to accommodate a number of persons at the same time.

704,166. Street Car Fender; C. Zimmerman, Chicago, Ill. App. filed Feb. 19, 1902. A pair of normally open jaws which close upon and hold a person struck.

704,188. Car Truck; B. Haskell, Saginaw, Mich. App. filed May 13, 1902. Details.

704,210. Sander for Railways; J. Quin, Toronto, Canada. App. filed Aug. 24, 1901. Through gearing manipulated from the platform, a rotary shovel is operated to force the sand out of the hopper.

704,227. Ratchet Brake for Cars; H. Witte, St. Louis, Mo. App. filed July 3, 1901. Details.

704,432. Guard Rail for Street Cars; W. S. Bradley, Philadelphia, Pa. App. filed May 8, 1902. A rail which is swung across the end of the passage leading to the cross-seats of an open car to prevent entrance and exit.

704,452. Vehicle Brake; C. B. Fairchild, New York, N. Y. App. filed Sept. 16, 1901. A heavy brake brush is adapted to be forced into contact with the roadbed to obtain great braking power.

704,461. Car Fender; J. T. Hodgins, St. Louis, Mo. App. filed Nov. 4, 1901. A drum or disk arranged in front of the wheel is adapted to be forced into contact with the wheels when it is struck by an obstacle, and is thereafter rotated in a direction to roll the obstacle along the roadway.

704,491. Brake Shoe; G. A. Woodman, Chicago, Ill. App. filed April 5, 1902. The shoe has a back plate of ductile metal which holds the front plate together until it is worn out.

PERSONAL MENTION

MR. J. R. HARRIGAN, of Columbus, has been appointed superintendent of the Newark & Greenville Street Railway, which was recently purchased by the Appleyard interests.

MR. C. F. GLADFELTER, who was formerly associated with General Manager Gilbert, of the Chicago Traction Company, of Chicago, Ill., has been appointed auditor of the Miami & Erie Canal Transportation Company.

MR. W. B. GRAHAM, assistant superintendent of the St. Paul City Railway Company, has resigned from that company to accept a position under General Superintendent Dow Smith, of the Brooklyn Rapid Transit Company.

MR. E. P. VINING, formerly general manager of the Market Street Railway, of San Francisco, Cal., has become prominently identified with the Midland Pacific Railroad, which is to build a road from Bakersfield, Cal., to the Pacific coast.

MR. W. A. BAILEY has resigned as treasurer of the Worcester & Webster Street Railway Company, of Worcester, Mass., and will probably be succeeded by Mr. M. J. N. Potter, manager of the Worcester & Webster Street Railway. Mr. Bailey will in the future devote his entire attention to the Worcester & Southbridge Street Railway Company.

MR. CHARLES THRASHER, for a long time auditor of the Southern Ohio Traction Company, and later of the Cincinnati, Dayton & Toledo Traction Company, has been appointed auditor of the Western Ohio Railway. Mr. Thrasher will be succeeded by Mr. John Huntington, of Lorain, O., at present auditor of the Lorain Street Railway Company.

MR. C. W. MANSFIELD, who has been connected with the president's office of the Brooklyn Rapid Transit Company for about a year, has been given the management of the company's office building on Montague Street. Mr. Mansfield has a genius for details, and has not only thoroughly familiarized himself with the routine office work but has an extensive knowledge of the road and its operation.

MR. C. W. GEARHART, who recently resigned his position as superintendent of the Bridge Division of the Brooklyn Rapid Transit Company, has accepted a position with the Crocker-Wheeler Company in its sales department. The announcement that Mr. Gearhart had gone to Boston, which appeared in these columns a few weeks ago, was an error, as Mr. Gearhart resigned his position with the railroad in order to accept his present one with the manufacturing company. He will make his headquarters at the main office of the company, Ampere, N. J.

MR. W. S. DIMMOCK, who for the last year has been general manager of the lines of the Richmond Passenger & Power Company, of Richmond, Va., has resigned from the company to accept a position with Stone & Webster, of Boston, taking charge of their lines in Tacoma, Wash. Mr. Dimmock has left Richmond for Boston, the headquarters of Stone & Webster, and after a rest of about ten days he will start for Tacoma. Before becoming general manager of the Richmond Passenger & Power Company Mr. Dimmock was general manager of the Omaha & Council Bluffs Railway & Bridge Company and the Omaha, Council Bluffs & Suburban Railway Company. When he entered the electric railway field Mr. Dimmock had been prominently identified with a number of steam roads. Beginning at the bottom he worked up through the transportation and freight departments, holding positions of trust with the Burlington, Wabash, Union Pacific and other lines. Much of the experience gained while in the service of the steam companies proved advantageous to Mr. Dimmock, for in his street railway connections he has had to solve in the operation of suburban electric lines problems similar to those met in steam railroad work. Mr. Dimmock was a charter member of the Street Railway Accountants' Association, and has also taken an active part in the affairs of the American Street Railway Association.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, July 16, 1902.

The expectations of immediate gold exports commonly held a week ago, were after all unfulfilled. A firmer tendency in the local time money market, and a simultaneous easing of rates abroad, caused renewed drawings of bankers' bills, which served to depress exchange quotations sufficiently to allow no further chance for profit in shipping gold. Meantime the Paris demands in connection with the French Government debt conversion appear to have been supplied. Sterling exchange at Paris has consequently recovered a fraction, and so has helped to render the situation unfavorable to a movement of gold. These developments have relieved the local money position substantially, at the moment when it was beginning to feel the strain of the heavy withdrawals of currency by the West. Along with this the Treasury has been disbursing unusually large sums on account of war department expenses, and special appropriations, the government deficit for the month thus far already reaching upward of $10,000,000. A lasting suspension of the "Sub-Treasury drain" is not, of course, to be expected, even with the diminished internal revenue. But the temporary excess of government outlay is certainly a timely factor in assisting the money market over an uncertain period. Whether the Western currency demands are largely an incident of the Chicago corn corner, or whether they are the early beginnings of the regular crop-moving requirements, the main fact is that the local banks in remitting now will lighten the pressure of the movement when the season is farther advanced. The curious feature of last week's operations, which completely upset Wall Street's preliminary calculations, was the substitution of bank notes for legal tenders in the forwardings to the interior. As a result of this, the loss in lawful money holdings reported in Saturday's bank statement, turned out less than half what had been anticipated. Surplus reserve instead of decreasing heavily, as apprehended, actually increased over $2,000,000. This unlooked-for showing served to check the hardening tendency which had begun to appear in call money rates, but it did not affect the disposition of lenders to hold out for better terms in their time contracts. Rates on this class of loans have been marked up quite generally to 5 per cent.

The Stock Market

The upward movement, which for some time has been gathering energy in the stock market, has broken out into a more vigorous demonstration during the last week. Outside developments of a favorable character are partially responsible for the more aggressive nature of the advance. The government experts issued on Thursday last their first computation of the season's corn crop, and it made a most excellent impression upon all classes of the financial community. Without going into a lengthy analysis, suffice it to say that the present outlook promises the largest yield in the history of the country, and that the conditions are brightest in the sections where good results are most needed—namely, in the States of the Missouri Valley, which suffered most from last summer's disaster. Along with the extraordinary corn estimates, the official returns indicate a record oat crop, and the third largest crop of wheat ever gathered. These indications have gained strength, moreover, from the final termination of the long spell of rainy weather in the West, and the development of the normal July conditions of sunshine and heat which are needed for the ripening of all grains. The promising crop position, it need hardly be pointed out, has been the influence of first importance in the week's movement on the Stock Exchange. Next to it comes the relief already described in the money market, and following this are the further evidences of a gradual disintegration of the miners' forces in the coal strike. With the satisfactory adjustment of these several uncertainties in the outside situation, the powerful speculative and financial interests which for some time past have been laying their plans for another "bull" campaign, have felt emboldened to begin active operations again. How far they will carry their undertaking at this particular time, is something regarding which one person's judgment is as good as another's. At this writing there are no signs that the advance is about to halt.

The local traction group, although displaying more activity than the previous week, have not cut a prominent figure in the trading. Sentiment is very bullish on the three active stocks, however, and confidence is expressed that they will shortly join the procession toward higher prices. We note some further accumulation of Brooklyn Rapid Transit by houses representing the leading speculative interests in the property. Manhattan Elevated also continues to be absorbed very confidently on all recessions. The dealings in Metropolitan have been too light to possess any significance, but it is noteworthy that someone is losing no opportunity to bid up the quotation on the new issue of the Metropolitan Securities Company. Business has also begun on the curb in the new 4 per cent Metropolitan bonds "when issued." They are quoted a fraction above 99.

Philadelphia

The new Philadelphia Rapid Transit stock has been the feature in its local market during the past week. It rose on heavy buying from 9 to 9⅞, and the indications rather point to a continuance of speculative operations encouraging an upward direction. There is nothing new in connection with the property itself, apart from a good deal of conjecture as to the character of the Union Traction report for the fiscal year which is due now before long. The general expectation is that a moderate increase will be shown over the earnings of the previous year. Union Traction holds steady around 45, but with dealings light and very much scattered. Doubtless the arrangement for a gradual dividend increase from 1½ per cent the first year, to 3 per cent after 1908, has invited some outside investment purchases. Philadelphia Traction has also been well bought at an advance to 99¼, which is the highest it has sold since the payment of the last quarterly dividend. Other sales of traction stocks have been few and unimportant, including only American Railways at 45¾, Railways General at 4¾ and Consolidated of New Jersey at 68¼. Bonds have been moderately active, with sales reported in Electric People's Traction 4s at 99½, Syracuse Rapid Transit 5s at 103½, United Railways 4s at 87¾, Consolidated of New Jersey 5s at 100¾, and Indianapolis Railway 4s at 86¾.

Chicago

All danger of a strike on the Chicago surface lines seems at the moment to have been removed. The City Railway has flatly refused to grant the demands of its employees for an increased wage scale. On the removal of the strike apprehension Union Traction common recovered sharply from 13 to 15. Reports were circulated from speculative sources later that the company was about to undergo reorganization, but these stories were so quickly denied by officials that they had little effect. Metropolitan Elevated preferred rose sharply from 90 to 91½, reflecting the view that the company could easily pay a 2 per cent dividend in August, and 3 per cent in February, completing the authorized 5 per cent on the preferred stock. Liquidation in Lake Street Elevated is seemingly over for the present at least. The stock does not rally, however; it is hanging reluctantly around 10. The only other sales for the week were scattered lots of Metropolitan common around 38, and Northwestern common at 35½.

Other Traction Securities

Business in the Boston tractions continues exceptionally light. Dealings in Massachusetts Electric, by comparison with recent records, have amounted to practically nothing during the last week. The common is off a point to 41½, and the preferred is unchanged at 97¾. Scattering sales are reported in Boston Elevated at 166 down to 164, and in West End common at 95¾. The feature of the Baltimore dealings has been the sensational fluctuations in Nashville Railway securities. The basis of the advance during the last fortnight was the expectation of a decision from the Tennessee court dismissing the motion attacking the company's charter, and so giving the reorganization committee a clear course to carry out its plans. Anticipating this, the 5 per cent trust certificates which sold as low as 63 two weeks ago, rose to 78, and the stock advanced from 3 to 7⅛. On Monday the news was received that the court had handed down a decision unfavorable to the company and practically declaring the charter forfeited. The bond certificates broke violently on this announcement to 70, and the stock to 6o. United Railways of Baltimore securities remain quiet but firm around 70 for the income bonds, and 16 for the stock, the general 4s selling around 97. Other Baltimore transactions for the week comprise City and Suburban (Washington) 5s at 104 to 105, Anacostia & Potomac 5s at 102½ to 103, Atlanta Railway 5s at 105, Charleston Consolidated 5s at 95, Charleston Railways 5s at 105, City Railway Light & Power of Newport News 5s at 100, and Lexington Street Railway 5s at 103¾. Columbus Street Railway shares have become more active, the preferred selling up above 108 and the common rising to 52¼. All offerings of Louisville common around 125 have been obsorbed, and the probabilities are that the stock would find buyers if offered as high as 130. New Orleans Railways common has been strong at an

advance of a half point to 11. Rochester Railway preferred is selling freely at 101½, and the bonds at 112⅝. On the New York curb sales of $5000 San Francisco Street Railway bonds were made at a decline to 90½. St. Louis 4s are stronger at 87½. San Francisco preferred has sold at 63½, Toledo at 31 up to 31½, Washington Electric 4s at 82¼, and American Light & Traction preferred at 94.

Toledo Railways & Light was again the leading feature on the Cleveland exchange last week, 783 shares selling at 30¼ to 30½. Southern Ohio Traction advanced from 67 to 70¼ during the week, on sales of 542 shares; it was strong at the close at 70⅝ asked. Bidding was strong on Detroit United, but only about 200 shares changed hands, at 78. Northern Ohio Traction common dropped a point and a quarter on 226 shares, which sold from 40 to 41¼. The preferred was strong at 89 and 89¼, 102 shares selling. Western Ohio dropped to 25½ and 25¾, 220 shares selling. Lake Shore Electric sold on the exchange for the first time since the stock was listed, 200 shares brought 10, subsequent quotations advancing to 11¾ bid and 17 asked. A sale of Syracuse Rapid Transit common was made at 27. Total sales in traction was 2417 shares compared with 2038 the week before. Monday 200 Detroit United sold at 79 and 79⅛, and 87 shares of Northern Ohio Traction common went at 40.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid July 8	Closing Bid July 15
American Railways Company	45⅝	45½
Boston Elevated	164	164
Brooklyn R. T.	67⅞	68⅝
Chicago City	206	206
Chicago Union Tr. (common)	15	14¾
Chicago Union Tr. (preferred)	50¼	47½
Cleveland Electric	a87	..
Cleveland City	106	..
Columbus (common)	50½	52
Columbus (preferred)	107	108¼
Consolidated Traction of N. J.	68½	68¼
Consolidated Traction of N. J. 5s	*110	109¾
Detroit United	76¼	78⅞
Electric People's Traction (Philadelphia) 4s	99¼	99½
Elgin, Aurora & Southern	41	a45
Indianapolis Street Railway 4s	86¾	87⅝
Lake Street Elevated	9⅞	10¼
Manhattan Railway	132	132½
Massachusetts Elec. Cos. (common)	42¾	41½
Massachusetts Elec. Cos. (preferred)	97½	97½
Metropolitan Elevated, Chicago (common)	38	37½
Metropolitan Elevated, Chicago	89	90
Metropolitan Street	148¾	148⅝
New Orleans (common)	34	34
New Orleans (preferred)	112½	112¼
North American	121½	126¼
Northern Ohio Traction (common)	41	39⅝
Northern Ohio Traction (preferred)	89¼	89
North Jersey	30⅝	30½
Northwestern Elevated, Chicago (common)	35½	36
Northwestern Elevated, Chicago (preferred)	80	80
Philadelphia Rapid Transit	9	9⅝
Philadelphia Traction	98½	99¾
St. Louis Transit Co. (common)	30¼	30½
South Side Elevated (Chicago)	108	109
Southern Ohio Traction	64	70⅞
Syracuse Rapid Transit	26	..
Syracuse Rapid Transit (preferred)	a70	..
Third Avenue	131	131
Toledo Railway & Light	30¼	30⅞
Twin City, Minneapolis (common)	119¼	119
United Railways, St. Louis (preferred)	82	82½
United Railways, St. Louis, 4s	87	87¼
Union Traction (Philadelphia)	44⅞	45
Western Ohio Railway	25	22⅝

* Ex dividend. † Last sale. (a) Asked. (b) Ex-rights

Iron and Steel

The general reports of the iron market continue the same substantially as they were a week ago. The coal strike continues to hamper the foundry iron makers to such an extent that some of them are unable to supply their customers. In the West, the product is being sold freely for delivery in 1903. On the other hand, in the steel trade, supply seems to be fast overtaking demand, owing to the fact that sheet and wire mills which find business dull are reselling their stock of billets and bars. No let up, however, is reported in the tense condition of the structural material, and steel rail branches of the industry, and in the latter the chances favor an early considerable increase in imports of foreign goods. Quotations are unchanged on the basis of $21.50 for Bessemer pig, $33 for steel billets, and $28 for steel rails.

Metals.

Quotations for the leading metals are as follows: Copper, 12 cents; tin 28¼ cents; lead, 4⅛ cents, and spelter, 5¼ cents.

WORCESTER, MASS.—The trustees of the Worcester Railway & Investment Company have declared a regular semi-annual dividend of $2.25 per share, payable on August 1, to shareholders of record at the close of business on July 21.

BOSTON, MASS.—The Railroad Commissioners will not give hearings on the petition of the Boston & Northern, Old Colony and the Lawrence & Reading Street Railway Companies for increased capital until next August, at the earliest. The Boston & Northern asks for $2,250,000 new capital, the Old Colony, $1,250,000, and the Lawrence & Reading, $100,000.

PITTSFIELD, MASS.—The Pittsfield Street Railway Company, which recently absorbed the Hoosac Valley Street Railway, is to petition the Railroad Commissioners for authority to increase its capital stock from $100,000 to $400,000, for the purpose of taking up the floating indebtedness and the bonded debts of the company and to make important improvements to the line. The stockholders of the company held a meeting a few days ago and these directors were elected: Colonel F. S. Richardson, of North Adams; Hon. W. B. Plunkett, of Adams; A. H. Rice, P. H. Dolan and W. L. Adam, of Pittsfield. The directors elected the following officers: Colonel F. S. Richardson, president; A. H. Rice, vice-president; Ezra D. Whittaker, of Adams, treasurer; S. Proctor Thayer, of North Adams, clerk. P. H. Dolan and P. C. Dolan, of Pittsfield, will continue as general managers of the road, and W. T. Nary is to remain as superintendent. C. Q. Richmond, of North Adams, resigned as president of the company, and A. C. Houghton and W. W. Richmond resigned as directors.

WORCESTER, MASS.—The directors of the Worcester Consolidated Street Railway Company have voted to petition the Railroad Commissioners for the right to increase the capital stock of the company by an amount not to exceed $500,000. The present capitalization is $3,995,000. The additional money is wanted for the purchase of new cars and to pay for the addition to the Market Street car house.

BOSTON, MASS.—The Boston News Bureau says it is understood that the $1,000,000 Old Colony Railroad 3½ per cent thirty-year bonds were sold to Blake Brothers & Company, Estabrook & Company and R. L. Day & Company jointly, on a 3⅜ per cent income basis, or in the vicinity of 102.35.

DETROIT, MICH.—The Evening News, of July 15, says that President J. C. Hutchins and other Detroit United Railway directors are in Cleveland in consultation with the bankers' committee having the Everett-Moore interests in charge. The proposition is said to be to organize a new company to include the railways in Detroit, the Detroit & Toledo Shore line, the Monroe & Toledo Railway, known as the Black-Mulkey line, and the Everett-Moore railways between Toledo and Cleveland.

BROOKLYN, N. Y.—There has been filed in the office of the County Clerk of Kings County the $150,000,000 mortgage authorized by the stockholders of the Brooklyn Rapid Transit Company in March last, covering the property, stock, securities, etc., of the company. The mortgage is dated July 1, and the Central Trust Company of Manhattan is the mortgagee. The purpose of the mortgage, as previously stated, is to allow the company to issue stock for the amount, the money raised to be used for the various improvements in the road and for taking up underlying mortgages as they become due.

NEW YORK, N. Y.—A majority in value of the mortgage bonds of the Staten Island Electric Railroad Company and of the receipts calling for the delivery of stock of the Richmond Borough Company, and of the bonds and stock of the New Jersey & Staten Island Ferry Company and the Richmond County Power Company, having been deposited under the terms of the agreement lodged with the Guaranty Trust Company, of New York, dated April 1, 1902, the committee, consisting of William Lanman Bull, R. Somers Hayes, John Greenough and Walter G. Oakman, has declared the plan of reorganization operative. The time for deposit of securities under the plan mentioned has been extended to July 31 next, after which no deposits will be accepted except on such terms as may be fixed by the committee.

STEUBENVILLE, OHIO.—The Steubenville Traction & Light Company has increased its capital stock from $700,000 to $1,000,000.

YOUNGSTOWN, OHIO.—The Youngstown & Southeastern Electric Railway Company was incorporated July 11, with $50,000 capital stock, by H. E. Hamilton, Thomas E. Connell, E. H. Moore, Gordon Cook and James J. McNally. The plan of the company is to construct an electric railway between Youngstown and Poland.

HARRISBURG, PA.—At the regular monthly meeting of the Board of Directors of the Harrisburg Traction Company a semi-annual dividend of 2½ per cent was declared.

NASHVILLE, TENN.—The Court of Chancery Appeals has delivered an opinion invalidating and declaring void the consolidation attempted to be effected in 1900 by the constituent lines of the Nashville Street Railway. The consolidated properties are bonded at $6,500,000, and stocked for a like amount. If the Supreme Court upholds the decision the railway company will be compelled to make terms with the city before a consolidation can be effected or the constituent lines will have to be operated independently and the consolidated stocks and bonds will be invalidated, it is said.

NORFOLK, VA.—The Norfolk, Portsmouth & Newport News Company has given a mortgage for $4,000,000 to the North American Trust Company to secure an issue of 40-year 5 per cent first mortgage gold bonds, and has also given a mortgage for $2,000,000 to the Richmond Trust & Safe Deposit Company to secure an issue of 5 per cent 40-year bonds.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., May '02	60,717	33,911	26,806	12,957	13,879
	1 " " '01	48,976	28,301	20,294	11,382	8,821
	5 " " '02	251,306	148,773	102,533	......	......
	5 " " '01	210,776	132,335	78,441	......	......
	12 " Dec. '01	617,011	*350,843	266,168	136,162	130,006
	12 " " '00	513,722	*317,473	196,249	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., May '02	131,871	90,893	40,977	23,476	17,501
	1 " " '01	73,725	60,995	12,730	19,901	†7,170
	11 " " '02	1,347,142	928,159	418,983	239,299	179,684
	11 " " '01	1,214,749	836,460	378,289	219,834	158,455
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,076	......	......
	1 " " '01	15,678	9,311	6,367	......	......
	10 " " '02	187,638	103,966	83,672	......	......
	10 " " '01	169,756	94,355	75,401	......	......
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,336,597	3,532,899	2,896,350	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., May '02	1,156,345	*730,152	426,192	......	......
	1 " " '01	1,075,576	*715,161	360,415	......	......
	11 " " '02	11,624,417	*8220,062	3,404,355	......	......
	11 " " '01	10,980,174	*7217,904	3,762,270	......	......
	12 " June '01	12,135,559	*7216008	4,919,551	4,341,748	577,803
	12 " " '00	11,768,550	*7106373	4,662,177	4,185,405	586,772
BUFFALO, N. Y. International Tr. Co.	1 m., May '02	264,184	146,787	117,398	97,330	20,068
	1 " " '01	291,666	161,077	130,589	92,020	38,569
	1 " " '00	209,309	115,487	93,822	78,250	15,572
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	6 m., May '02	399,572	208,324	191,248	75,826	115,422
	6 " " '01	243,745	159,425	86,320	76,714	9,607
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., June '02	17,750	7,065	10,685	......	......
	1 " " '01	17,254	6,196	11,057	......	......
	6 " " '02	78,940	38,021	40,919	......	......
	6 " " '01	65,401	34,403	31,056	......	......
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	......	......
	12 " " '00	757,964	378,061	379,903	......	......
CLEVELAND, O. Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	......	......
	1 " " '01	2,435	3,016	†581	......	......
	12 " Dec. '01	47,976	*32,002	15,974	18,025	2,051
	12 " " '00	49,646	*33,272	16,374	18,254	3,060
Cleveland & Eastern	1 m., Feb. '02	4,916	3,616	1,300	......	......
	1 " " '01	3,525	4,037	†512	......	......
	12 " Dec. '01	90,390	52,022	38,368	42,678	†4,310
	12 " " '00	68,893	36,672	32,221	40,148	†9,987
Cleveland El. Ry. Co.	1 m., May '02	217,563	......	......	......	......
	1 " " '01	187,049	......	......	......	......
	5 " " '02	963,960	......	......	......	......
	5 " " '01	854,594	......	......	......	......
	12 " Dec. '01	2,296,898	1,255,953	1,040,945	244,231	796,714
	12 " " '00	2,061,506	1,121,037	940,467	259,483	681,984
Cleveland, Elyria & Western	1 m., June '02	25,198	13,026	12,172	......	......
	1 " " '01	22,236	9,736	12,501	......	......
	6 " " '02	128,392	77,729	50,661	......	......
	6 " " '01	107,027	64,259	42,768	......	......
	12 " Dec. '01	249,399	136,865	112,394	57,023	55,371
	12 " " '00	179,606	102,303	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., May '02	17,128	9,032	8,096	......	......
	1 " " '01	13,498	6,583	6,915	......	......
	5 " " '02	61,816	35,180	26,630	......	......
	5 " " '01	49,700	28,193	21,507	......	......
	12 " Dec. '01	164,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*69,592	71,520	72,500	†980
DENVER, COL. Denver City Tramway Co.	1 m., Apl. '02	124,516	66,533	57,983	32,864	25,119
	1 " " '01	116,357	62,866	53,490	31,304	22,186
	4 " " '02	481,348	251,118	230,230	131,259	98,972
	4 " " '01	435,207	236,913	198,292	125,622	72,739
	12 " Dec. '01	1,507,293	818,821	688,365	383,180	305,185
	12 " " '00	1,302,850	722,455	579,895	374,301	205,548
DETROIT, MICH. Detroit United Ry.	1 m., May '02	282,415	151,336	131,079	67,752	63,327
	1 " " '01	243,447	138,301	105,142	57,360	47,782
	5 " " '02	1,307,822	747,710	560,112	327,107	232,205
	5 " " '01	1,122,812	635,934	486,377	286,785	199,592
	12 " Dec. '01	2,919,171	*1596725	1,322,446	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " '01	28,877	18,062	10,816	9,622	1,194
DULUTH, MINN. Duluth-Superior Tr.	1 m., May '02	44,473	20,296	24,167	9,745	14,442
	1 " " '01	37,206	19,628	17,576	9,158	8,418
	5 " " '02	196,910	110,278	86,632	48,190	38,443
	5 " " '01	169,074	99,527	69,547	45,557	23,960
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., May '02	35,115	20,343	14,772	8,333	6,439
	1 " " '01	29,616	16,097	13,519	8,333	5,186
	12 " " '02	379,252	216,017	163,235	100,000	63,235
	12 " " '01	330,578	208,823	121,755	100,000	21,755
HAMILTON, O. Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,590	14,405	9,185	7,500	1,685
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	304,704	166,757	136,946	90,000	46,946
LONDON, ONT. London St. Ry. Co.	1 m., May '02	12,234	7,386	4,848	2,410	1,938
	1 " " '01	10,001	6,818	3,183	2,076	1,107
	5 " " '02	51,421	34,609	16,812	11,306	5,506
	5 " " '01	46,195	31,954	14,241	9,886	4,355
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., June '02	222,450	107,193	115,257	66,015	49,242
	1 " " '01	202,416	94,430	107,986	62,780	45,206
	6 " " '02	1,274,029	612,304	664,725	389,354	272,771
	6 " " '01	1,123,763	586,463	537,302	365,323	171,978
	12 " Dec. '01	2,442,312	1,186,531	1,255,808	755,139	501,660
	12 " " '00	2,220,698	1,129,787	1,090,911	824,663	266,247
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., May '02	296,901	136,964	160,038	58,783	101,294
	1 " " '01	251,946	114,340	137,606	56,633	80,971
	5 " " '02	1,356,556	649,001	706,555	292,801	414,752
	5 " " '01	1,178,257	563,664	614,594	273,065	341,428
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., May '02	178,408	86,780	91,628	18,672	72,955
	1 " " '01	161,283	90,765	70,518	11,633	58,885
	8 " " '02	1,257,518	766,238	491,280	194,907	296,373
	8 " " '01	1,174,090	743,687	430,412	75,995	354,417
NEW YORK CITY. Manhattan Ry. Co.	3 m., Dec. '01	3,038,435	1,404,971	1,633,465	753,135	880,329
	3 " " '00	2,738,526	1,240,606	1,387,902	749,837	638,065
	12 " Sept. '01	10,455,872	5,328,649	5,127,223	2,682,182	2,444,091
	12 " " '00	9,950,785	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,738,972	2,148,964	1,151,140	992,824
	3 " " '00	3,786,030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '01	14,720,767	6,755,181	7,965,636	4,584,069	3,481,567
	12 " " '00	14,487,134	6,631,254	7,856,880	4,443,780	3,360,100
OLEAN, N. Y. Olean St. Ry. Co	1 m., Mar. '02	3,994	2,411	1,584	1,146	438
	9 " " '01	3,835	2,043	1,792	1,187	604
	9 " " '02	41,735	21,611	20,124	12,343	7,781
	9 " " '01	39,270	19,276	19,994	11,088	8,905
PHILADELPHIA, PA. American Railways	1 m., May '02	97,701	......	......	......	......
	1 " " '01	73,408	......	......	......	......
	11 " " '02	908,356	......	......	......	......
	11 " " '01	764,560	......	......	......	......
RICHMOND, VA. Richmond Trac. Co.	1 m., Sept. '01	20,991	18,669	5,322	3,196	2,136
	1 " " '00	20,727	10,770	9,957	3,846	6,111
	12 " " '01	218,569	139,542	79,027	38,618	40,410
	12 " " '00	203,057	108,198	94,859	37,628	57,230
ROCHESTER, N. Y. Rochester Ry.	1 m., May '02	88,164	47,772	40,391	24,749	15,642
	1 " " '01	81,016	47,471	33,545	24,185	9,360
	5 " " '02	438,506	241,196	197,311	123,854	73,457
	5 " " '01	409,848	261,259	148,589	120,453	28,137
SCHENECTADY, N. Y. Schenectady Ry. Co.	3 m., Dec. '01	84,061	46,949	37,112	13,454	23,658
	3 " " '00	30,876	14,517	16,359	6,087	10,272
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., May '02	57,769	32,558	25,211	19,025	6,186
	1 " " '01	51,936	28,962	22,976	18,088	4,888
	11 " " '02	632,420	349,466	283,955	210,221	73,734
	11 " " '01	564,347	309,889	254,458	204,971	49,487
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., May '02	117,005	*60,246	56,759	......	......
	1 " " '01	101,255	*55,037	46,218	......	......
	5 " " '02	548,001	*298,234	250,877	......	......
	5 " " '01	496,027	*249,479	246,548	......	......
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	*616,945	565,572	409,061	156,511
W. NEW BRIGHTON, S. I. Staten Island Ry.	3 m., Mar. '02	38,189	46,906	†8,717	8,779	†17,496
	3 " " '01	35,897	38,288	†2,391	8,317	†10,708

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Reorganization of Rapid Transit Commission Proposed

The agitation for a reorganization of the Rapid Transit Commission has been revived, and it is now confidently asserted that special legislation will be enacted next winter for this purpose. Only a rash man would attempt to predict at this distance what is to happen when the snow flies, yet the friends of the commission admit that there is a strong probability of a reorganization of the board on an entirely different basis from that upon which it was originally founded. The chief objection that has been raised against the organization is the fact that it is a self-perpetuating body, and, as such, is out of touch with the spirit of American institutions. It is proposed to make the tenure of office for the commissioners six years, which, it is said, meets the ideas of the present commission. The bill, if introduced, doubtless will give the Mayor the appointing of a full board of six regular members, and will provide that the terms of the commissioners to be appointed by him shall terminate in two, four and six years. This, it is explained, will make it possible to make changes in the board from time to time, and thus, the advocates of the measure point out, any unwise general policy could not be continued for an indefinite length of time.

The Cleveland Situation

It looks just now as if the 3-cent fare plans of Tom Johnson and his colleagues in Cleveland were knocked in a cocked-hat. Mayor Johnson and his followers have been engaged in the setting up of the pins for their game during the last few years, and they had everything arranged for an impressive climax, when to their amazement they found themselves pronounced intruders and usurpers and unceremoniously hustled out of office. The whole trouble developed as a result of the inability of the Supreme Court of Ohio to see things in the same light as the reformers, who have been in control of the Cleveland city government for some time. The present municipal organization is pronounced unconstitutional by the highest tribunal in the State, and the Attorney-General has instituted proceedings to oust the incumbents from office. In the meantime they have been enjoind from granting any franchises or enacting any legislation excepting as may be absolutely necessary for the continuance of the city government.

The Brooklyn Tunnel Contract

The opening of the bids by the Rapid Transit Commissioners of New York, on July 21, to construct a tunnel under the East River from the City Hall, Manhattan, to the foot of Atlantic Avenue, Brooklyn, was marked by one incident which calls for more than passing notice. This was the attempt made by President Swanstrom, of the Borough of Brooklyn, to prejudice the chances of the award of the contract to the Brooklyn Rapid Transit Company, by charging that company with bad faith in all of its previous dealings with that city. The letter from President Swanstrom, which was couched in the strongest and most intemperate language, when analyzed was found to consist of only two definite instances of what the president chooses to term a disregard by the company of its statutory obligations. One of these was that it refused to keep in repair, in certain streets, the street pavements between its tracks and for 2 ft. outside thereof, as required by its contract with the city; the other was that it had refused to remove its tracks from certain streets, as demanded by the municipality. These charges were in part denied and in part explained by the counsel of the company present, who stated that the contract for paving with the city was made when horse traction was in use, and was for cobblestone pavements, and that the company had always been ready to lay the pavement required from them by law or contribute the cost of such pavement to the expense of laying granite blocks, if such pavement was preferred by the city. This seems certainly a fair ground to take, for it is hardly reasonable to ask a company when its cars and motive power do not wear the pavement to go to greater expense than required by its contract, when they did. The defense of the company for not removing its tracks was not made public at the

meeting, but President Swanstrom's position in the paving question, which formed the greater part of his letter, was so absurd that it is only reasonable to assume that his complaint in regard to the second matter was equally unfounded in justice. Independently, however, of the equity of the position taken by the Brooklyn Rapid Transit Company in these points, and independently also of the relative advantages to the city at large of the bids of the Belmont syndicate and the Brooklyn company for the construction of the tunnel, the Borough of Brooklyn would be best served, in our opinion, by the granting of the best possible facilities for the admission of the cars of the Brooklyn Rapid Transit Company into lower New York. This section of the Greater City is to Brooklyn what the business district of any city is to its residential sections, yet the incident which we have just related shows the chief executive of the borough doing all he can to defeat the through passage, and for one fare, of a large part of his constituents to their places of business. The outcome of the contest for the East River tunnel contract has yet to be announced, and undoubtedly the inducements offered by both bidders will receive due weight; nevertheless, the animus shown by the official representative of the borough most largely interested will hardly be relished, we think, by the residents of Brooklyn.

The Rapid Transit Commission is certainly confronted with a very serious problem in the matter of awarding the contract for the Brooklyn tunnel. We believe that altogether too much weight has been given to the financial question, as it is not by any means the most important consideration. At the present time the demand for additional transportation facilities comes principally from the people of Brooklyn doing business in Manhattan, and the requirements of this large and important class can only be met by affording direct communication between the downtown business district of New York and all parts of Brooklyn. When the subway system is completed it is expected that all sections of the greater city will be within easy access, and for this reason pressure is brought to bear upon the commission to make the proposed tunnel a part of the subway system at once and place it under the same management. The Rapid Transit Commission will be called upon to weigh carefully the claims submitted, and reach a decision that will conserve the best interests of the entire community.

The Pennsylvania Franchise Defeated.

The action of the New York Board of Aldermen upon the Pennsylvania Railroad tunnel franchise is discouraging, but it is in keeping with the record of that body. It had been hoped that the board would recognize the fair and generous attitude of the Pennsylvania company in its dealings with the Rapid Transit Commission, but the immediate compliance of the railroad company with demands that were generally considered prohibitive, has simply encouraged the aldermen to make a raid upon the corporation. The compensation provided for in the tunnel contract exceeded that paid by any corporation in the country for municipal privileges of any kind, yet the franchise imposed no burden upon the city or property owners; gave the company no rights which would burden the streets or present obstacles to traffic, in fact, took nothing from the city, but on the contrary provided for service that would be of great and lasting benefit.

The effect of the proposed improvement was noticeable upon the values of real estate in the locality of the terminals, even before the plans were perfected, yet in spite of this recognition of the value of the work to the city the aldermen rejected the plan and increased their demand. President Fornes' advice during the discussion should have been followed by his associates. He cautioned them not to be too eager. It should not be a question of how much could be gotten out of the corporation, he said, but how much ought to be asked; not a case of extortion, but of fair dealing. The aldermen were deaf to all such appeals, however, and only denounced those who made them as tools of the corporation.

The experience of the Pennsylvania company will not encourage corporations seeking privileges to be frank and generous when dealing with the New York municipality in the future, and the city is bound to feel the effects of this policy; moreover, it will doubtless result in great financial loss to the city, as well as inconvenience and delay in securing the transportation facilities which the business interests so much desired, and which it was the aim of this franchise to assist in securing.

The Drift of Railway Practice

In nothing more than in the character of the power plant does electric railroading show the change that a decade of experience has brought. The older plants with their small dynamos and mazes of shafting have been either reconstructed or abandoned, and the modern electric railway power station is, as a rule, of the highest order of efficiency as regards the nature of its equipment. When well operated, it delivers power at a price which only the best cotton mill practice can compete with. Yet we are bound to admit that the general run of electric railway power stations of moderate size are not economically successful. The cause is not hard to find. Setting aside the natural disadvantages of small plants in the matter of operating costs, one finds in these electric railway installations, first, a bad load factor, and, secondly, injudicious choice of units as regards capacity. Now, when only a small number of cars are operated it is a difficult matter to get a good load factor, and yet by a little tact on the part of the management much more can be done than would at first sight seem possible. The one most fruitful cause of trouble is simultaneous starting or grade climbing by a considerable proportion of the cars. The ordinary conditions of service prevent complete elimination of the first difficulty, although it may be ameliorated by watchfulness at the trying times when unusual crowds must be taken care of. But simultaneous grade climbing is another matter, and a little attention to schedules may result, not only in greatly improving the load factor of the system, but in actually relieving the maximum peak, so as to obviate the necessity of additional investment in apparatus.

We have in mind one plant in particular in which a great improvement was made by the good sense of the management in fixing the schedules. The city in which it operated had a public square which lay, as it were, at the bottom of a shallow bowl. Into this three diverging car lines ran and made connections. Out of it they climbed simultaneously, while the ammeter needle at the station made frenzied efforts to kick off the stop at the end of the scale. When the cars came into the bowl, on the other hand, the load was extremely light, unless the outgoing cars made unusual demands on the station. The result was not only a singularly bad load factor, but a villainously severe peak recurring every quarter of an hour, and during the evening hours of heavy load overtaxing the capacity of the generators. Finally the manager grew weary of the situation and readjusted the time table so that the cars entered and left the square successively at intervals long enough to allow one to clear the grade as another entered it. The relief was, of course, great and immediate. The periodical peak vanished and the maximum daily demand for current was diminished nearly 25 per cent. It might at first be supposed that the failure of the cars to meet at the inward end of the lines would have caused some inconvenience to the public, but as a matter of fact it worked both ways, for while some passengers who would have liked close connections, could not get them, others were glad to get five minutes or so for brief errands, and on the whole the plan worked admirably. The same sort of thing has been tried in divers places, with similar results, and it certainly enables a very important improvement to be made in the conditions of the power station.

But still other plants of moderate size suffer from what one may call "swelled head." That is the station is laid out by optimistic gentlemen, who, mindful of the chronic state of insufficiency which characterizes many urban systems, make what they are pleased to call "provision for future growth." This phrase too often implies units suited to a plant much larger than will be needed for some years to come. Provision for the future should

assuredly be made, in opportunity for additional units and additions to the station itself. These imply only a small additional fixed charge, which is but a trifling burden. A direct-coupled unit, however, of twice the size that is necessary for present necessities is a constant drain on the exchequer, and will lose enough money before it is really needed for the load to buy a better machine. We do not advocate an eye merely to present necessities, but we do maintain that Squeedunk Court House does not need a station laid out on metropolitan lines, that a plant with units of capacities that can be fully utilized, and in which the load factor can be kept high will turn out power cheaper than a station of ever so imposing equipment kept in a normal state of quarter load. There are times when it is well to pull in one's horns and look at the future without roseate spectacles. It is a fact that many small electric roads do not pay at all, or pay very poorly, and we think that in not a few cases this result can be traced to over confidence in the future, leading to capital charges that are far too severe for the probable receipts. It must be remembered that the history of the art shows that roads are generally re-equipped, not from the wearing out of the old apparatus and tracks, but from its being superseded by better equipment. One cannot proudly fold his arms and congratulate himself that he has built as he would build a granite dam, for a century to come. In less than ten years he will probably re-equip the system, and hence it is good policy to keep on the alert and ahead of actual requirements, but not to construct things which must be rejected before the future for which they were built can possibly arrive.

The Eternal Transfer Question

What the average man does not know about the practical operation of street railways would fill a book as big as any unabridged dictionary, and several long chapters would have to be occupied by a rehearsal of his ignorance on the subject of free transfers. City councils would furnish copy for at least one additional chapter on the same subject. A popular opinion seems to be that street railway companies carefully select the combination routes over which no passenger wishes to ride and solemnly grant transfers over them, reserving all routes in actual use for the payment of double fares.

We earnestly wish that some experienced traffic manager would write up for the benefit of the public the situation as it actually presents itself, for only detailed reference to concrete cases can adequately present the subject, but there are at least a few simple and general considerations which can be laid down without entering into the troublesome features of any particular case.

As a rule we believe, as the result of somewhat extended observation, that most street railway companies aim at giving the passenger free transfers over their lines to complete his ride in any one given direction. We do not propose to discuss here the justice of this policy except to say that there need be no reason other than that of expediency for giving transfers at any junction. There is nothing in the payment of a 5-cent fare which gives the passenger an inherent right to be transferred to another car of the same or a different company. Nevertheless so many companies have adopted the practice that it has become an almost integral part of the American one-fare system, as distinguished from the foreign arrangement of graded fares, running from 1 cent or 2 cents up, according to distance. The difficulty comes in its application in such wise as to suit best the convenience of the traveling public.

Obviously it is unfair to ask a street railway company to give a passenger a return check for a single fare, and the same consideration makes it unreasonable to require free transfers to lines which virtually constitute a return route. A transfer from the Broadway to the Third Avenue line, at the post office, enabling a passenger to go up town again, would be manifestly absurd. The same condition is true for lines sufficiently convergent to form a closed route by a comparatively short walk at one end of the ride. Almost any old street railway man can call to mind instances of extraordinary ingenuity in beating the road by its own transfer system, and in most cities there exist practically closed transfer routes, which cannot be avoided save by denying a transfer when it really ought to be given. The aggregate amount of loss to the company is usually small, for the number of dead-beats is limited, but now and then routes which ought to be free transfer routes are kept as double fare routes for fear of dead-beats. A company certainly has a right thus to defend itself if it really incurs the risk of material loss, but a little shrewdness will oftentimes avert the difficulty.

Another class of cases in which street railways are frequently justified in refusing free transfers are those in which two routes are open between certain points, of which one is congested. For instance, two suburbs are connected by a car line, and also have lines meeting at some common point in the city. In such case it is distinctly for the benefit of the public that passengers should not be encouraged to use the crowded city lines as a route from suburb to suburb. If there is a single fare from suburb to suburb by a practicable route it is all that can reasonably be asked, particularly if free transfers are given for limited distances along the main lines from the cross line. Each locality has questions of its own as to details, but the general principle that of two possible free transfer routes the one should be chosen that will least inconvenience the majority of the traveling public is thoroughly sound.

A similar principle holds for lines like the crosstown lines in this city. The imperative need of the great mass of the public is good accommodation up and down town and a system of crosstown transfers which would tend to overload certain already congested downtown lines would soon prove to be a nuisance. It is one of the cases where the greatest good of the greatest number must prevail, and this requires such adjustment of crosstown transfers as will best distribute the traffic on downtown lines. Many cities present similar situations, which must be dealt with in like fashion.

Almost every free transfer system gives the railway company the bad end of the bargain at some point, and it is not unusual to find single fares over routes 12 miles or 15 miles in length, which is more than the public has a right to expect. Such cases probably do not result in any serious loss to the railway company, on account of the limited number of passengers who take advantage of them, but they are a bit annoying. There is a fortunate automatic check on indiscriminate abuse of the transfer system in the changes of cars, which are necessary. On a well-loaded railway a change of cars is an intolerable nuisance to the passengers, and the number of dead-beats who will go to the trouble of working their way over an elaborate transfer route for the sake of getting the better of the company is very limited.

Under American conditions the public expects a liberal amount of free transfers and will get them by gentle means and mutual concessions if it can, forcibly if persuasion does not prevail. A broad policy on the part of a railway company will result in a liberal and sound transfer system, and nothing goes further in establishing pleasant relations with the public and in averting the continual attacks of the 3-cent fare contingent, which neither listens to argument nor considers the matter from a reasonable standpoint. But a really fair and wise transfer system is a tough proposition to work out. It needs very shrewd and careful attention to details of traffic to avoid the difficulties of the situation, and the whole matter ought to be given close and intelligent study. Every addition to the rapid transit facilities of a large city complicates the problem by establishing new points of junction. But the public, as we remarked at the start, understand so little the difficulties of the situation that it is apt to be quite unreasonable in its demands. If it could be brought clearly to see even the practical difficulties that surround a single case, one frequent source of friction between really allied interests would be removed.

Recent Improvements on the Boston Elevated Railway

The surface and elevated lines of Boston, included under the corporate management of the Boston Elevated Railway, are furnished current from eight power houses, namely, Central, Harvard, Lincoln, Dorchester, Allston, Charlestown, East Cambridge and East Boston stations. These stations are quite widely distributed, although all are operated in parallel except that at East Boston.

Especial interest centers at present in the Charlestown station, where the first of two large power units, recently installed, has been put in operation. In order to accommodate this unit an addition to the original power house was necessary, and the company succeeded in evolving a completed design by harmoniously blending the two radically different types of architecture.

The Charlestown station is located near the Sullivan Square terminal of the Boston Elevated Railway, at a point where water sufficient for condensing purposes can easily be obtained. The equipment of the old station consisted of three 500 hp boilers and

CHARLESTOWN STATION OF THE BOSTON ELEVATED RAILWAY

two horizontal cross-compound Allis engines, rated at 1000 hp each. These engines are direct-connected to multipolar generators of 800 kw capacity.

In order to take care of the largely increased demands of the service it was found necessary to enlarge the power equipment at Charlestown, and it was determined to install a Westinghouse vertical cross-compound engine, the order being placed through the Boston office of Westinghouse, Church, Kerr & Co. This engine has two cylinders, 44 ins. and 87 ins. in diameter, with 60-in. stroke, and runs at 75 r. p. m. It is given a nominal rating of 4500 hp, using steam at 160 lbs. initial pressure with a vacuum of 26 ins., and has an ultimate capacity somewhat exceeding 7000 hp.

The high-pressure cylinder is fitted with poppet valves for use with superheated steam, and the low-pressure cylinder with a Corliss valve gear of Westinghouse design. The cast-steel fly-wheel is 28 ft. in diameter, with 26-in. face, and weighs 350,000 lbs. The shaft is hydraulically forged steel, 37 ins. in diameter, with an 18-in. hole in the center. The total weight of the complete engine is, approximately, 1,125,000 lbs.

This engine is the first of the kind built in this country, making provision for using superheated steam.

The general appearance of the machine is shown in the accompanying cuts. It is very similar to the Bay Ridge engines. The bed-plate is a heavily ribbed casting of box pattern, made from cupola iron, and supports the main journal. It forms a crank pit into which oil from the principal working parts drains. The main shaft journals are 34 ins. in diameter and 60 ins. in length. The lower shell is of the ball and socket type, and has a jacket through which water may be circulated. The bed-plate and lower shell have been designed to permit the latter to be removed if the shaft be raised one-eighth of an inch. The housings are generally rectangular in cross section, and are made in halves and fitted together at the top with a machined joint and turned bolts in reamed holes. The housings are doweled to the bed-plates to insure correct alignment. Sheet steel oil guards are fitted in the opening in the housing on the side next the generator. Oil guards also surround the eccentrics and the outer ends of the main bearings. Cross head slides are provided with bored guides and have ample openings on the side to permit removal of the cross head.

The cylinders are not jacketed and a horizontal reheating receiver is placed between the high and low pressure cylinders. Cylinder covers are of the box pattern, heavily ribbed, and they contain the steam and exhaust valves and ports.

The valves are located in the cylinder heads, reducing the clearance to 3 per cent for the high pressure cylinder and 2 per cent for the low. The valve gear allows a cut-off up to three-quarters of the stroke. The crank is of the fan-tail pattern, finished all over, and the cross-head pins, crank pins and connecting rod are of open hearth forged steel. Especial attention has been given the details of the valve gear. The admission and exhaust valves of each cylinder are driven by separate eccentrics. The admission valves have what is commonly called a three-quarter gear, and the exhaust valves are actuated by a wrist plate gear. All valve gear connections are steel rods, fitted with heads provided with means for taking up wear, and for adjusting the length from center to center of journals. The maximum allowable pressures on projected areas of cross-head and crank pins are 1200 lbs. and 1000 lbs., respectively. The fly-wheel is of special construction, 28 ft. in diameter, 26 ins. face. The arms and rim are of cast steel and the center of air furnace cast iron, and the speed may be increased to 100 r. p. m. without exceeding the elastic limit of any member.

The crank shaft is of fluid compressed steel, 39 ins. in diameter in the wheel and 34 ins. diameter in the bearings, with a 16-in. hole through the center. It weighs 75,000 lbs. without cranks or wheel hub. The main bearings are lined with babbitt and are 60 ins. long. They are made in two parts, a top and a bottom shell, the latter being removable for relining or repairs by raising the shaft, as already described. The bottom shell is water-jacketed, and is so designed that should the babbitt metal be forced out, the shaft will not be let down on the shell. The maximum pressure per square inch on the projected area of the bearings does not exceed 250 lbs. An automatic stop is provided, and is fitted with pressure lubrication for both bearings and cylinders.

At three-quarters of rated horse-power a steam consumption is

NEW GENERATING SET; ENGINE DESIGNED FOR SUPERHEATED STEAM

guaranteed of 15 lbs. per horse-power per hour, including the water furnished to the receiver, the initial pressure being 165 lbs. and the vacuum 26 ins. In case a vacuum of 26 ins. is not obtained, a credit of .4013 lbs. per square inch of mean effective pressure in the low pressure cylinder is to be allowed for each inch the vacuum falls below 26.

The armature of a Westinghouse direct-current generator is carried on the main shaft between the high pressure and low pressure cylinders. This is one of the largest direct current railway

generators in New England. It is a 24-pole machine of 2700-kw capacity. The commutator and armature are 12 ft. and 15 ft. in diameter, respectively, and the total weight of the generator is about 338,000 lbs.

An interesting feature of the switchboard installation, which was also designed by the Westinghouse Company, is the operation of the circuit breakers, which can be thrown out from any portion of the building by means of electric buttons.

The condensing system includes two Allis condensers for the small engines built by the Allis Company, and a Bulkley Jet Condenser for use with the Westinghouse engine.

The capacity of the boiler room has been increased by adding four 500-hp boilers, built by the Aultman & Taylor Company, of Mansfield, Ohio. Coal is supplied to the power house by rail and loaded from cars into overhead hoppers, although the power house is located so that coal can be brought by either water or rail. The boilers are equipped with Greene Economizers, arranged in the usual manner, with by-pass flues for leading the gases direct to the stack, should occasion require. The method employed for the removal of ashes is of particular interest. The overflow from the condensers and pumps is carried through trenches, which pass under the ash pits of the boilers. The ashes can be dumped at will into these trenches and carried off with the overflow to flats or meadows which are being filled and enclosed.

While the new boilers were primarily installed for the purpose of furnishing steam to the Westinghouse engine, the scheme of piping has been carefully arranged so that the boilers may supply steam to any engine. Cylinder oil for the entire station is forced by city water pressure from a tank located in the basement.

The company recently discontinued the former system of running trains on the Atlantic circuit of the elevated line, and established in substitution therefor a new and more extensive service, which enable passengers to ride from any elevated station directly to any other station on the entire system without the inconvenience of changing cars. No change was made in the service on the main line, trains in both directions between Dudley Street and Sullivan Square continuing to run through the subway. The changes will be confined to improvements and extensions of the service upon the Atlantic circuit, and are shown diagramatically in the cuts. Instead of simply passing around the circuit, all Atlantic trains will run to either Dudley Street or Sullivan Square. All connections made by Atlantic Avenue trains will be included in the new service.

The train movements so established are very simple. The new routes constitute a "loop" system. Starting from either of the terminals, trains will run inbound to the junction of the former Atlantic circuit, returning via the Atlantic Avenue subway circuit to the terminal station from which they started. Trains run on these routes in both directions, that is to say, trains run from Sullivan Square through the subway, continuing to Atlantic Avenue and returning to Sullivan Square, and other trains run from Sullivan Square direct to Atlantic Avenue, returning by way of the subway to Sullivan Square. Likewise trains start from Dudley Street and run through the subway, thence to Atlantic Avenue and return to Dudley Street, and other trains start from Dudley Street and run to Atlantic Avenue and the North station, returning by way of the subway.

The destination and route for each train is plainly indicated by three different methods. First, at each terminal station a brightly illuminated signboard shows the destination and route of each train. Second, the platform men and the trainmen clearly and loudly announce the destination and route of each train while it is loading and unloading passengers. Third, colored lanterns or "markers" over the front end of the first car of each train indicate the destination and route of that train. A red light over the motorman's head, that is on the right-hand side of the hood, indicates that the train will run to Sullivan Square, and a green light in the same position indicates that it is bound for Dudley Street. A white light on the other side of the car indicates that the route from the terminal will be by way of the subway, and a yellow light in the same position indicates that the route from the terminal is by way of Atlantic Avenue.

ENGINE ROOM IN CHARLESTOWN POWER STATION, BOSTON ELEVATED RAILWAY

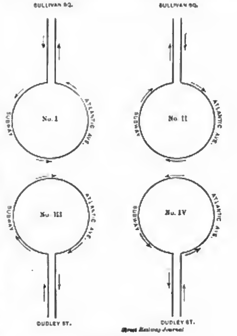


DIAGRAM OF TRAIN MOVEMENTS

The airship of Santos-Dumont is rapidly approaching completion at Brighton Beach, where a house has been built for it on the land of the Brooklyn Rapid Transit Company. An early voyage by the aeronaut is expected.

Improving the Service

The operation of an electric railway presents a never ending series of problems to the progressive manager. Each section of the country possesses peculiarities which are reflected in the traveling public, and scarcely a day passes on any busy system which does not bring to the manager or superintendent complaints of one kind or another concerning the service. Doubtless many of these are unjust, but few roads are so perfectly operated that the majority of complaints are without foundation. There is always abundant opportunity for the painstaking manager to effect changes for the better in a service that so closely affects the great masses as does the street railway.

During a recent trip across country in Massachusetts a few points were noted, small in themselves, but considerable in the aggregate, which afforded room for suggestive criticism. First of all the condition of the track and roadbed was impressed upon the passenger in a most disagreeable manner, for while in spots it was excellent, in other places, for several miles, the joints were in a condition that would scarcely be tolerated in a lumber camp. The motorman was operating a single truck, which lurched, tossed and jolted over the joints and around curves in the most reckless manner. The handling of the controller was in keeping with the rest of the experience, "full multiple and no coasting" being the motorman's motto. The discomfort of a single-truck car made itself felt here more than anywhere else on the trip, whereas the poor track and joints would have been far less wearing and racking if reasonable care had been used in the handling of the controllers. The line was a single track through a delightful country district, abounding in attractive scenery, and, if the amount of traffic noted on the cars is any index of the road's business, there was certainly little excuse for the abnormally poor track existing between the two important cities connected, and still less excuse for the operation of old and battered single-truck cars in a service which might be the company's pride, and contribute greatly to the comfort and pleasure of patrons. High-speed operation with single-truck cars oversteps the bounds of both safety and pleasure, to say nothing of the long continued jolting day after day to which the motorman and conductor are subjected with its injurious action upon their internal physical organization. Air brake control likewise is absolutely essential in all heavy and rapid service. The day is certainly coming when the double-truck car will reign supreme in long distance, fast service, above 25 miles per hour. No one can ride over a rough country road without at once feeling keenly the difference in comfort between these two classes of cars and being profoundly grateful to the company which has the progressiveness to employ the double-truck equipment for all such service where fast time is essential.

The incessant collection of fares which was kept up by the conductor was another drawback to riding in comfort and undisturbed peace. Instead of permitting through passengers to pay the full amount of their fares when they boarded the car they were called upon to contribute in small sums at frequent intervals. A visit from the conductor every 3 miles gradually gives the passenger the impression that he is being subjected to something akin to highway robbery, whereas, if the single straight fare to the passenger's destination could be paid at once, much inconvenience would be saved as well as much of the sensation of being mulcted by the company. In one car on this trip the conductor collected thirty-eight fares without ringing in one until the last was taken up, when the passengers were subjected to a continuous fusillade of thirty-eight shots from the register bell, which kept up for 15 to 20 seconds, and was, of course, thoroughly annoying. Nor was the car seriously crowded. Transfer checks were almost unknown on this trip. Once a conductor handed a passenger who asked him for transfers two bits of pasteboard marked "13", which he collected again from the same passenger some 5 miles further on, leaving the astonished patron of the road in the dark to this day as to the "transfer" effected.

It was a pleasure to notice, however, that no "stealing turnouts" occurred on this line. The confidence of the passenger in the railway company's safety of operation shrinks to small dimensions when his car rounds a curve at high speed to meet one coming head on in the opposite direction a hundred yards away.

On one line which operates an hourly time table the car had just left the small town where connection was to have been made when the second car arrived. A delay of an hour ensued. A reasonable attention to good time table practice would have obviated all this vexation as no known delay in time had occurred, and the annoyance to which the passengers were subjected on this occasion was due entirely to the failure of the management to appreciate the importance of this feature of successful operation.

Last, but not least, the passenger himself can do much to improve the service. In one case an open car entered a siding on a city street at the end of its run, and the passengers attempted to disembark. A large crowd which had been waiting, boarded the car before scarcely any of the passengers had alighted, and one woman, in a selfish frenzy, lest she might miss a seat, attempted to turn over the seat back, despite the fact that in doing so she was pinning in an elderly lady who was utterly helpless to move either way. The common principle of decency and consideration for the rights of others on the part of passengers will often do more toward assisting the company to give good service than a dozen printed rules in an operating book.

It is in no spirit of carping fault finding that these lines are written, and if they contain any suggestions which may help superintendents or managers to make some of the ragged edges of operation smooth, their purpose will have been attained.

Nut Lock on Compound Thread Bolt

An ingenious nut lock has been devised by W. W. Annable, master mechanic of the Grand Rapids Railway Company. The bolts on which this nut lock is to be applied are cut with a compound thread; that is, a right-hand thread is cut on the bolt, and the bolt is then run through a die which will give a left-hand thread of the same pitch. There are, therefore, two threads on the same bolt, one right-hand and the other left-hand. The only place that the thread is materially weakened is at the two points diametrically opposite each other, at which the right and left hand threads

COMPOUND THREAD AND NUT LOCK

cross, yet this takes out only a relatively small percentage of the total strength of the thread. The action of the nut lock is as follows: A nut with the usual right-hand thread is run onto the bolt and tightened in the ordinary way. A washer, the total diameter of which is somewhat larger than the nut, is then put on top of this first nut, and is followed with a nut having a left-hand thread. This nut with the left-hand thread is screwed down onto the first nut and washer. One edge of the washer is bent down over one of the faces of the nut with the right-hand thread, the other edge of the washer is bent up over one of the faces of the nut with the left-hand thread. If the nuts turn they must then turn together. If the lower nut starts to unscrew, it has the effect of tightening the upper nut with the left-hand thread down against it. If the upper nut starts to unscrew it has the effect of tightening the lower nut so that it is absolutely impossible for either nut to turn in either direction.

The accompanying sketch shows the nut lock as applied.

Allotment of Space for Street Railway Exhibition at Detroit

The allotment of space for exhibition purposes in connection with the Detroit convention of the American Street Railway Association was made by John H. Fry, chairman of the committee on exhibits, and T. C. Pennington, secretary and treasurer, at Detroit on July 5. A list of exhibitors, showing the space number, name and address of company or individual making exhibit, and amount of space allotted is presented herewith, together with diagrams of the main floor and gallery of the exhibition hall. At the time of the allotment it was found that 22,530 sq. ft. of floor space had been reserved by applicants.

The Light Guard Armory, in which this exhibition is to be held, contains in the main floor and gallery, upward of 15,000 sq. ft. of floor space available for exhibition purposes, in addition to a reasonable allowance for aisles. It was apparent that provision would have to be made at once for additional space, as the applications then filed exceeded this amount of space. The Common Council of the city was appealed to and permission was granted the association to utilize the sidewalk and part of the roadway for exhibition purposes. The armory occupies a corner, and, by placing a temporary structure over the sidewalk on the two streets upon which it faces, upward of 7000 sq. ft. was added to the available floor space. This annex, as it is termed on the diagram herewith presented, will be connected with the main hall so as to form a part of the exhibition proper. It will be noticed that there is very little space left for exhibition purposes, and manufacturers who desire representation should make immediate application to John H. Fry, assistant general passenger agent, Detroit United Railway, 12 Woodward Avenue, Detroit, who is chairman of the committee on exhibits.

Plotting Speed-time Curves

BY C. O. MAILLOUX

PART II.

The information and knowledge obtained in the preceding investigation of the nature and character of the three kinds of fundamental speed-time curves, namely, the acceleration curve, coasting curve and brake curve, is of much practical utility and convenience in the plotting of these curves, and also in the plotting of run curves, which, as we have already seen, are in reality made up by joining together various portions of acceleration, drifting and braking curves.

In this case we must, in a measure, reverse the process followed in the analysis of train motion, for, instead of separating the curve into its components, we must assemble these components synthetically, so as to produce the curve.

Preliminary Considerations.—There are certain considerations which enter into the discussion of every specific problem in train motion. These include many things, such as the character and

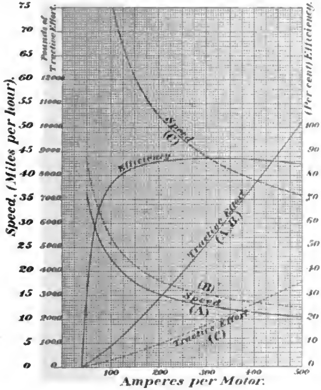


FIG. 5

location of the railway lines to be operated, the nature, character and other characteristics and conditions of the train service required, etc., etc. These things react upon and determine the schedule speed, headway and other service conditions, which, in turn, together with the total weight of a loaded train unit, determine the character and capacity of motor equipment required per train unit. A complete analysis of all these characteristics and conditions is beyond the scope of this paper. The preliminary calculations, by means of which the first approximation is made in regard to the number and capacity of motors per train equipment, are also beyond the scope of this paper.

The purpose of this section of the paper will be fulfilled if we assume that the motor equipment has already been decided upon, since one of the principal practical applications of the speed-time curves, more especially the service run curve, is to test or gage the qualities and fitness of a specific equipment, by furnishing information as to whether the proposed equipment is capable of doing the service required or wanted under the actual or assumed service conditions.

The plotting of the three fundamental speed-time curves will first be discussed, after which we will be better prepared to understand the process of plotting the run curve.

NOTE.—The first instalment of this paper appeared in the STREET RAILWAY JOURNAL July 5, and contained Figs. 1, 2, 3 and 4, to which reference is made in the text.

Acceleration Curves.—The acceleration curve of a car, being the criterion of the performance of this car and of its motor equipment, must be constructed by reference to the fundamental data relating to the performance of the particular electric motors used in the said equipment. These data are carefully determined by the motor manufacturers, by means of more or less comprehensive and elaborate special tests made for that purpose, and they are shown graphically on certain curves known as "motor characteristic curves" (Fig. 5), which usually give the relation between the various values of current (amperes) sent through the motor, and three different quantities, namely, the tractive effort or horizontal pull (pounds) exerted by the motor, the speed attained (m.p.h.), and the efficiency obtained, corresponding to the current values. The currents (in amperes) are usually represented in these diagrams by distances measured horizontally, while the other three quantities are represented by distances measured vertically, each according to its own appropriate scale. The tests of which the curves are the graphical summary and representation, are based in each case upon a particular gear ratio, which is noted on the curve sheet. These curves are sometimes made for various gear ratios, but usually are made only for one or two particular gear ratios. By means of these curves, the curves corresponding to other ratios can be easily obtained.

These curves are usually based upon tests made at a standard voltage of 500 to 550 volts. If the voltage to be used in the case under consideration is greater or less than the standard voltage, a correction will be required in the speed values. The speed in a series motor is, as is well known, practically proportional to the potential difference at its terminals. Hence, an increase in the voltage will increase the train speed in proportion. If, for instance, in the actual case, a mean voltage of 550 volts were assumed, the corrected speed curve (*B* in Fig. 5) would be one having ordinate values 20 per cent greater at every point. The curve of tractive efforts (*A B*) would remain unchanged so long as the gearing ratio remained the same. A change in the gearing ratio has the effect of modifying both the tractive effort and the speed. If the gearing ratio is made such as to cause the train to run faster, that is to say, if the number of teeth in the driving or motor pinion is increased, while the number of teeth in the driven wheel or gear on the car axle is correspondingly reduced, the result will be to raise the speed, while lowering the tractive effort; and vice versa. The corrected curves corresponding to each particular gear ratio may be drawn, and a new set of curves can be made for each change. This is not absolutely necessary, however, since the corrected values, both for speed and tractive effort, may be obtained direct from the original curves, by multiplying the values therein given by a suitable correcting factor or coefficient, as is well known. The speed correcting factor may include both the change in voltage and the change in gear ratio, or it may include either of those two things separately. When a change is made in the gear ratio, a correcting factor will also be required for the tractive effort—this factor being equal to the reciprocal of the factor determining the change in speed due to change in gear ratio. An illustration of the effect of change in voltage and in gear ratio on the motor characteristics is given in Fig. 5. In this diagram the speed curve drawn with solid line (*A*) is the curve showing the results obtained in the original shop test with a certain gear ratio and a mean voltage of 500 volts at the motor terminals. The dotted speed curve (*B*) shows the increase in speed which would result if the mean voltage were raised to 600 volts. As the gearing ratio remains unchanged, the tractive effort curve shown by the solid line (*A-B*) would remain the same for both speeds. The speed curve drawn with broken line (*C*) indicates the speed values resulting from a change both in gearing ratio and in voltage. The change in gearing ratio in this particular case was such as to increase the relative speed of the car 2.87 times. The change in voltage being, as already stated, such as to increase it in the ratio of 600 to 500, or 1.2 times, it follows that the total increase of speed was

$$1.2 \times 2.88 = 3.46 \text{ times.}$$

In this case, the dotted line of tractive efforts (*C*) shows the tractive effort values which correspond to the speed curve (*C*). The co-efficient, by which the values of tractive effort corresponding to the curve *A* must be multiplied, is, as already stated, equal to the reciprocal of the change in the gearing ratio

$$\frac{1}{2.88} = 0.347.$$

The method of approximate determination of the gear ratio is passed over as being beyond the scope of this paper.

The various correcting factors, if any, having been determined and applied, in each particular case, substantially in the manner just indicated, the corrected values of tractive effort and speed corresponding to the various current values will now be known; and these values may be plotted in curves analogous to the corrected curves

(C) in Fig. 5. Dividing the tractive effort values, which correspond to the various current values, by the total weight of train expressed in tons, we have the gross tractive effort per ton, which is the quantity P used in equation V. Taking the speed values and the tractive effort values corresponding to the same current values, we may tabulate the tractive effort values as a function of the speed. On referring to the equation (V), we see that we still need the values of the terms f, c and G. It is usual to begin by plotting the acceleration curve corresponding to a level and straight track. In such a case, the values of c and G both become zero. The values of

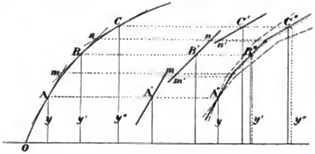


FIG. 6

the train resistance (f) are usually computed for different speeds, by means of some particular formula. The number of these formulæ is legion, but a completely satisfactory and comprehensive one still remains to be found. The latest and, perhaps, the most authoritative information on this subject will be found in some articles on "Train Resistance" in the STREET RAILWAY JOURNAL for May and June, 1902.

By means of the two sets of values of P and f, and using the formula given in equation (V), the acceleration coefficients A', corresponding to various difinite values of these quantities, and, therefore, to certain definite speeds, may be computed and tabulated. We then have two things, namely, the speed value and the acceleration coefficient corresponding to said speed. In the first method ordinates are then to be displaced sidewise (to the left, in this case), until the tangent line of any ordinate meets or crosses the tangent line corresponding to the ordinate of the previous speed point, that is to say, of the ordinate immediatly to the left of it. The proper meeting points (m n) between the tangent lines are to be determined by the eye, being located usualy about half-way between the two corresponding ordinate points. The process might be illustrated by means of a file of soldiers of unequal height, with outstretched arms, and moving closer together until their hands touch. If the proper place of the tangent to the ordinate y in Fig. 6 is at the point A on the curve $OABC$, then the tangent lines B' and C' would find their proper places when the ordinates y' and y'' have moved to the left as far as the points B and C respectively. The curve $OABC$ osculating these tangent lines, as shown in the figure, would be the curve required. This method has serious drawbacks. In the first place, it is not easy to determine the proper points, m and n, at which the tangent lines should meet. The difficulty of accurately drawing the tangent line itself is already very great, without the difficulty of determining by the eye the distance at which the next ordinate should be placed. If, for instance, in Fig. 6 the tangent lines were made to meet at the points m' and n' corresponding to the mean ordinate, or half of the speed increment, instead of meeting at the exact points, m and n, the result would be to displace each ordinate, as clearly shown at the right end of the figure, where the solid tangent lines passing through the points A'' B'' and C'' represent the tangent lines in the same relative locations as the tangents at the corresponding points in the curve $OABC$, while the dotted lines represent the effect of changing the meeting point from the points m n, to the half-way points, m' and n' respectively. The figure also shows the effect of an error in the angle of the tangent line. This error is usually constant, being due to the particular method of drawing and the protracting instruments used. It is, therefore, apt to be a cumulative error. As clearly indicated by the broken lines, starting from the initial ordinate at the point A'' the diagram shows the increase in divergence resulting from a constant error in angularity, the effect being to make the curve too high when the angle is too large, and too low when the angle is too small. The errors due to the two causes might be cumulative, or they might tend to partially

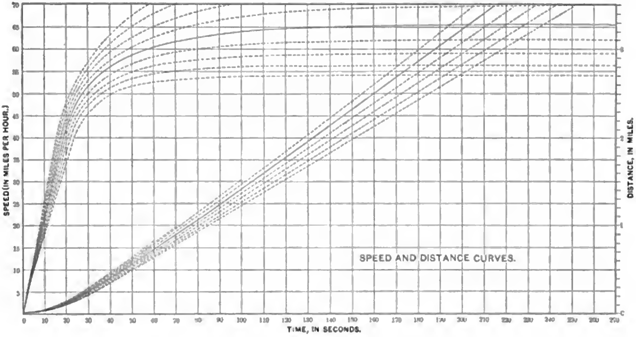


FIG. 7

used for plotting speed-time curves, this is all the information that was required. The process of plotting consisted in drawing ordinates equal to the speed value, and drawing tangents to these ordinates, equal to the acceleration coefficient—then displacing the ordinate to the right or left, until the tangent line met the tangent line corresponding to the ordinate of the previous speed point.

Reference to Fig. 6 will clearly show the general nature of this method. The process of plotting consisted in drawing ordinates such as y, y', y'', equal to various speed values, and then drawing at the upper end (A' B' C') of each of these ordinates, a tangent line whose angularity is proportional to the corresponding acceleration coefficient for each of these ordinates. The

compensate each other. In the figure it is clearly seen that, under the conditions shown, the errors would tend to compensate if the error in the angle of the tangent was such as to make this angle greater than it actually is, while they would be cumulative in the contrary case. The method is totally unscientific and unsatisfactory, notwithstanding the fact that it is still used. There is really no telling what the percentage of error may be. It is all conjecture and guess-work.

No method of curve plotting can be entirely satisfactory without some means of predetermining both co-ordinates of each point to be plotted.

The method of calculating the time increments, as analyzed in

Appendix C, constitutes a great improvement on the method just described. The method is sufficiently described in Appendix C. By means of this method, using equations (*i*) and (*ii*), the time points corresponding to the various speed points may be determined with any degree of accuracy desired. The conditions influencing the accuracy, and the error to be expected, in any case, are fully discussed in Appendix C. These time values having been tabulated, the curve may be plotted by locating the ordinates on a sheet of paper in the usual way. After obtaining the co-ordinates for an acceleration curve on a straight and level track, we can, by assuming proper values for G, in equation (V), obtain and tabulate the acceleration coefficients of other acceleration curves corresponding to various grades; and the time values corresponding to the various speed values having been computed and tabulated, these curves may be plotted. Fig. 7 shows a set of nine acceleration curves, including one for a level and straight track, four for up-grades of ½ per cent, 1 per cent, 1½ per cent and 2 per cent, respectively, and four for the corresponding down grades. This method, while more simple and far more accurate than the crude "tangent" method, still admits of improvement.

The method to be described has the advantage of being practically a graphical method, and of being comparatively simple and quick in practical use. Incidentally, it serves many useful purposes, by scissa. The curve is then drawn through these points. In one of the curves, (Q), the resistance values (f) used in computing the acceleration coefficients, included the friction of motor bearings and gearing, while in the other curve (R) this additional resistance was excluded. This explains the difference in ordinate values between the two curves. The first curve, (Q), corresponds to cases when the car is moving by momentum only, at which times the mechanical resistance due to friction of motor bearing and gears must be overcome by the kinetic energy of the car. The second curve, (R) corresponds to cases when motive power is being applied to the car. It is true that this resistance still consumes energy when the motors are furnishing power to the car, but since the curve of tractive effort, (Fig. 5), represents the tractive effort which is available for *external work*, it follows that in determining the amount of gross traction per ton ("P"), the friction of motor bearings and motor gearing is already eliminated. It is for this reason that two curves of equivalent acceleration due to train resistance are required, (Q, R,)—one to be used in plotting acceleration curves, and the other to be used in plotting retardation curves.

The curves Q', R', are the same as the curves Q, R, but reproduced below the axis of x (with ordinates of negative signs).

(The train resistance values for speeds above 1 m. p. h. used in computing the co-ordinates of the curve R, agree substantially

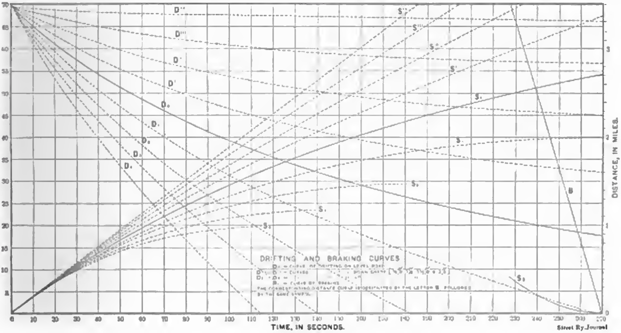


FIG. 8

giving graphically and accurately, in readily intelligible manner, the answer to many questions, the answer to which otherwise necessitates and involves more or less tedious computations and some thought. The method is based upon the theorem given at the end of the Appendix B, to which reference has already been made. It requires two charts, which may be drawn either on separate sheets, or else combined together on the same sheet. These charts are, respectively, the "Chart of Coefficients" (Fig. 9) and the "Chart of Reciprocals" (Fig. 10).

In the "Chart of Coefficients," the abscissæ represent speed values in miles per hour, and the ordinates represent acceleration coefficients, that is to say, the values of the differential coefficients ($\frac{dv}{dt} = k$), ranging between zero and 2.5 miles per hour per second. On this chart are drawn various curves representing the variation of the acceleration coefficient as a function of the speed. These curves are really curves of "equivalent" acceleration for the various quantities, P, f, G, c, which enter into the equation (V) for resultant acceleration.

The curves Q, R, are the curves of equivalent acceleration for the train resistance (f). These curves are plotted as follows: The value of f having been determined, for various speeds, either by means of some formula, or by reference to tabulated data or to curves obtained from actual test, the "equivalent" acceleration corresponding to each value is calculated by the formula given in equation (21*a*); and each acceleration coefficient is then plotted as an ordinate, using the speed value corresponding thereto, as ab- with the values obtainable for the train resistance of a single car by the formula of W. J. Davis, Jr., [see STREET RAILWAY JOURNAL, Volume XIX., May 3, 1902, page 554]. Between 0 m. p. h. and 1 m. p. h. the train resistance values used are such as to make allowance for the increase in train resistance when starting from rest. The curve, as drawn, indicates an initial starting resistance of about 18 lbs. per ton. For further information on this subject see paper on "Train Resistance" by J. A. F. Aspinall, M.I.C.E., read before the Institution of Civil Engineers, Nov. 26, 1901.)

The curve M gives the equivalent acceleration values of the gross traction (P) of the particular motor equipment, whose time-function curves are to be examined. The curve is prepared substantially in the same manner as the curves Q, R, the values of "P" being determined by reference to the "corrected" motor characteristic curves, as already stated. The acceleration coefficients corresponding to the gross traction (per ton) obtainable at various speeds, are computed by equation (21*a*), and the values so obtained are plotted on the chart (curve M).

The curve N is what might be called a curve of "net" acceleration coefficients, obtained by subtracting the ordinate values of the train resistance coefficients (curve R) from the corresponding ordinate values of the gross traction coefficients (curve M).

The gravity factor G, is, as we know, independent of the speed; consequently, the value obtained by equation 21*a*, for any given value of G, corresponding to any definite gradient, is constant at all speeds; the resultant curve will, therefore, be a straight line, parallel with the axis of x. In the chart, these lines have been drawn at the proper calculated ordinate distances corresponding

and equivalent to all percentages of grades between 0.1 per cent and 5 per cent. These gradient percentage lines have been repeated below the axis of x, the two sets being thus suitable for up-grades and down-grades.

Since, as already seen, a grade of 1 per cent represents a force of 20 lbs., it follows from equation (V) that the acceleration coefficient due to such a grade would be

$$= .01098 \times 20 = .22 \text{ m. p. h. per second.}$$

It follows, therefore, that the scale of gradient percentages given at the right-hand end of the chart is such that the vertical distance, corresponding to each 1 per cent of grade, is equal to 0.22 when measured on the scale of coefficients at the left-hand end of the chart.

The quantity c being also constant at all speeds, will also be

The effect under those conditions would, therefore, be the same as if the total grade were:

$$= + 2.672 + 0.203 = + 2.875\%$$

In the case of a down-grade the effect, of course, would be equal to the difference between these two values, or

$$= - 2.672 + 0.203 = - 2.469\%$$

This net value, which includes the allowance for both gradient and curvature, is the value that would be used in plotting the curve by means of the chart of coefficients.

When b equals 0.8 we have, from equation (XI),

$$N = \frac{20}{0.8} = 25°$$

In this case the coefficient for each degree of curvature would,

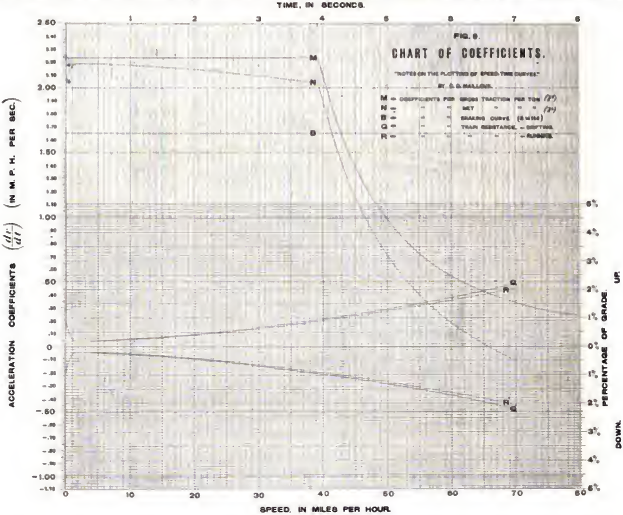


FIG. 9

represented by a straight line. The curves corresponding to this value are not shown on the chart.

The correction for curvature may, however, be made by reference to the gradiant percentage lines, the effect of the track curvature being the same as an equivalent "up-grade." Since a 1 per cent grade corresponds to 20 lbs. of tractive effort, the number of degrees of track curvature which is equivalent to a 1 per cent grade will be:

$$\frac{20}{b} = N \qquad (XI)$$

where N = the number of degrees of curvature,
and b = increased train resistance in pounds per ton per degree of track curvature.

And the "equivalent grade percentage" would be:

$$G = \frac{N\,b}{20} = .05\,N\,b \qquad (XII)$$

As an illustration, let us assume an up-grade having an actual gradient of 2.67 2per cent, and a track curvature of 4°-30' (4.5°), and let b equal 0.9. The equivalent grade due to the curvature would be:

$$\frac{4.5 \times 0.9}{20} = 0.203\%$$

therefore, be 1/25, or 0.04 of the coefficient corresponding to a 1 per cent grade. It follows, therefore, that two of the smaller spaces, each corresponding to a tenth of a per cent of grade, would represent the coefficient for 5 degs. of track curvature.

When b equals some other number the relation between the two kinds of coefficients is not so simple, for which reason the writer finds it preferable to make all corrections for track curvature by reference to equation (XII).

When there is no track curvature, the algebraical sum of acceleration coefficients includes only three coefficients, namely, those due to the gross traction, the train resistance and the grade. The curve N being already the algebraical sum of the first two, it follows that we have only to take either the *sum* or the *difference* in ordinate values, at any speed point, between the curve N and the horizontal line corresponding to any gradient, in order to obtain the corresponding resultant acceleration. This resultant acceleration coefficient is equal to the sum of the ordinate values in the case of a down-grade, and to their difference in the case of an up-grade. Thus, on a down-grade of 1 per cent, the resultant coefficient would be equal to the full vertical distance between the curve N and the "1 per cent" line *below* the "zero" line (or axis of X), just as if the zero line itself had been displaced downward as far as the "1 per cent" down-grade line.

The effect of an up-grade would be exactly contrary, being the same as if the zero line had been displaced upward to the corresponding up-grade "percentage" line.

The point at which the curve *N* crosses any gradient percentage line corresponding to an up-grade being, of course, the point at which the equivalent acceleration coefficients cancel each other, and give a resultant acceleration equal to zero, it follows that this point is at the maximum speed that the particular motor equipment under consideration would give on that grade. If, instead of an up-grade, we examine the point of intersection of the curve *N* with a down-grade, we find, as is to be expected, that the maximum speed will be considerably higher. The chart may also be used to answer questions such as the following: On what down-grade, at any given speed, would the equivalent acceleration due to gravity be the same as that due to the train resistance? Also, on what grades would this force be sufficient to cause acceleration, and at what rates? The answer to this question is obtained very easily by taking the ordinate of the curve *(Q)*, corresponding to any speed, and comparing it with the ordinate corresponding to any grade. When the two values are alike there is no resultant acceleration. If one is greater than the other there

scale of ordinates. The scale of ordinates, in the original chart of coefficient, from which Fig. 9 was made, is such that 1 m. p. h. per second equals 20 cms, so that the acceleration coefficient values may be easily read and plotted to the third decimal place. This accuracy is not so important for the portions of speed-time curves having a high rate of acceleration, but it becomes very important in the case of low accelerations, that is to say, in plotting the relatively flat portions of acceleration and retardation curves. In these portions the acceleration coefficients have relatively small values, and consequently the percentage of error would be increased, unless these values can be read at least to the second, preferably to the third, decimal place. The greater ease and facility with which a chart can be used when plotted to a larger scale really simplifies the task of plotting the curves and probably saves time in the end.

It is obviously desirable that the scale of *ordinates* be precisely the same in both charts, since otherwise it would be necessary to use proportional dividers or equivalent means of compensation for the difference in scales, in transferring the ordinate values from the chart of coefficients to the chart of reciprocals, in order to get the proper time increment values corresponding thereto. For

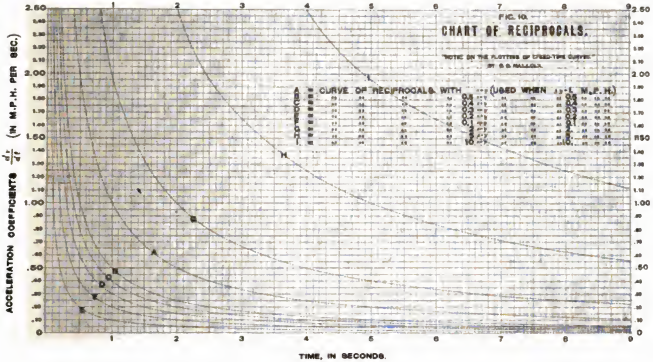


FIG. 10

will be acceleration or retardation, according to the case. The chart thus answers at once, and in a very satisfactory manner, all questions in regard to the speed attainable under any desired set or aggregation of conditions. The chart of coefficients is, therefore, an instrument for quickly and accurately determining the answer to equations (28) and (*I*) under any kind of conditions, actual or hypothetical.

The train resistance coefficients, when once properly determined, will serve for any case where the *train units* are of the same *kind* and *character*, it being now known that the train resistance values ("*f*," from which the curve *R* is derived) vary with the number of cars per train, and it being probable that they also vary according to the form and the size of car. It is evident that several different curves, analogous to the curve *R* and corresponding to train units of different kinds, may be all plotted on the same chart of coefficients. The gradient percentage lines on the chart will, for obvious reasons, be the same for all cases whatsoever. Hence, we have only to plot the curve of gross traction coefficients (*M*) for any other motor, to be at once able to answer all questions about the speed and acceleration obtainable under any and all conditions. It is not well, however, to plot too many curves on the same chart, especially when they run closely together. It is more convenient, less confusing, and therefore preferable, to use a distinct chart for the "traction" curves ("*M*" and "*N*"), and for the "resistance" curves ("*R*"), corresponding to each kind of train unit, or for not more than two distinct kinds of train units.

It is desirable to plot the chart of coefficients with a rather large

this reason the two charts should be both made on the same kind of co-ordinate paper.

The charts shown in Figs. 9 and 10 have been reproduced with a view to making them suitable for practical use. For this reason they have been reproduced in sufficiently large size to permit accuracy in plotting or reading the coefficient values, and great care has been taken in the photo-engraving to have the scale of ordinates exactly the same in both charts. *

The chart of reciprocals (Fig. 10) serves for determining quickly the time increment value corresponding to any speed value. In this chart the ordinates represent acceleration coefficients exactly as in the chart of coefficients, and the abscissæ represent time values in seconds, on a scale sufficiently large to indicate small fractional values of seconds. On this chart are drawn various reciprocal curves. The curve *A* is the true reciprocal curve, being obtained by dividing 1 by *each* acceleration coefficient value and plotting the resulting value. The curve *B* is a curve obtained in the same way, by taking *half* the reciprocal value. In like manner, we obtain the curves *C, D, E, F*, corresponding, respectively, to the 0.4, 0.3, 0.2, 0.1, reciprocal values, and the curves *G, H, I*, corresponding, respectively, to twice, five times, and ten times, the reciprocal value.

This chart is so prepared as to take advantage of the relation shown in Appendix *C* in equation (*i*), where the acceleration coefficient enters, it will be noted, as a *reciprocal*. The manner of

* These two charts have been reproduced to a smaller scale in this case.—[EDS.]

using it is very simple. The acceleration coefficient value for any speed having been determined by means of the chart of coefficients, it is transferred by dividers, or in any convenient way, to the chart of reciprocals, where it is used as an ordinate value and moved sideways, as such, until it intersects the "proper" reciprocal line. The "proper" reciprocal line depends upon the speed differences or increments, as the equations in Appendix *C* clearly show. Consequently, with speed increments of 1 mile per hour, curve *A* would be the proper curve; with speed increments of, respectively, 0.1 m. p. h., and 10 m. p. h. the "proper" curves would be curves *F* and *H*. The smaller the speed increments the more numerous will be the plotted points, and the greater accuracy of the curve plotted. The process of determining, by means of these charts, the co-ordinates of a speed-time curve corresponding to any set of conditions, is so simple as compared with all previously known methods that one can afford to use smaller speed increments and thus make the curve easier to draw and more accurate and satisfactory for any purpose.

It is important to note that the same reciprocal curve will not serve for all portions of a given speed-time curve, with equal accuracy, and that the reciprocal curves corresponding to relatively large speed increments (such as, for instance, curve *I*) will be quite limited, both in application and in accuracy. This peculiarity, which is due to the form of the reciprocal curves, will be understood without difficulty, on glancing at the chart of reciprocals. It is seen that the higher acceleration coefficients (which correspond, as we know, to the more inclined portions of speed-time curves) have the shortest time-increment values, and that as the coefficient values become reduced (that is to say, as the speed-time curve "flattens") the time increment values increase more and more rapidly. This relative increase in time increments continues until, for each reciprocal curve, in succession, beginning with curve *I*, which corresponds to the highest speed increments (Δ y = 10 m p h.) and ending with curve *F*, which corresponds to the smallest speed increment ($\Delta y = 0.1$ m. p. h.), a point is finally reached at which the time-increment values obtained by reference to that particular curve would exceed the longest time value (9 seconds) which can be read on the chart. Thus, in the case of curve *I*, the chart limit would be reached when the acceleration coefficient became reduced to 1.11. This means that the curve *I* would be entirely useless for determining the time values of any speed-time curve or portion thereof not having acceleration coefficient greater than 1.11. The chart limit for curve *H* would be, in like manner, an acceleration coefficient,

$$= \frac{5}{9} = 0.55$$

and the chart limit for any other curve would be

$$= \frac{\Delta y}{9}$$

where Δ y = the speed increment corresponding to that particular curve. For example, in the case of curve *A*, where $\Delta y = 1$, the limit would be

$$\frac{\Delta y}{9} = \frac{1}{9} = 0.111$$

and for curve *F* where $\Delta y = 0.1$ the limit would be

$$\frac{\Delta y}{9} = \frac{0.1}{9} = 0.011$$

These considerations clearly show that the reciprocal curves corresponding to the larger speed increments, such as curves *G*, *H*, *I*, can be used for determining the time-values only when plotting speed-time curves which have considerable slope or inclination, (either upward or downward). It also becomes apparent that as the speed-time curve flattens, the reciprocal curves corresponding to smaller speed increments, (such as *B*, *C*, *D*, etc.), become, first, desirable, then indispensable. For very accurate work the writer uses the curve *A* or the curve *B* for the highest accelerations, (usually the curve *A* for coefficients above 2 and the curve *B* for coefficients between 1.5 and 2.); and he uses, successively, the curves *C*, *D*, *E*, for intermediate lower coefficients, the curve *F* being used for the lowest coefficients. In cases when still greater accuracy is required than can be obtained with curve *F*, such as for plotting the nearly horizontal portions of speed-time curves (having coefficients approaching zero), the writer proceeds as follows: The net coefficient value, as obtained from the chart of coefficients by means of dividers or in other convenient manner, is increased twice, three times or four times its value, and then used in the usual way for finding the time increment on the chart of reciprocals, by reference to curve *F*; the time value thus obtained is then divided by the multiplying factor used in enlarging the net coefficient, the result being the net time-increment value. A glance at the chart will readily show that this process is virtually the same as if a new reciprocal curve corresponding to smaller speed increments than the curve *F* were to be drawn. The method has the advantage over such a curve, however, that the coefficient is magnified, and that the time-increment reading is made at a point farther to the left, on the chart, where the reciprocal curves are farther apart, and where their inclination is greater, thereby enabling the reading to be made with much greater accuracy.

The five "observations" given at the end of Appendix C, constitute rules which may be useful in selecting the proper reciprocal curves, for each particular case. Practical experience will, however, be the best guide.

Drifting Curves.—In the case of drifting curves, we have, as pointed out in equation (*VII*) to consider only the effects of the train resistance, track curvature and grades. The resultant acceleration coefficient at any speed is readily obtained from the chart of coefficients just as in the case of acceleration curves. When the train is drifting and the energy required for turning the motors comes from the kinetic energy stored in the train, there is usually an increase in the train resistance due to the friction of the motor gears, etc., these motors being no longer electrically driven. The kinetic energy of the rotating parts, tends, in some measure, to counterbalance, or to neutralize, this increase. In case it is not fully neutralized, a new curve should be drawn, showing the acceleration coefficients corresponding to drifting and braking curves. The curve, Q, as already stated, represents such a curve on the chart of coefficients. The values of the acceleration coefficient, as given on this curve, are the ones which should be taken in determining the resultant retardation graphically by means of this chart. The determination of the time increments is done in exactly the same manner as in the case of acceleration curves. Fig. 7 shows a set of nine drifting curves, including the drifting curve for a level and straight track, and four curves, each corresponding to up-grades and down-grades of, respectively, ½ per cent, 1 per cent, 1½ per cent and 2 per cent.

Braking Curves.—The co-ordinates of a braking curve should, in reality, be determined in substantially the same manner as the co-ordinates of acceleration and coasting curves. In order to do this, it would be necessary to draw on the chart of coefficients the curve of equivalent acceleration coefficients, corresponding to a given rate of braking. This curve would be almost, but not quite, a straight line parallel with the axis of *x*. The difficulty of this method is, that the form of brake lines varies so widely and at times quite erraticaly. In practice, the process of plotting the braking curves is greatly simplified by making the assumption that the braking curve is a straight line. This is not exactly true, as already pointed out. In Fig. 3 the curve *y* A B C is a true braking curve reproduced from an actual diagram obtained in the braking tests conducted by the New York Railroad Commission with various street-car brakes in New York City, in 1899. The dotted straight line, *y a b c*, is the line inclosing the same area as the brake curve, this fact being clearly shown by the two distance curves O *e f g* and O *e' f' g'* on the lower part of the diagram. The first of these curves correspond to the true brake curve, *y a b c*, while the second corresponds to the equivalent brake curve, *y a b c*. It will be seen that while the area enclosed by the two curves is exactly the same (being a trifle under .02 mile), the time required to cover this distance is greater in the case of the true brake curve than in the case of the modified one. In some cases, the time error resulting from the assumption of a constant rate of retardation, would be greater than in others, and might be serious. In most cases, however, it is negligible.

A closer approximation to the actual form of the brake curve can be made in the manner indicated in the right-hand portion of Fig. 3, where the true brake curve *y A B C*, and the straight line *y a b c*, previously referred to, are both reproduced, together with the broken line, *y-b-C*. It will be seen that this broken line constitutes a much closer approximation to the actual brake curve than the straight line, *y a b c*. The acceleration coefficient of the straight line is found by calculation to be, approximately, 1.84. The broken line has an acceleration coefficient of about 2.31 in the upper portion, and 1.2 in the lower portion. The two portions of the broken line, *y-b'*, and *b'-C*, correspond to equal "droos" or reductions of speed. It is seen that the acceleration coefficient, (which, in this case, might better be called retardation coefficient), is about 25 per cent greater, for the upper portion (*y b'*), while the retardation coefficient of the lower portion, (*b'-C*) is nearly 40 per cent less, than the acceleration coefficient of the straight braking line, *y-a-b-c*. By sub-dividing the brake curve into three portions, the broken line, now consisting of three portions, would enable a still greater degree of approximation to the true curve to be obtained, as will be readily understood. Unfortunately, owing to the erratic variations in the form of the curve itself, it would be more difficult to assign proper values to the retardation coefficients of the different

portions in terms of the retardation coefficient of the straight braking line, (y-a-b-c), corresponding to the same distance. For this reason, the writer does not recommend sub-dividing the brake curve into more than two portions, and does not even recommend this except in cases where extreme accuracy is desired.

The assumption that the braking curve is a straight line greatly simplifies the process of plotting. The determination of the speed and time values, by which the line of braking may be drawn, comes under three general cases constituting braking problems, which are treated and discussed as such in Appendix D.

It will be evident, of course, that the slope of the brake curve will still vary, even though the rate of retardation, due to the friction of the brake shoes, be assumed to be constant. This is apparent from equation (IX), in which it is seen that four factors (B, f, c, G,) enter into the equation for the retardation coefficient in braking. Owing, however, to the very fact that there is so much variation and uncertainty in the form of the brake curve, it is usual to make the assumption that a braking force of 150 lbs. per ton covers all three of the factors, B, f and c for high speed service. Hence, the only other force usually considered is the force of gravity (G). This, as we have already seen in Section I, enables equation (IX) to be simplified practically to the form shown in equation (X). The reason why the factor G is still retained and considered separately, is that the effect of gravity may be considerable on grades of relatively high percentage, and also that the effect would be opposite on up-grades and down grades, respectively. In the case of the factors f and c, on the other hand, the effect is relatively small and always has the same sign. The force of gravity (G) being positive on down grades will have the effect of neutralizing a part of the braking force applied. Thus, on a down-grade of 1 per cent, which corresponds, as already seen, to a tractive effort of 20 lbs., and taking, according to the usual practice, as stated above,

$$B - f - c = 150$$

the net braking effort would be

$$150 - 20 = 130 \text{ lbs.}$$

and the coefficient, which, in this case, might properly be called retardation coefficient, would be, according to equation (IV),

$$= .01098 \times 130 = 1.43$$

In the case of an up-grade of 1 per cent, the retardation coefficient would be equivalent to

$$= .01098\ (150 + 20) = 1.87$$

The value of k used in the equations given in Appendix D is understood to be, in every case, that which corresponds to the resultant or net retardation, and it is determined in the manner just indicated.

It is seen that the foregoing method of plotting the braking curve still involves certain assumptions, which, in the present state of our knowledge, are unfortunately unavoidable. It is very much to be hoped that further experiments should be made for the purpose of determining the form of the true braking curve under various conditions of braking. It is also to be hoped that some convenient and practical means of analytical expression or of graphical representation of an average or typical braking curve may be arrived at. It is only then that it will be possible to eliminate the assumptions which now have to be made, and to attain a higher degree of precision in the plotting of the braking curve.

Distance-Time Curve.—Attention was called in Appendix A, in connection with equation (e), to the fact that the area of any portion of the speed-time curve comprised between two given intervals of time corresponds and is equal to the distance traversed by the moving body during that time. By taking advantage of this fact it is possible to plot on the same diagram on which the speed-time curve itself is drawn, another curve, the distance-time curve, usually called the "distance" curve. Such distance curves are shown in Figs. 1 to 4, inclusive. The co-ordinates for this curve are obtained, in each case, by integrating, successively, small strips of the area enclosed by the speed-time curve. This integration is usually done in practice by means of a planimeter or other integrating instrument. If, for example, we first integrate the portion corresponding to the first 20 seconds, the result obtained by the integration may be made a measure of the distance which the car will have traversed within the first 20 seconds. If, as pointed out in Appendix D, the numerical "area" result of the integration is divided by 3600 (the number of seconds in one hour) the resulting figure will be the distance expressed in miles. Integrating, in like manner, the area comprised between 20 and 30 seconds we obtain the distance traversed in the interval of time comprised between the twentieth and thirtieth second. By integrating successively all the other portions of the speed-time curve between definite time limits in the same manner, other corresponding distance values (s) will be obtained. The total distance traversed will evidently be equal to the aggregate sum of all the separate distance values thus obtained. This total distance will be the highest point of the distance curve.

The object of integrating the area enclosed by the speed-time curve in separate strips, or "by parts," is, of course, to obtain the co-ordinates for various intermediate points on the curve for the purpose of plotting the same. In plotting out the distance curve, the distance corresponding to the inferior time limit of integration (in equation [e], Appendix A) is equal to the so-called "constant of integration." Thus, in Fig. 4, in plotting the distance curve, o-a-c-e, between the points a and c, the distance value (a) obtained, as indicated in equation (e), by the integration of the acceleration curve from the beginning to the point b, would be equal to the constant of integration, which, in the case shown, is

$$a = \text{one mile,}$$

and this value would have to be added to the distance value obtained by the integration of the portion of curve comprised between the points b and d, in order to give the total ordinate value or the actual location of the distance curve corresponding to the point c—that is to say, the ordinate at the upper limit of integration. This is evident, for, if the distance value obtained by integrating the area comprised between the points b and d, were to be plotted by measuring off from the axis of x, instead of from some point (a) higher up, it would then serve to indicate only the increase of distance covered between the points b and d. The addition of a distance value (a) equal to the distance already covered up to the point b, is necessary to bring the corresponding portion of the distance curve comprised between the points b and d into its proper place (c).

It is evident that the smaller the strips of area which are integrated at a time, and the more accurate the method of integration used, the more numerous will be the plotting points and the greater will be the accuracy with which the distance curve can be plotted. In the diagrams Figs. 1 to 4, inclusive, the distance curves are plotted so as to represent distances in miles, according to a scale of miles which is shown at the right-hand end of the diagram in each case. The process of computing the total area enclosed by the speed-time curve in very small portions is somewhat tedious. The work may be greatly simplified by the use of an instrument called the integraph, which was once exhibited, in 1888, before this Institute, by its learned inventor, the late Mr. B. Abdank-Abakanowicz. This instrument is an integrating instrument which, in addition to giving the numerical result of the integration, actually shows the steps of integration graphically, by drawing the so-called "integral" line. It is made in two sizes by Mr. G. Coradi, of Zürich, Switzerland, the distinguished maker of integrating instruments known by his name. The instrument admits of some range of adjustment, whereby the scale or ordinates may be varied. It is evident, however, that by means of proportional dividers, or by other well-known drafting-room methods, the scale or ordinates may be enlarged or reduced, so as to make it suitable for any scale desired for plotting the curve. The writer has made considerable use of the integraph during the last two years, and has found it exceedingly useful and convenient, not only on account of its precision but also as a time-saving device in work of this character.

The distance-curve is of great utility in the plotting of the run curves, because it constitutes the most practical means of determining the proper time points corresponding to a given distance. This is exemplified by means of the simple run-curve shown in Fig. 4. In plotting this run-curve it was desired to let the first or accelerating portion (which, as previously stated, was taken from Fig. 1), continue until a distance of exactly 1 mile had been covered. The dotted line b-a in Fig. 1, which intersects the distance-curve at a point (a) equal to a distance of 1 mile on the right-hand or "distance" scale, therefore represents the point at which the acceleration portion terminates. The drifting portion (B) of the curve in Fig. 4, was obtained by means of Fig. 2, beginning at a point (b) representing exactly the same speed as the point (b) in Fig. 1. The line b-a in Fig. 2 intersects the distance curve at the point a. It being desired to let the drifting portion (B) of the run-curve also represent the same total distance traversed, exactly 1 mile, this curve was cut off in Fig. 2 at the point (d), so located that the last ordinate would intersect the distance-curve, in Fig. 2, at a point (c) whose vertical distance (c, c') above the starting point (a) was equal to 1 mile, when measured on the distance scale. The portion of the distance-curve in Fig. 2, comprised between the points a and c, could, therefore, be reproduced in Fig. 4, starting from the point a. It is seen that the point c, in Fig. 4, corresponds to a distance of exactly 2 miles on the distance-scale. The distance curve constitutes a convenient means, and the most practical means, whereby the various kinds of curves may be cut off and connected at the proper points in assembling them together to form the run-curves. This will be further exemplified hereinafter in discussing

the plotting of a service run-curve, constituting a practical illustration of the process of plotting such curves.

From the above it will be seen that the speed-time curve establishes a relation between the distance, speed, and the time, in any given case. Hence, if any two of these three quantities are given or assumed the third can be determined. In the majority of cases the distance is known, at least approximately. The quantities to be determined by means of speed-time curves are either the speed to be obtained when the time is assumed, or known, or else the time required for a given service when the speed is known or assumed.

Brooklyn Tunnel Bids

Bids for the construction and operation of the Brooklyn tunnel extension were opened Monday by the Rapid Transit Commission. The Brooklyn Rapid Transit Company offered to build the tunnel for $7,000,000 and to provide a system of transfers good over about 90 per cent of the company's lines in Brooklyn. The Interborough Rapid Transit Company, to which the interests of the Belmont-McDonald syndicate have been transferred, made an offer to construct the subway for $2,000,000, and to carry passengers between the Bronx and Brooklyn for a single fare of 5 cents. The company put in an alternative bid of $3,000,000, with the condition that the company should have the privilege of building a subway under Broadway between Union Square and Forty-Second Street.

Each bid is exclusive of $1,000,000 which the commisison is willing to allow for terminals and for the purchase of real estate. It was estimated that the cost of building the Broadway extension would be at least $3,600,000. The effect, therefore, of the alternative bid of the Interborough company, should it be accepted, would be that deducting the cost of the Broadway extension—an improvement that the Commission has always had in contemplation—the city would have to pay out only $500,000 for the Brooklyn tunnel.

Mr. McDonald, on behalf of the Interborough Company, explained that that corporation was very anxious to have the Brooklyn tunnel a part of the present subway system. It was because of this fact that such a low bid was made, as its acceptance would leave the city with sufficient funds to "proceed with the extension of the Rapid Transit road from Broadway and Forty-Second Street to Union Square, this extension being absolutely indispensable to the successful operation of the road and the serving of the most important shopping district in the city, with a view to giving a connection with the projected Pennsylvania terminal at Thirty-Third Street and Broadway to furnish an equal facility to that now provided at the Grand Central Station."

If the alternative bid of $3,000,000 for the Brooklyn extension is accepted by the Commission the Interborough Company will construct the extension from Forty-Second Street and Broadway to Union Square for the nominal sum of $100,000, provided this piece of road is authorized by the first of next July.

Mr. McDonald said that the cost of building the tunnel to Brooklyn would be at least $10,000,000, but that the company had made a low bid because it wanted the tunnel. He pointed out also that his company could afford to bid less than the Brooklyn Rapid Transit Company, because it had all its plant ready and on the spot to begin work.

John L. Wells, counsel to the Brooklyn Rapid Transit Company, laid before the commission a long list of routes over which the tunnel passengers would be transported in Brooklyn for one 5-cent fare. Mr. Wells added, however, that people traveling south of Kings Highway on these lines, for instance, to Coney Island, would have to pay an additional 5-cent fare.

August Belmont, on behalf of the Interborough Company, said passengers would be conveyed from the Bronx to the Brooklyn terminal for one 5-cent fare. He said he had been assured that if his company got the contract his companies would be allowed to operate through cars to Jamaica over the lines of the Long Island Railroad for an additional 3-cent fare. Mr. Belmont added he had received other assurances from a Brooklyn trolley company which enabled him practically to promise that an agreement would be entered into with that company whereby passengers would be conveyed to Coney Island and other outlying points on the system owned by the company he referred to for a 3-cent additional fare.

Strike at Albany Averted

The Troy branch of the labor organization which controls the employees of the United Traction Company, operating in the cities of Troy, Albany, Watervliet, Rensselaer and Cohoes, threatened to strike recently unless the company dismissed two former members of the union, who were charged with embezzling funds of the order to the amount of between $100 and $200. The company suggested that the matter be referred to a board of arbitration. Bishop Burke, of Albany, was selected by the company, and Michael Muldoon, of Troy, by the employees. In accepting the responsibility Bishop Burke said: "It will be my purpose to consider fully the points and differences and to decide fairly. The company and the men both have rights, and I believe that much more can be accomplished through arbitration than by striking. I shall also consider the public."

When the question was submitted to the Board of Arbitrators they had little difficulty in reaching a decision. They reported to the company that the two men, William F. McGuire and Michael Pickett, whose discharge from the service of the traction company was demanded by the union, should be dismissed, the testimony taken showing that the company would be within its rights in letting them go. The company immediately discharged the men, and all danger of a strike was averted.

Cleveland's Three-Cent Council Enjoined

The last two weeks have been a most exciting period in the history of Mayor Tom L. Johnson's campaign for 3-cent fare railroads in Cleveland. On Monday, July 14, the Council passed eleven ordinances establishing as many routes for 3-cent fare lines, and calling for bids for them. The routes included the former Hoefgen lines, which have been shown by a map in the STREET RAILWAY JOURNAL, with the addition of franchises for a road through the flats to connect with the proposed new line to Akron, and for crosstown lines on Doan Street and Madison Avenue. During the week the public, and probably the Mayor as well, were treated to a surprise in the announcement that a company headed by Harrison B. McGraw, a prominent attorney, would enter the field with bids for the franchises over the proposed routes. Mr. McGraw is a partner of H. Clark Ford, president of the Eastern Ohio Traction Company, and has acted as attorney in many of the Everett-Moore transactions. This was taken to indicate that Mr. Everett would again enter the local Cleveland field, and on a 3-cent fare basis. Thus far matters looked promising for Mayor Johnson and his pet project.

But on Saturday afternoon the Mayor's hopes were shattered when Attorney-General Sheets started quo-warranto proceedings in the Circuit Conrt to oust the Cleveland City Council and demanded that the members show by what right they hold office. Judge Caldwell, of the Circuit Court, granted on order restraining the Council from granting further franchises or special privileges of any kind until the case is heard and decided. The suit is the result of the recent decision of the Supreme Court of Ohio in declaring the Cleveland city government unconstitutional. There is little possibility that the case will ever come to trial, since in October the State Legislature will convene to decide on a new code for Ohio cities, and in that event even a favorable decision for the City Council would count for naught. The suit was started by Judge W. W. Boynton, who is a property owner on one of the streets over which it was proposed to build a 3-cent fare line. He denies that he is acting for any one but himself and neighboring property owners. The injunction not only restrains the City Council from taking further action in 3-cent fare matters, but prevents possibility of extensions of franchises for the existing companies, hence it seems improbable that the latter are in any way connected with the suit. Members of the Council have taken steps to induce Governor Nash to call an immediate special session of the Legislature to relieve the city of its embarrassing position and to preserve its credit, which is now endangered.

In the meantime John B. Hoefgen's car load of rails, scattered on Rhodes Avenue, will continue to gather rust, since it begins to look as if it would be many a day before a 3-cent fare car ran over them.

Picturesque Park for Roanoke

The Roanoke Railway & Electric Company, of Roanoke, Va., has just purchased a tract of about forty acres of mountain land, lying 3 miles south of the city and extending about three-quarters of a mile up the ravine between the mountains south of the city. The northern end of this tract is near one of the principal lines operated by the company, and it is understood to be its intention to use the property for park purposes. The natural advantages are such that it is not unreasonable to suppose that it will prove to be one of the most picturesque spots in Virginia. It is reported that the railway company will at once put a large force of men to work on the property under the direction of an experienced landscape architect, and that it is the intention to erect a large casino, dancing pavilion and other attractions, and also build a lake at the lower end of the tract.

Topics of the Week

Mayor Low announced last week that, after a conference with Messrs. Lindenthal and Parsons, in which all the plans for the relief of the Brooklyn Bridge traffic had been considered, it had been decided to connect the two bridges as proposed by Mr. Parsons. Mr. Lindenthal will prepare plans for the bridge, and Mr. Parsons will produce a scheme for the subway part. The Mayor hopes to have these plans submitted by September 1. Mr. Lindenthal, however, has not given up his plan of installing a moving sidewalk, and he does not consider the present decision as a rejection of his proposal.

The June report of one of the suburban companies operating in the West shows the effect of the cool weather of that month on the earnings of the electric railways that are heavy carriers during the summer months. By actual count there were twenty-eight rainy days for the month. The gross receipts of the company increased only $500 over the same month in 1901, while the increase for the latter month over June, 1900, was almost $14,000. The net earnings of this company, instead of showing a healthy increase, as has been noted since the road was first placed in operation, actually show that there was a decrease of $471 for 1902 as compared with 1901.

A timely note of warning to steam railway companies, who make a point of hampering trolley companies, has been sounded by Judge Mand, at Morristown, Pa. In the course of a decision upon one of these controversies the court said: "Technical objections against trolley companies only tend to establish them in popular favor. I think railroad companies ought to let well enough alone. If they do not, I think the time will soon come when the people will tire of this senseless litigation and rise up and elect a Legislature that will grant greater franchises and give more power to the trolley corporations." This is a sensible and conservative statement, and is deserving of very careful consideration by public officials as well as steam railroad managers.

In Iowa, where considerable construction work is being done and where many extensive interurban lines are projected, the officials of the various interurban railways of the State, both those which are partially completed and those which have not as yet actually commenced the work of construction, have agreed upon the fare to be charged for the transportation of passengers. This rate as agreed upon will be 1½ cents per mile, or just one-half the rate charged by steam railways. Freight rates have not yet been arranged, and it may be that no action will be taken on these rates for some time. The agreement as to passenger rates does not bar the several companies from making special rates for excursions.

Judging from the daily newspaper accounts of street railway events the "dog days" are having the customary effect upon copy makers. Last week a "Chicago invention" delighted the heart of every imaginative journalist of the yellow order. It proved to be an oft-exploited and exploded theory of street railway propulsion, in which it was proposed to employ "small electro-magnets" imbedded between the tracks, which would work automatically, so that the car would be attracted to magnets ahead, cutting out those which it passed over. A simple calculation as to the power required to "attract" a street car carrying an ordinary motor equipment, and the size and character of the "small electro-magnets" proposed for this purpose, might jar the average reader, but it could not hope to make an impression upon the yellow journalist.

The popularity of trolley rides as a means of recreation, especially when the lines extend into the suburban districts or connect nearby towns, has attracted several enterprising authors and publishers to present hand-books explaining the connections between cities and villages in certain localities, where the network of trolleys can be utilized for pleasure riding. Some of these guides are very interesting and instructive, and the demand for them demonstrates that when they are accurate in their information and reliable in their descriptions of the points of interest along the line, their production can be made profitable. They can also be made very serviceable for the railway companies, and progressive managers, by encouraging the distribution of this class of literature, will attract many sightseers to their lines. This has been shown to be the case particularly in New England, in the vicinity of New York and among the coast resorts.

The franchise tax litigation has advanced another step toward final settlement. At Albany last week Supreme Court Justice D. Cady Herrick confirmed pro forma the report of Referee Robert Earl. In order to bring in all questions raised by the corporations so that they can be passed upon by the higher courts on appeal, Justice Herrick announced that he would decline to find favorably on all questions raised by the corporations upon which Referee Earl had declined so to find. William H. Page, representing the Metropolitan Street Railroad Company, was the spokesman for the corporations at the hearing, and Attorney General John C. Davies and Deputy Attorney General Henry C. Coman appeared for the State. Former United States Senator David B. Hill and Charles F. Brown appeared as special counsel for the Metropolitan Street Railway, and Charles A. Collin for the Brooklyn Rapid Transit Company. An appeal from Justice Herrick's decision, affirming that of Referee Earl, will be heard at the September term of the Appellate Division. The Appellate Division is expected to render a decision so that the case can be argued in the Court of Appeals in November, and final decision is looked for in December.

The legal department of the Metropolitan Street Railway Company and the corporation counsel of New York do not agree upon the question of the right of the city to tear up tracks in streets for which the company holds franchises. Some time ago the corporation counsel advised Borough President Cantor that he had authority to remove "unused tracks," and added the following explanation of his views on what constituted an abandoned route: "There is a popular impression that the running of one car or train a day is an exercise of a franchise technically necessary to and sufficient for its preservation. I can find no authority for such doctrine and I do not believe it is sound. The franchise confers a right to operate a road for the convenience of the public, and a street railroad, I believe, necessarily implies frequent running of cars at all times of the day. The running of a single car is, however, some evidence of an intention not to abandon the route, and when such intention is a material circumstance it is possible that the court might regard it as sufficient to save the rights of the company." Thereupon Mr. Cantor announced his intention of tearing up the tracks when the company refused to remove them. It was contended on the part of the company that the franchise had been obtained from the State, and that the borough president had no authority in the premises. In order to protect its interests the company secured an injunction restraining the city from removing the tracks.

Pennsylvania Railroad Tunnel Contract Rejected

The railroad committee of the New York Board of Aldermen reported adversely upon the contract for the Pennsylvania Railroad tunnel, which had been approved by the Rapid Transit Commissioners, and this action was sustained by the Board, much to the surprise of all who had been interested in securing the passage of the measure. The reasons given by the committee for its adverse report upon the proposed contract were that "it does not provide for pipe galleries in the tunnel for the use of the city; no time limit is fixed on the construction, and there is no provision for the employment of union labor at the prevailing rate of wages."

During the debate upon the measure Borough President Cantor added to the list of objections "that the compensation is inadequate; that the franchise is exclusive and perpetual, and that power of control is with the self-perpetuating Rapid Transit Commission, the only undemocratic body in the State."

The final vote by which the contract was rejected showed that many members who had been counted upon as friends of the measure were recorded against it. The action of the aldermen kills the contract made between the Pennsylvania Railroad Company and the Rapid Transit Commission. The special act passed by the Legislature last spring which was designed to empower the Commission to grant a perpetual franchise to the Pennsylvania company provided that the aldermen should have the right to approve or reject the contract, but that they should not have the right to modify it in any way. The decision of the aldermen is final, and the only thing left for the Pennsylvania company now is to renew its application if it still desires to go ahead with its project on terms likely to be accepted by this Board of Aldermen, and it will be necessary for an entirely new contract to be drawn. Mr. Boardman, representing the Pennsylvania company, is reported to have said when opposition developed, that even if the contract were defeated the company would make another application and would ultimately succeed in getting the franchise. The Pennsylvania company has already begun work on the Jersey side of the tunnel.

New York Transportation Needs

The second of Mayor Low's weekly talks upon municipal matters was devoted largely to consideration of the subject of interborough communication, although the official title of the bulletin was "Our Insufficient Working Capital." The Mayor pointed out that the city was suffering because of present conditions and that its proper development was being seriously retarded.

"From the moment of the creation of Greater New York, the city has been confronted with the problem of interborough communication. This is as it should be, for consolidation, among other things, was intended to bring about just that. The extent to which this subject has momentarily involved the city in expenditure is shown by the estimated cost of the works now in course of construction:

1—Rapid transit subway	$36,500,000
2—Williamsburg Bridge	20,000,000
3—Manhattan Bridge	16,000,000
4—Blackwell's Island Bridge	12,500,000
Total	$85,000,000

"For the single purpose of developing interborough communication the city is already committed to an increase of its debt, within the next few years, in the sum of, say, $32,000,000; and it is confronted with a very large additional expenditure for the same purpose in the near future, say, perhaps, $55,000,000 more. I say this because a suitable connection of the East River bridges, the East Side tunnel, and a second tunnel to Brooklyn in a certain sense are already pressing."

The Mayor advocates a liberal policy, and points out that the introduction of a municipal system of interborough communication may be fairly likened to the introduction of a municipal system of water supply. The cost of the initial plant only comes once.

Union Freight Station for Electric Lines at Cleveland

It seems probable that immediate steps will be taken by the Cleveland interurban and city companies to erect a temporary union freight station at which several interurban roads may unload goods without delaying city traffic. A year ago the city and interurban companies formed a freight station company. A lot having a frontage of 132 ft. on Bolivar Street and running through to Eagle Street, a distance of 396 ft., was purchased and leveled off, and turnouts were laid from the tracks on Erie Street. Then came the Everett-Moore embarassment affecting three of the interurban roads and the largest city company. Since then the matter has been held in abeyance, and in the meantime the freight business of the roads has increased to such an extent that absolutely no more business can be handled with the present facilities. Recently several conferences were held, and the city companies submitted a proposition offering to erect the station and charge the interurbans for its use. It has practically been settled that one-half of the station shall be built at once. This plan is favored, because it will not require the expenditure of a large sum at the outset, and it will be easy to double the capacity of the station at short notice. The turnouts are already in and three tracks with a complete system of crossovers are to be laid at once. Extending the full length of the property will be a wide platform, giving access to cars standing on the tracks nearest the station. The system of crossovers will make it possible for any of the cars to be placed in any position on the tracks. At the platform there will be room for eight or ten cars to unload or load at once. Back of the platform there will be a station building, but plans for this have not been prepared. At the other side of the station building there will be space for a wide road for teams. When the business demands it, a duplicate station and platform can be erected on the other side of the tracks and other tracks may be added if necessary.

A Handsome Time Table

The Milford, Holliston & Framingham Street Railway Company, of Milford, Mass., has issued for the convenience of its patrons one of the neatest time-tables of the year. Superintendent M. E. Nash has arranged a very complete train schedule, which is printed in clear type, of the style used in steam railroad practice, and has adopted the use of light-faced type for morning and heavy-faced type for afternoon and evening hours. The book contains a very complete map of the system and its connections, as well as a large number of views along the road and in Lake Nipmuc Park, which is operated by the company, and is one of the most attractive trolley resorts in Massachusetts. No expense has been spared by the treasurer and general manager, E. W. Goss, in building the road, beautifying the park or supplying the rolling stock, and the service required, as indicated by the time-table, shows that his efforts have been appreciated by the residents of the territory traversed by his lines. The pamphlet gives all connecting lines, rates of fares, names of hotels and boarding-houses in the towns through which the road passes, etc., and a most interesting description of the country.

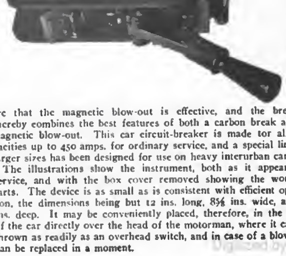
Boston Elevated to Increase Stock

A special meeting of the Boston Elevated Railway Company has been called for July 25, to authorize an increase in the capital stock of the company from $10,000,000 to $15,000,000. The proceeds of the new stock are to be applied to defraying the cost of the construction and equipment of the road and expenses incidental thereto, and to pay the indebtedness so contracted. It is said that the cost of erecting the elevated structure, both road and terminals, has far exceeded the estimates of the engineers, and the cost of the rolling stock is also said to have exceeded the original estimates. The Railroad Commissioners will hear the application of the company for permission to increase its capital stock on July 28.

An Efficient Car Circuit-Breaker

The novelty of using circuit-breakers on electric cars in place of overhead switches, has entirely worn off, and a number of roads have adopted this system of protecting their rolling stock equipments. As street railway problems have increased in importance, the managers have appreciated the necessity of keeping their cars in continual operation, and the use of circuit-breakers has been claimed by many to largely prevent the blocking of the line. The automatic and instantaneous action of the brake, and the ease with which it can be reset after it has been thrown out, in addition to the fact that it can also be used as a hood switch, has placed it in a position where its merits are now thoroughly appreciated. The Cutter Company, of Philadelphia, realizing the importance of keeping this branch of its business up to the standard which it has produced in developing its other lines of well-known I. T. E. circuit-breakers, have perfected the form shown in the accompanying engravings. This circuit-breaker has laminated copper contacts and a magnetic blow-out. The first break is at the copper contacts, and the final arc is made on carbon blocks. It is upon this arc that the magnetic blow-out is effective, and the breaker thereby combines the best features of both a carbon break and a magnetic blow-out. This car circuit-breaker is made for all capacities up to 450 amps. for ordinary service, and a special line of larger sizes has been designed for use on heavy interurban cars.


CIRCUIT BREAKER FOR ELECTRIC CARS


WORKING PARTS OF CIRCUIT BREAKER

The illustrations show the instrument, both as it appears in service, and with the box cover removed showing the working parts. The device is as small as is consistent with efficient operation, the dimensions being but 12 ins. long, 8⅝ ins. wide, and 5 ins. deep. It may be conveniently placed, therefore, in the hood of the car directly over the head of the motorman, where it can be thrown as readily as an overhead switch, and in case of a blow-out can be replaced in a moment.

Richmond Trolley Strike Settled

The strike of the employees of the Virginia Passenger & Power Company, of Richmond, Va., has been settled by arbitration. The entire system is in operation and no man has lost his place. The arbitrators—two men selected by the men and two by the company—met July 18, and in a short session reached a compromise without calling in the fifth man provided for in the agreement. The men demanded a nine-hour day and 20 cents an hour. They secured the nine-hour day and 18½ cents for motormen and 17½ cents for conductors on main lines and on branch lines 16½ cents for motormen and 15½ cents for conductors.

Levis County Railway Company

Progress on the new electric railway in Levis, St. Joseph, Bienville and St. Romuald, the towns across the St. Lawrence River from Quebec, goes steadily forward. The mortgage, or deed of trust, to the New York Security & Trust Company, was recently recorded at the Levis Registry office.

The car house of the company is situated on Fraser Street, and is in full view from the terrace in Quebec. It is a very pretty and substantial structure, with brick walls and wooden roof. The two pointed towers on the front face the river and are each to be surmounted by a flagstaff. This building at present is receiving its roof.

The brick sub-station building was completed several weeks ago, and on July 17 the machinery foundations and the cement floor were finished. The switchboard has been shipped by the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, and is expected July 25. The motor generators follow in two weeks. Power at 10,000 volts has been contracted for with the Canadian Electric Light Company. There is a mile and a half of street trenched, and with the ties laid stands ready to receive the steel rails, which will be shipped from Sault Ste Marie on July 24. The ties are distributed along the greater part of the streets. There are 5 miles of poles erected. All the overhead material arrived in town last week and will be put in place as soon as the rails are laid. The private telephone system is completed and in operation.

The cars and equipment will be ready about the time the rest of the construction is finished, which will be about the end of August. A 350-ft. trestle is being built at one part of the line, and the piers for the reception of a 65-ft. steel bridge across a river will be ready Aug. 1.

The electric elevator up the side of the cliff, opposite the Intercolonial Railway station, is in the hands of the Fensom Elevator Works, of Toronto. The face of the cliff, where it is to be located, has been grubbed and cleared for the reception of the steel work, due to arrive Aug. 1.

Altogether, the outlook is most promising that the Levis County Railway will be running before fall.

New Publications

The Municipal Year Book, 1902. With Summaries and Editorial Discussion by M. N. Baker, Ph. B., C. E. 310 pages. Price $3.00. Published by the Engineering News Publishing Company, New York, 1902.

This work includes a directory of municipal officials and franchise companies engaged in conducting public service works in each of the 1524 largest cities of the country. This list includes all of the incorporated communities of 3000 inhabitants, and a complete exhibit of the relative extent of municipal and private ownership. The information is classified first alphabetically by States and afterwards in compact tabular form with the cities, arranged in order of population, Greater New York leading with 3,437,202, Rice Lake, Wis., closing the list with 3002 inhabitants. The work ought to be of special interest to engineers and city officials who are engaged in making comparative statiscal studies in this line, and for all who are interested in any way in municipal service. The data contained in the book was furnished by city officials of the places mentioned, and the publishers mention the fact that all but five or six of the 1524 cities and towns included furnished formal reports. When the material had been compiled copies of the matter were sent to the officials of the cities interested, for final correction, so that the work can be accepted as not only authentic but in a measure official.

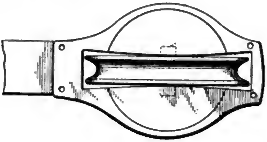
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JULY 15, 1902

704,506. Car Brake; F. O. Brown and E. T. Moore, Dallas, Tex. App. filed Oct. 4, 1901. An object coming in contact with the lower front edge of the fender presses it downward and operates the front and rear brake rods positively, to force a shoe down on the rail and under the wheel.

704,749. Trolley Pole Attachment; C. P. Lapham, Houghton N. Y. App. filed Feb. 7, 1902. The wheel is mounted in two horizontally arranged semi-disks, which permit it to swing laterally to a limited extent.



PATENT NO. 704,749

704,776. Car Fender; E. A. Booser, Altoona, Pa. App. filed Feb. 10, 1902. This fender is constructed to be easily folded against the dash of the car, and when folded permits the bumpers to project through it.

704,797. Railway Heater System; S. H. Harrington, New York, N. Y. App. filed Jan. 3, 1901. A switch controlling the heater circuit is operated automatically by the brake staff, so that when the brake is applied the heater circuit will be closed and at all other times open.

704,784. Track Sanding Apparatus; J. J. Dolan, Jr., Baltimore, Md. App. filed April 26, 1902. The end of the air pipe, which projects into the sand boxe, is covered by a shield, which prevents the sand from running out when the pipe is removed for any purpose.

704,803. Electric Controller; A. E. Hobrebe, Philadelphia, Pa. App. filed Dec. 12, 1901. The controller cylinder is mounted upon the hinged door of the casing so that it may be swung into view when desired.

PERSONAL MENTION

MR. H. C. LANG has resigned his position of secretary of the Springfield & Xenia Traction Company, of Springfield, Ohio, and Mr. Will Christy has been elected to fill the vacancy. Mr. Lang continues as secretary of the Southern Ohio Traction Company and the Western Ohio Railway.

MR. J. R. CURTISS has been appointed superintendent of construction on the extension of the Canton-Akron Railway, of Canton, Ohio, from Navarre to New Philadelphia. Mr. Curtiss was formerly at the head of the Curtiss Construction Company, of Cleveland, and has been identified with the building of a number of Ohio roads.

MR. F. F. BODLER, master mechanic at the repair shops of the North Jersey Street Railway Company, has resigned to accept a similar position with the United Railways of San Francisco. He will be succeeded by Mr. J. M. Young, who was master mechanic at the West Hoboken shops of the Jersey City, Hoboken & Paterson Street Railway Company. Mr. Bodler has been connected with the New Jersey systems for a number of years, having been assistant master mechanic of the North Jersey and master mechanic of the Jersey City, Hoboken & Paterson Companies before being made master mechanic of the former. He joins in San Francisco Mr. G. F. Chapman, who recently resigned his position of general superintendent of the North Jersey to become general manager of the Western system.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR

Ambulances and Fire Engines

In Smith vs. American Society for the Prevention of Cruelty to Animals (7 Misc., 158), it was held that an ambulance is entitled to the right of way in a street, and it is the duty of owners or drivers of other vehicles, upon seeing it approaching on the tracks of a railway, to deviate from their course sufficiently to enable it to turn out of the track to avoid collision with an approaching car on the same track. The following language from the opinion by Judge Bischoff is worthy of quotation:

The ambulance was entitled to the right of way. Laws 1879, Chap. 186; 3 R. S. (Banks Bros., 7th ed.), 2086. Hence it was incumbent upon those in charge of plaintiff's wagon, upon seeing the ambulance approaching in an opposite direction, to deviate from their course sufficiently to enable the ambulance to turn out of the downtown track to avoid its collision with a car approaching toward it on the same track. Instead of so doing those in charge of plaintiff's wagon persisted in their course, thus leaving the driver of the ambulance no means of escape but to turn to the right or easterly side of the roadway, which he attempted to do when the collision occurred, as already stated.

The inference, therefore, is irresistible either that, seeing the ambulance, the persons in charge of plaintiff's wagon disregarded it and its right of way, or that they failed to use the ordinary precaution of persons driving along the public highways or city streets, to be on the alert for vehicles approaching in an opposite direction, and so failed to see the ambulance. In either case, therefore, the collision was the fault of those to whom plaintiff had intrusted his wagon for the time being, and not of the driver of the ambulance."

In New York a right of way to ambulances is expressly granted by the statute above cited (c. 186, laws 1879), which act also provides that the right of way so conferred shall not affect the existing right of way of the United States mail or of the officers, men and fire apparatus of any municipal fire department, or insurance patrol. In other States, special privileges in favor of ambulances and fire engines exist at common law. (See Thomas on Negligence, pp. 1172, 1180; Elliott's Roads and Streets, Second Edition, Section 839, Note.) It was held by the Supreme Court of Kansas in City of Kansas vs. McDonald (45 L. R. A., 429) that a city ordinance making it a misdemeanor for any person intentionally to ride or drive any horse, mule, or other beast faster than an ordinary traveling gait in any of the streets of the city, is unreasonable as applied to officers of the fire department when driving to a fire, and for that reason will not be enforced.

The rule is that an ordinary vehicle has equal rights with a horse car or electric car in the streets of a city. This rule is subject to such modifications as the rigid roadbed of the street railway company renders inevitable. "A street railway company has a paramount, but not exclusive right to the use of that portion of the street occupied by its tracks. A person lawfully driving on the tracks may not recklessly or negligently obstruct the passage of cars, but he is not absolutely bound to keep off or get off the same." (Thomas on Negligence, p. 1143.) Of course a car cannot leave the track even to make way for ambulances or fire engines, but by stopping when called upon to do so, or in any other feasible manner according to circumstances, it is under the same duty as an ordinary vehicle to facilitate their passage.

A case recently decided by the Supreme Court of Alabama illustrates the liberal attitude of the courts toward the rights of fire wagons, and of persons connected with them. (Birmingham Ry. & Electric Co. vs. Baker, 31 So. R., 618.) It was held that where the concurring negligence of the driver of a hose cart and employees in charge of a street car results in a collision, the negligence of the driver cannot be imputed to a fireman riding on the cart, but having nothing to do with the driving, who is injured in the collision, and it will not preclude him from recovering from the street car company.

It appeared that a hose cart, going about as fast as the horses could run, and with the gong sounding, collided at a street crossing with a street car; and plaintiff, who was a fireman on the cart, was injured. Plaintiff's witnesses testified that the car had stopped before attempting to cross the street on which the cart was approaching, and that the motorman started his car without warning when the cart was only 18 or 20 ft. from the intersection of the streets, and made no attempt thereafter to stop the car. One witness testified that the motorman was looking ahead when he started the car, and another that he was looking back through the car. Defendant's witnesses testified that the car did not start after it had stopped, and that the cart ran into it. It was held that the question whether the motorman saw or heard the approaching cart when he started the car, if he did start it, and wilfully or wantonly or with reckless indifference to consequences, failed to exercise proper care to prevent the collision, was for the jury.

It was further held that the question whether a fireman, who has no time to put on his coat before responding to a fire alarm, and who does so while on the cart on the way to a fire, is negligent in so doing, is a question for the jury.

"The evidence tended to show that the firemen, when starting to a fire, would not have time to put on their coats, and to avoid getting wet, and to be in readiness for service when they arrived at the fire, they put them on while on the way, and this they were allowed to do." It is not improbable that if a person riding in an ordinary vehicle going at great speed should rise to his feet and attempt to put on his coat, such action would be held contributory negligence as matter of law.

Note.—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York City.

LIABILITY FOR NEGLIGENCE.

NEW YORK.—Steet Railways—Crossing—Contributory Negligence—Persons Crossing Track—Rights—Charge—Instruction—Operation of Car—Notice—Damages—Amount.

1. Plaintiff, driving on a city street, saw a street car near him, going up town on the nearest track, and a car coming down town on the other track, at rapid speed, some 300 ft. away. He checked his horse until the nearest car had passed, and drove back of it. When he reached the point where he could see the other car, his horse was on the track, and the car was coming at a rapid rate, and only 20 or 30 ft. away. He whipped up his horse, but the hind wheels of his buggy were struck by the car, throwing him to the ground, and he was injured. Held, that the court properly refused to hold that plaintiff was guilty of contributory negligence in going on the track in front of the car, knowing that it was running at such rapid rate, since plaintiff had a right to presume that the speed of the car would be checked on approaching the crossing.

2. Any error in charging that plaintiff "had the right to assume that the car would not be run in such a way as to endanger him" was obviated by adding, "Every person who uses the street crossings has a right to assume that the people who are operating street cars are exercising them with due regard to the rights of others, and that they will exercise ordinary care and prudence in their operation."

3. Where a person driving to cross a street railway at a street crossing sees a car, running at a rapid rate, 300 ft. distant, such fact is not notice to him of an intention to continue such rate of speed in disregard of the rights of others at the crossing.

4. Where plaintiff in a personal injury case—a young man—appears to have sustained the permanent crippling of a limb, in addition to temporary suffering, a verdict for $4,346.98 is not excessive.—(Bertsch vs. Metropolitan St. Ry. Co., 74 N. Y. Suppl., 238.)

NEW YORK.—Street Railroads—Action for Injuries—Persons Crossing Track—Negligence—Evidence.

Plaintiff, while crossing defendant street railway company's track at night, immediately behind one of its cars which had stopped at a crossing, fell into the "fender" attached to the rear of the car, and was dragged some distance. The conductor was collecting fares when the accident happened, and neither saw him fall nor knew he had fallen when he signaled to go ahead. The fender was properly folded up when the car started on its trip, and there was evidence that it was folded up nine blocks from the scene of the accident, and it did not appear how it had fallen, or that it was improperly constructed, or that its fastenings were defective. Held, that the facts did not show any negligence on part of defendant.—(Levison vs. Metropolitan St. Ry. Co., 74 N. Y Supp., 882.)

NEW YORK.—Street Railways—Injuries—Negligence—Question for Jury—Contributory Negligence.

1. Where in an action against a street railway for injuries, there was evidence that a northbound car standing on the north corner served to cut off the view of persons seeking to cross the street from east to west, and that the southbound car, which struck

plaintiff at the crossing was going at 10 miles an hour at the time, and that the bell was not rung on such car, the question of defendant's negligence is for the jury.

2. Where, in an action against a street railroad for injuries, there is evidence that plaintiff, on approaching the track on a certain street from east to west, saw a car go south, and looked up and down the street for approaching cars, and saw or heard none, owing to the fact that a northbound car standing on the north corner served to cut off the view of persons seeking to cross the track, and the failure to ring the bell of a rapidly moving southbound car, the question of contributory negligence in attempting to cross the track is for the jury.—(Tupper vs. Metropolitan St. Ry Co., 74 N. Y. Supp., 868.)

NEW YORK.—Street Railroads—Negligence—Unexplained Accident—Res Ipsa Loquitur.

Plaintiff was injured by the sudden and unexplained stopping of defendant's street car, and on trial introduced proof of such occurrence and rested. Defendant introduced four of its employees, who testified to the use of the best-known appliances, careful supervision and skillful service. Held, that the dismissal of plaintiff's case was error, since under the doctrine of res ipsa loquitur proof of the accident cast the burden of explanation on defendant. —(Langley vs. Metropolitan St. Ry. Co., 74 N. Y. Supp., 857.)

NEW YORK.—Street Railroads—Action for Injuries—Failure to Produce Evidence—Inferences—Underground Trolley—Shock from Slot Rail—Res Ipsa Loquitur—Instructions—Sufficiency of Instructions—Overcoming Presumption—Sufficiency of Evidence—Liability for Defective Track—Duty to Repair—Electric Shock from Slot Rail—Expert Testimony.

1. In an action against a street railway company for injuries alleged to have been caused by an electric shock from the slot rail of defendant's underground-trolley railway track, wherein it appeared that defendant had appliances from which it could detect any escape of electricity from the conductor rails to the slot rail, and defendant introduced its track master, chief engineer, and electrical engineer to show that there was no leak at the time of the accident, but failed to produce those in direct charge of the detecting appliances, every inference warranted by the evidence should be indulged against defendant, because, presumably having evidence in its possession, it omitted to produce it or to explain the omission.

2. Where a pedestrian is injured by a shock of electricity received from the slot rail of an underground-trolley street railway track, the doctrine of res ipsa loquitur applies, so as to raise a presumption of negligence sufficient to call for an explanation from the company, or to put it to its proof.

3. Plaintiff claimed to have been injured, just after a snowstorm, by an electric shock from the slot rail on defendant's underground-trolley street railway track. There was evidence that electricity could escape from the conductor rails if excessive snow or moisture settled in the conductor conduit, or by defective insulation. There was also evidence that defendant's road was constructed properly. Held, that an instruction assuming the proper construction of the road, and that there was no evidence that electricity could escape except in consequence of the snowstorm, and charging that, if the snowstorm was the cause of plaintiff's injury, he could not recover, was properly refused, as improperly assuming that the electricity could not escape except through snow, and as omitting defendant's duty to use due care to remove the snow.

4. Refusal to give instructions whose subject-matter is fully covered by other instructions is not error where the requests therefor are not read before the jury, but are given to the court in writing, and it merely fails to give the instructions requested.

5. Plaintiff claimed to have been injured, just after a snowstorm, by an electric shock from defendant's underground-trolley railway track, while defendant denied this, and claimed plaintiff merely slipped and fell. The court instructed that, if the jury believed defendant had exercised ordinary care to prevent the escape of electricity, or that it was impossible for the slot rail to become charged therewith, or that defendant had sufficiently explained the accident, or that it was unavoidable by ordinary care, they must find for defendant; but that, if they should find that plaintiff was free from contributory negligence, that the accident was due to an electric shock, and not inevitable, but could have been prevented by ordinary care, and that defendant was guilty of negligence, they should find for plaintiff; that the burden of proof was on plaintiff to show by a fair preponderance of the evidence that his injuries were caused by some negligence of defendant, and that, if the evidence was as consistent with the absence of such negligence as with it, plaintiff could not recover, as he was "bound to make it more than a balanced case"; and that plaintiff could not recover "without affirmative proof that defendant did not exercise ordinary care in the construction, operation," etc., of its road. Held, that the instructions were sufficient to justify a failure to instruct specifically that plaintiff must establish his case by a preponderance of evidence, and that the mere happening of the accident was not sufficient to justify a recovery.

6. Plaintiff was injured, just after a snowstorm, by an electric shock from the slot rail of defendant's underground-trolley railway track. There was evidence to show that the slot rail could have become charged from the conductor rail in only two ways, viz., defective insulation, or by snow or excessive moisture in the conductor conduit; and defendant showed by expert testimony that its road was properly constructed, and by its employees that it had exercised care in removing the snow and other substances from the conduit, which evidence was uncontradicted except by the circumstances of the accident. Defendant also introduced employees to show that the ground-leak indicators at the power house showed no leak at the time in question, but no one in direct charge of these indicators was introduced. Held, that the question whether defendant's evidence sufficiently overcame the presumption of negligence raised by the fact of the injury by electricity was for the jury.

7. Where the insulator of the conductor rails of an underground-trolley railway gets out of repair, or the conductor conduit becomes filled with snow or moisture, so as to charge the slot rail with electricity, without any negligence on the part of the railway company, it is not liable for injuries to pedestrians, caused by such conditions, unless it fails to remedy the defects within a reasonable time after actual or constructive notice thereof.

8. Where the plaintiff claimed to have been injured by an electric shock from the slot rail of defendant's underground-trolley railway track, the testimony of an experienced electrical engineer, who knew the effect of electricity upon the human body, and was thoroughly conversant with the subject, was admissible to show that, if the slot rail was charged with electricity, and plaintiff stepped upon it under the conditions existing at the time of the accident, he would receive an electric shock.—(Ludwig vs. Metropolitan St. Ry. Co., 75 N. Y. Supp. 667.)

NEW YORK.—Connecting Carriers—Ejection of Passenger—Street Railways—Transfers—Error of Initial Carrier—Contributory Negligence—Liability of Carrier—Damages—Malice.

1. A street railway company is liable for ejecting a person who presents a transfer ticket from a connecting road, not acceptable under the rules of the company because not properly punched, though the mistake was made by an employee of a connecting road, there being a traffic agreement between the two roads, whereby transfers were issued from one to the other.

2. Where one is ejected from a street car because his transfer ticket was not properly punched, he is not to be charged with contributory negligence in receiving the same, he not understanding the ticket, and being ignorant of whether it was correctly punched.

3. Where one is ejected from a street car because his transfer ticket is not properly punched, and is arrested at the instance of the conductor, and imprisoned, the refusal of the transfer, ejection, arrest, and imprisonment are to be treated as continuous acts, for which the company is responsible.

4. The passenger is only entitled to compensatory damages for loss of time, fare on another car, and injury to feelings because of the indignities suffered.

5. The good faith of the conductor is no defense.

6. Where one is ejected from a street car because the hour was not correctly punched in his transfer ticket, a regulation of the company making such a transfer worthless is no defense to an action for the ejection.—(Jacobs vs. Third Ave. R. R. Co. et al., 75 N. Y. Supp. 679.)

NEW YORK.—Street Railroads—Collision with Wagon—Contributory Negligence.

Where the driver of a heavy wagon attempts to cross the tracks of a street car company at night, and, before doing so, looks both ways upon the track, and is unable to discover any car approaching, but does see the headlight of one, which he believes to be moving toward him at a distance of three or four hundred yards and where the evidence justifies the jury in determining that such car was travelling at an unusual, reckless, and dangerous rate of speed, which fact such driver did not and could not know before starting to drive across such track; and when, by reason of such high rate of speed, and the failure of those in charge of the car to make any effort to stop it, such wagon is struck, and the driver injured—the question as to whether the latter was so far guilty of contributory negligence as that he may not recover is one of fact for the jury, under proper instructions of the court.—(Metropolitan St. Ry. Co. vs. Slayman, 68 Pacific Rep. 628.)

OHIO.—Carriers—Injury to Passenger—Evidence.

1. In an action to recover for personal injury occasioned by negligence of the defendant, the plaintiff cannot recover by merely proving an act of the defendant which was the proximate cause of the injury; but, to authorize a recovery, the plaintiff must also show that such act resulted from culpable negligence by the defendant.

2. Where a passenger on a street railway car was thrown from the car and injured by the sudden stopping of the car in the effort to avoid a collision, and by the shock of a collision which was not brought about by the negligence of the defendant, it is damnum absque injuria.—(Cleveland City Ry. Co. vs. Osborn, 63 N. E. Rep. 604.)

PENNSYLVANIA.—Carriers—Injury to Passenger in Alighting—Negligence—Evidence.

Negligence of a carrier is not shown by testimony of a passenger that as he went to get off the car his foot caught in the step, and that he pulled to get it loose, and when he did get it loose he fell.—(Howell vs. Union Traction Co., 51 Atlantic Rep. 885.)

PENNSYLVANIA.—Street Railway—Injury to Cyclist—Contributory Negligence.

1. The dominant right to the use of street railway tracks is in the company, and must be deferred to by all the public having a right to cross, and they must use ordinary prudence to ascertain whether the owner of the track is about to use it.

2. A cyclist is bound to look and listen just before crossing street railway tracks, and is guilty of contributory negligence if he fails to do so.

3. In a suit against a street railway company for killing a cyclist of mature years crossing its tracks, there was evidence of the car going at a high rate of speed. Plaintiff's witnesses, including decedent's son, testified that the car was 50 ft. to 75 ft. away when decedent attempted to cross. He had then 17½ ft. to go to entirely clear both tracks and place himself outside the running board on the far side of the car, and was moving at from 10 ft. to 15 ft. per second. Several of plaintiff's witnesses testified that they were afraid the car would strike him. Held, that even if decedent looked to see if a car was coming, he was negligent in crossing.—(McCracken vs. Consolidated Traction Co., 50 Atlantic Rep., 830.)

PENNSYLVANIA.—Street Railways —Negligence—Parent and Child—Evidence.

Where a child two years old was in the front room of her father's house, in charge of a sister fifteen years, who was scrubbing the walk in front, and while such sister went arond the house for a pail of water the child went out onto a street car track, and was run into by a car, the question of the parents' negligence in permitting such escape of the child is for the jury.—(Jones et al vs. United Traction Co., 50 Atlantic Rep.,827.)

PENNSYLVANIA.—Street Railroads—Crossing Accident—Negligence of Carriage Driver—Evidence.

1. The driver of a carriage approaching street car tracks on a cross street at a slow trot checked his horse, but did not stop, and, on getting within the house line, looked west (the view being unobstructed for about 100 feet), and, seeing no car, looked east, and then west, when a car was seen approaching at a distance of about 50 feet; and, the horse being near the track, the driver, to avoid a collision, turned to the east and drove rapidly in the direction the car was going, but was unable to keep ahead of the car or get off the track before the carriage was struck by the car. The car was running about 20 miles an hour, and no notice was given of its approach. Held not to show, as a matter of law, that the drive was negligent.

2. There being no fixed duty to stop before attempting to drive across street car tracks, the question whether a failure to do so is negligence is for the jury.—(Haas vs. Chester St. Ry. Co. et el., 51 A. Rep., 744.)

PENNSYLVANIA. — Street Railroads—Crossing Accident—Collision With Wagon—Negligence of Driver—Failure to Look for Cars.

Where the driver of a covered wagon, approaching street car tracks on a cross street, merely glances down the track for a distance of 50 or 70 feet on first reaching the street where the tracks are located, and then drives across the tracks, without again looking for approaching cars, his negligence precludes a recovery for injuries received in a collision with a car.—(Pieper vs. Union Traction Co. of Philadelphia, 51 At. Rep., 739.)

PENNSYLVANIA.— Railroads — Crossing Accident — Collision—Negligence of Driver of Wagon—Duty of Looking—Country Electric Roads.

1. Where the driver of a covered wagon stops and gets out on the swingletree, and looks for an approaching electric car, while about 35 feet from the track, at a place where he has an unobstructed view of the track for 319 feet, and then climbs back into the wagon, and, without looking further, attempts to cross the track at a walk, and is struck by a car, his contributory negligence precludes his recovery.

2. The fact that an electric railroad is in the country, and that cars are not so frequent, and obstructions to travel are not so great as in a city, does not relieve a person about to cross the track from the duty of continuing to look for approaching cars till he reaches the track.—(Keenan vs. Union Traction Co., 51 At Rep., 742.)

PENNSYLVANIA.—Injury to Employee—Negligence of Fellow Servant.

Any negligence of an inspector of the electrical apparatus of a trolley car, who, after inspecting it for efficiency, says: "All right. Put your pole on"—acting on which the conductors puts on the trolley, and the car runs on him, the controller being open, is that of a fellow servant.—(Shugard vs. Union Traction Co., 51 At. Rep., 325.)

PENNSYLVANIA.—Injury to Employee—Negligence—Presumption—Cross-Examination.

1. In an action by an employee, negligence of a street railway company as to sanding wet tracks cannot be presumed from the mere fact that two weeks before the accident from slipping of the car it substituted a new system of sanding in place of that used before.

2. Where the complaint is that defendant did not properly sand its tracks, it is proper cross-examination of a witness testifying that sand boxes had been discontinued on the cars to show by him that another system of sanding had been adopted, and was then being used.—(Smith vs. Philadelphia Traction Co., 51 At. Rep., 345.)

PENNSYLVANIA.—Street Railroads—Accident at Street Crossing—Pedestrians—Sufficiency of Evidence.

In an action against a street railway company for negligent killing of a pedestrian at a crossing, three witnesses for plaintiff testified that the car was running from twelve to twenty miles an hour, and that no bell was sounded; and two other witnesses testified to the excessive speed of the car. Three witnesses for defendant testified that a bell was sounded, and two that they heard none. It also appeared that when deceased left the curbing she looked toward the car, then about 200 ft. away, and when struck she was almost across the track, and that the car ran 180 ft. before it stopped, after striking deceased. Held, that the evidence was sufficient to sustain a judgment for plaintiff.—(Henderson vs. United Traction Co., 51 Atlantic Rep., 1027.)

PENNSYLVANIA—Street Railroads—Accident on Street—Negilgence—Absence of Lights.

Several witnesses testified, in an action against a street car company for running over a child on the street while going down a hill on a dark night, that there were no lights in the car, and that the conductor was attempting to put on the trolley. One witness testified that no bell was rung before the accident, and another testified that if a bell had been rung he would have heard it. The motorman testified that the night was very dark and the track was slippery. A witness testified that he believed the lights were burning in the car, and another testified that there must have been a headlight. Held, sufficient evidence of defendants' negligence to sustain a recovery.—(Welsh et al. vs. United Traction Co., 51 Atlantic Rep., 1026.)

PENNSYLVANIA—Street Railways—Collision with Delivery Wagon—Negligence—Contributory Negligence—Question for Jury.

1. A boy driving a delivery wagon was not guilty of contributory negligence, as matter of law, in backing it up at right angles to the curb to deliver heavy goods at a store, though in so doing his horses necessarily stood across defendant's street car tracks, where, owing to obstructions in the street, he could not have placed his horses and wagon longitudinally opposite such store, and it was not shown that he saw any car approaching when he placed his wagon against the curb, nor that he had reason to apprehend the approach of one before he could deliver his goods.

2. In an action against the street railway company to recover for his wrongful death, the wagon having been run into by a car, certain of the plaintiff's witnesses testified that they heard no bell or other signal, and others that no warning was given. This evidence was contradicted by that of the defendant. Witnesses for the plaintiff testified that the car was going twenty miles per hour.

It appeared that the wagon was carried 50 ft. after being struck, and that the car ran 160 ft. beyond the point of collision. The street was narrow, and the community thickly populated. The obstructions at the point in question had been there for several months. Held, that the question of defendant's negligence was for the jury.

3. The motorman of the car was negligent in failing to give warning of his car's approach, though the place of the accident was not at a street crossing.—(Fenner et al. vs. Wilkesbarre & W. V. Traction Co., 51 Atlantic Rep., 1034.)

TEXAS.—Street Railways—Passengers — Injuries — Instructions.

Plaintiff, a street car passenger, as a car slowed down upon reaching a cross street, stepped from the car to its sideboard, intending to alight, and was thrown off by its sudden start. There was evidence showing that by the company's rules cars only stopped to let off passengers after crossing cross streets, and also evidence that the car slowed down just as it reached a cross street for the purpose of permitting plaintiff to alight. Held, that an instruction which assumed that the car slowed down when reaching the cross street to enable plaintiff to alight was erroneous, since defendant's servants were not negligent in slowing down the car if they did not know of plaintiff's intention, while, if the slowing down was to enable him to alight, it would be liable for lack of ordinary care, and these were matters of fact to be determined by the jury. (Rapid Transit Railway Company vs. Lusk, 66 S. W. Rep., 799.)

TEXAS.—Railroads—Obstruction of Street—Negligence.

Where a railroad company tore up the pavement at a point where its road intersected a street and left stones lying at the place without any signal light to show their presence, as required by an ordinance, violation of the ordinance constituted negligence, rendering the company liable to a cyclist injured by colliding with the stones. (Houston, B. & N. Ry. Co. vs. Pollard, 66 S. W. Rep., 851.)

VIRGINIA.—Street Railways—Negligence—Piling Snow on Crossing—Contributory Negligence—Instructions—Trial—Reading Law to Jury—Damages.

1. In an action against a street railway for injuries sustained owing to the piling of snow on a crosswalk by defendant, it having been assumed that the street was a public highway, and it being shown that there was a crossing constantly used, the importance of which the company recognized, as shown by the evidence of the superintendent that he directed the men to clean the snow from all crossings, and that he knew they removed it from that particular crossing, a contention that the street was not a public highway was of no avail to defendant, inasmuch as such question was immaterial.

2. It was not error to permit plaintiff to prove that others than herself had walked over the snowbank.

3. Defendant asked the court to instruct that, if the tracks were covered with snow, it had the right to remove it therefrom, provided that in doing so it exercised ordinary care, to which instruction the court added, "and, where the snow might reasonably have been deposited so as not to obstruct the way of pedestrians passing along the crosswalk, the depositing of snow at such a point so as to create an obstruction is a negligent act." Held, that the instruction as amended was proper.

4. The snow, having been removed from tracks by hand, it was not error to refuse to add to the former instruction, "if the snow was allowed to remain for an unreasonable time," since the negligence of the company consisted not in its failure to remove within a reasonable time, but in putting the snow in the first instance on the crossing.

5. Plaintiff testified that she knew that the crossing was obstructed by snow, which made it dangerous, but she had passed over the crossing shortly before the accident, and it was shown that many other persons had made their way over the same obstruction; and the court instructed that, though plaintiff saw the heap of snow and knew it was dangerous, she was not guilty of contributory negligence if she was exercising such care as persons of ordinary prudence would exercise under the circumstances. Held, that the instruction was not erroneous.

6. Where defendant claimed it was not guilty of negligence unless the snow was allowed to remain for an unreasonable time, it was proper not to permit counsel to read the jury a definition of "reasonable time" from a reported case and to read from another case a discussion as to what constitutes contributory negligence.

7. In an action for personal injuries a verdict for $2500 as compensation for a broken leg and much consequent suffering will not be disturbed as excessive. (Newport News & O. P. Ry. & Electric Co. vs. Bradford, 40 S. E. Rep., 900.)

WASHINGTON.—Street Railroads—Negligence — Construction of Tracks—Runaway Horse—Question for Jury—New Trial —Appeal.

1. Where a buggy attached to a runaway horse is overturned by street car tracks negligently allowed to remain above the street level the runaway cannot be said, as a matter of law, in an action against the car company, to be the proximate cause of an injury received by an occupant of the buggy, but the question of proximate cause is for the jury.

2. The question whether street car tracks allowed to remain above the level of a street render the street unsafe for ordinary travel is for the jury, in an action against the company for an injury alleged to have been caused thereby.

3. Where an order granting a motion for new trial, raising questions of law and fact, shows that it is sustained on one specific question of law only, which ruling was erroneous, the Supreme Court will not determine whether the motion should have been sustained on other grounds. (Gray et ux. vs. Washington Water Power Co., 68 Pacific Rep.)

WASHINGTON.—Street Railways—Personal Injuries—Negligence—Contributory Negligence—Direction of Verdict.

1. Plaintiff, while crossing a street car track at the top of a hill, was struck by a car which had just ascended the hill. The grade of the hill was 20 per cent, and the car, which was propelled by cable, was apparently stopped as quickly as possible on reaching the level; but before it had cleared the incline the accident had occurred. The speed of the car could not be checked without releasing its grip on the cable. Held, not to show, as matter of law, a want of negligence in the street car company.

2. In an action against a street railway company for personal injuries, where there was some evidence that the gong was not rung, it was a question for the jury to determine what the facts were in that particular, and whether failure to sound the gong was negligence.

3. The plaintiff had crossed one track of a street car company at about the center of the crossing of two streets, and had stopped to wait for a car on the other track to pass. While standing there he observed that his family had not followed him, and turned to go back, and was struck by a car which had just ascended a hill. He did not turn towards the direction from which the car was coming. There was some evidence that no gong was sounded. Held, not to show contributory negligence as matter of law.

4. Before the court will be justified in taking from the jury a question of contributory negligence, the acts done must be so palpably negligent that there can be no two opinions concerning them.—(Burian vs. Seattle Electric Co., 67 Pacific Rep., 214.)

WISCONSIN.—Street Railways—Disposition of Snow—Negligence—Pleading—Evidence—Instruction.

1. Where a case is submitted to the jury on a special verdict, it is error to tell them the legal effect of their answer on the question of contributory negligence.

2. A complaint against a street railway company, setting forth the requirements of an ordinance that it shall not allow snow or ice to accumulate on its tracks in a quantity to obstruct or hinder the passage of teams, or deposit the same on any portion of any street so as to obstruct it or render it unsafe, or so as to interfere with ordinary travel, also charges a breach of the common-law duty not to render the street unsafe for travel, by alleging that the company negligently caused the snow and ice on its tracks to be excavated and removed so as to leave a deep ditch, rendering the street unsafe and dangerous for public travel.

3. A street railway, by accepting its franchise to operate over public streets, assumes the duty of not leaving declivities on the sides of its track, dangerous to travel, in clearing the snow from its track.

4. For one to attempt to drive across a street railway track where there is a slope of 11 ins. to 14 ins. in the snow in a distance of from 1½ ft. to 3 ft. is not negligence per se.—(Gerrard vs. La Crosse City Ry. Co., 89 N. W. Rep., 125.)

WEST VIRGINIA.—Street Railways—Injury to Person on Track—Evidence.

1. A declaration by the motorman running on an electric car, made while the car was still on the body of one it had run down, that "I saw the child, but thought I could pass it;" or, "This is a terrible thing, I saw the child, but thought I could run past it."—is admissible in evidence as a part of the res gestae in an action for the injury.

2. A motorman in charge of an electric car moving in the public street, where he has reason to expect little children are playing, must exercise a high degree of watchfulness in the operation of the car.—(Sample vs. Consolidated Light & Ry. Co., 40 S. E. Rep., 597.)

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, July 23, 1902.

The week's developments have in the main been favorable to continued ease in the money market. It seems now to be pretty clear that the heavy currency transfers to the West in the early part of the month were connected with the Gates deal in the corn pit. Whether the corn operations have been completed is a matter upon which opinions differ. But at all events their influence upon the money market is no longer apparent, and the heavy outgo of funds has been succeeded by a return movement to this city of considerable proportions. The Treasury's excess of expenditures over receipts continues, but at nothing like the rate of the first two weeks in July. As a matter of fact the Sub-Treasury would have been a creditor during the last week in the exchanges with the local banks had it not been for large overland remittances of Alaskan gold. These arrivals aggregated more than $2,000,000 for the period ending last Saturday, and they left the banks with a net gain of $1,500,000 odd at the Sub-Treasury. This, together with the receipts from the out-of-town centers, caused an increase of over $3,000,000 cash in the last bank report, while despite the activity on the Stock Exchange, loans were reduced upwards of $3,000,000. The improvement in the bank reserve accompanying these changes was altogether satisfactory, although the surplus item is below the average run of previous years. An offset somewhat unexpected has come now, however, with the resumption of gold exports to Europe. A million dollars gold was taken Monday by the National City Bank for shipment to Berlin, and the very firm tendency maintained in the foreign exchange market suggests that more engagements will shortly follow. The exchange position, it will be noted, has been distinctly altered even from a week ago, first by the decline in New York money rates, and second, by the sales of our securities by foreign speculators. It is hard to foresee any considerable gold movement at this time, when the demands for the domestic harvest are so near at hand. Nevertheless even moderate exports, if continued, will project a new complication into the money situation. The most that can be said just now is that rates will doubtless continue easy for several weeks; but that afterwards the outlook is quite uncertain.

Time money is in strong demand for six months, at 4½ per cent, but not much is offered. Call money on the Stock Exchange does not go above 3 per cent.

The Stock Market

Another week of almost uninterrupted advance still finds no sign of an immediate termination of the "bull" campaign on the Stock Exchange. Prices for the general average of railway stocks stand now far above any previous level of recent years. Yet the sentiment of the leading speculative interests, and, to all appearances, of the great majority of the small outside speculators, continues confident in the ability of the market, not only to hold what it has gained, but to ascend to even greater heights. There must be some limit to the upward movement, and conservative people are constantly asking themselves whether the turn is not near at hand. But no one can point as yet to any danger signals, and few care to prophesy when the end will be reached. The one thing evident to all observers is that there is nothing in outside conditions which threatens an immediate check to the speculative buying movement. The money market may give trouble later on, but for the next four weeks at least there seems no likelihood of local resources becoming insufficient to accommodate all demands. Crops are making satisfactory progress, and the chances of a "bumper" corn yield, which is the main point of speculative concern, do not grow less as the season advances. The anthracite coal strike may drag along for some time further, but its most serious effects, now that the bituminous miners have decided to remain at work, have beyond much doubt been discounted. Railway earnings are on the increase, and with the assurance of a heavy grain movement for the coming season, traffic officials anticipate confidently that even the wonderful record of the last two years will be surpassed. Evidently the revulsion in the stock market, when it comes, will be the result of its own internal conditions; that is, will come about through over-speculation and excessive inflation of prices by manipulation. Only the close observer of day-to-day developments can tell when these seeds of reaction are about to bear fruit.

The local traction stocks, as anticipated in last week's article, have at length joined vigorously in the general upswing. No comment bearing on the specific value of their properties is called for, inasmuch as their movement is referable so obviously to general market conditions. The pool in Brooklyn Rapid Transit has made good use of its opportunities, and has apparently succeeded in attracting a fair-sized outside following. It is said that a prominent banking house has been buying the stock heavily of late, but we are not prepared to vouch for the correctness of this report. Manhattan Elevated has been taken in hand by a number of the larger operators, and although it is not clear whether insiders are co-operating, they are certainly not interfering with the advance. The rise in Metropolitan so far seems to be entirely sympathetic with the movement in the other tractions. There has been no heavy or no concentrated buying. Metropolitan Securities, however, has been led up energetically by speculators who feel that they are amply protected so long as only one installment of the subscription money has been called for.

Philadelphia

The feature of the week in Philadelphia has been the heavy dealings and steady advance in Philadelphia Rapid Transit. The shares touched 11¾ on Friday, as compared with 10⅜ three days previous, and held the greater part of their gain in the subsequent trading. Nothing has developed in connection with the property beyond what has been commonly known for some time. Apparently the rise means nothing more than that a speculative clique is taking advantage of the revival of activity in the general market, to put the stock up. The noteworthy feature is that Union Traction, the lessee company stock, has refused to take part in the advance, and that the volume of dealings in the issue has been comparatively small. This bears out the view suggested in this column several weeks ago that Union Traction has pretty well discounted the advantages expected to accrue to it under the deal, and that speculative interest will be diverted to Philadelphia Rapid Transit as the issue which has the main possibilities of a future increase in value. Business in the rest of the traction department has been very light. Sales are reported in Philadelphia Traction at a further half-point advance to 99¾, in American Railways at 46¼, Railways General at 5, Rochester Railway common (200 shares) at 66½, Consolidated of New Jersey at 69½, United Traction of Pittsburgh preferred at 51, Reading Traction (100 shares) at 32, and Indianapolis Street Railway at 83, the last-named three points down from the previous sale. In bonds Electric People's Traction 4s have again led the list in activity, large blocks changing hands around 99½. The other recorded sales include People's Passenger 4s at 105 (ex-interest), United Railways 4s at 87½, and Newark Passenger 5s at 116½.

Chicago

Sharp recoveries on light dealings have taken place in Chicago surface line stocks during the week. Union Traction common, which a week ago hung around 15, went back to 18, and the preferred reacted from 47 to 51. Denials of the speculative gossip about a reorganization was the ostensible reason for the advance. Chicago City Railway is up over 5 points on reports of excellent earnings. It is stated that the road is earning 16 per cent on its stock, against 11 per cent last year. Business in the elevated securities has been generally inconsequential. Metropolitan preferred holds strong at 92. Lake Street is quotably a half-point higher at 10½, but there is no disposition to buy the shares until the future status of the road is more definitely determined. Schemes of reorganization for the property are said to be well under way.

Other Traction Securities

A somewhat better demand developed in Massachusetts Electric during the week, under which the stock moved up from 41½ to 42¼. Boston Elevated rose a point on casual purchases to 165, and West End common was very firm at 96. In Baltimore the Nashville Railway securities have again been a notable feature. After last week's decision invalidating the company's charter had caused a sharp slump, support was extended by the pool, and the 5 per cent certificates rose to 74 and the stock to 6. On attempts of the speculative interests to realize, however, the certificates later on reacted to 72, and the shares to 4¾. The hardening tendency noted for some time past in United Railways of Baltimore issues, continues. The stock is up on fair-sized dealings to 16⅜, the income bonds to 70⅞, and the general 4s to 97¼. Other transactions of the week comprise Anacostia and Potomac 5s at 104, Atlantic Consolidated 5s at 105½, Charleston Consolidated Electric 5s at 94, City & Suburban (Washington) 5s at 104, Lexington Street Railway 5s at 104, Nashville Street Railway 5s at 102¾, and Norfolk Railway 5s at 113½. The New Jersey securities have not done much during the week. North Jersey Traction stock is off a half-point to 30½, but the bonds are up the same amount to 84½. The New York

curb has been enlivened by the launching of the new New Orleans Railways stocks, which has been accompanied by active manipulation for the advance. A syndicate of Eastern capitalists, known as the Pearsall Syndicate, took over some time ago, it will be remembered, the traction and lighting properties of New Orleans and formed a new corporation. The common stock, until lately, has been quoted in the New Orleans market as low as 10½, and the preferred at 51. But the inaugural performance on the New York curb has been a jump to 17¾ in the common and 56 in the preferred. Evidently the rise reflects simply the attempt to create a wider market for the new securities. Sales are also reported in the local curb dealings of San Francisco preferred at 64⅛ and 64¼, the preferred at 47¾. The total sales of traction stocks in Cleveland last week were 2352 shares, compared with 2417 for the previous week. Detroit United advanced during the week from 79 to 80, last sale at 79¾; total sales, 1304 shares Toledo Railways & Light are strong at an advance from 30 to 31¼ for 461 shares. Northern Ohio Traction held strong around 40¼, sales amounting to 162 shares. This price is now regarded as rather low, although a short time ago there was plenty on the market at 34 and 35. The new Cincinnati, Dayton & Toledo stock has appeared on the board at around 23; of the little remaining Southern Ohio Traction stock, 325 shares sold strong at 71 to 71½. Lake Shore Electric shows a tendency toward establishing trading quotations under 15. The first lot of the stock to change hands sold two weeks ago at 10, but with the news that the Everett-Moore Syndicate had arranged to finance the property, bids were raised and a small lot sold at 14⅛. The course of this stock is being watched with considerable interest. It is considered one of the most promising traction properties in the State, but the bonded indebtedness is so heavy that it will be a long time before it is on a dividend-paying basis. Monday 175 shares of Detroit United sold at 79¾. A small block of Cleveland, Elyria & Western went at 75, the first of this stock sold in some time.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid July 15	July 22
American Railways Company	45½	46¾
Boston Elevated	164	165
Brooklyn R. T.	68⅝	71
Chicago City	205	210
Chicago Union Tr. (common)	14¾	16⅝
Chicago Union Tr. (preferred)	47½	52
Cleveland Electric	..	82½
Cleveland City	..	..
Columbus (common)	52	52
Columbus (preferred)	108¼	108
Consolidated Traction of N. J	68¼	69½
Consolidated Traction of N. J. 5s	109¾	110½
Detroit United	75⅞	79¾
Electric People's Traction (Philadelphia) 4s	99½	99¾
Elgin, Aurora & Southern	a45	41½
Indianapolis Street Railway 4s	87¾	87¾
Lake Street Elevated	10⅛	10¾
Manhattan Railway	122½	136½
Massachusetts Elec. Cos. (common)	41½	42
Massachusetts Elec. Cos. (preferred)	97½	97½
Metropolitan Elevated, Chicago (common)	37¼	38
Metropolitan Elevated, Chicago	90	92
Metropolitan Street	148¼	150¾
North American	126¼	128
Northern Ohio Traction (common)	39¾	39¾
Northern Ohio Traction (preferred)	89	89
North Jersey	30½	30½
Northwestern Elevated, Chicago (common)	36	35
Northwestern Elevated, Chicago (preferred)	80	80
Philadelphia Rapid Transit	9⅞	11¼
Philadelphia Traction	99¼	99⅝
St. Louis Transit Co. (common)	30½	31
South Side Elevated (Chicago)	109	110
Southern Ohio Traction	70¾	..
Syracuse Rapid Transit	..	..
Syracuse Rapid Transit (preferred)	..	65
Third Avenue	131	132½
Toledo Railway & Light	30⅞	30¾
Twin City, Minneapolis (common)	119	121½
United Railways, St. Louis (preferred)	82¼	84
United Railways, St. Louis, 4s	87¼	87¾
Union Traction (Philadelphia)	45	44¾
Western Ohio Railway	22¾	..
New Orleans Railways (common)	..	17¾
New Orleans Railways (preferred)	..	56

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

There is not much to say that is new concerning the iron trade situation. Conditions remain substantially what they were a week ago, namely, a pronounced scarcity of the foundry and basic pig iron, due to the coal strike, and a very active demand in nearly all departments. Steel billets are easier on domestic resales and foreign competition, but as an offset to this the shortage of the pig iron supply threatens to curtail production. Orders are now on the books in the structural material branch for as far ahead as the last quarter of 1903. Quotations are as follows: Bessemer pig iron, $21.25; steel billets, $32; steel rails, $28.

Metal

Quotations for the leading metals are as follows: Copper, 11⅞ cents; lead, 4⅛ cents; tin, 28⅝ cents, and spelter, 5⅜ cents.

NEW HAVEN, CONN.—The new issue of stock which the directors of the Fair Haven & Westville Railroad Company have voted to make in accordance with authority conferred at a recent meeting of stockholders will bear the date of Oct. 1. The issue will amount approximately to $633,000, and will be offered at par to stockholders of record at the ratio of one share of new stock to six shares of old. Dating from Jan. 1, 1903, the new stock will begin to pay a 5 per cent dividend. The stock of the Fair Haven & Westville Railroad has a par value of $25, and its present quotation is about $49. The general purposes for which the new stock is to be issued will include the cost of construction of the Derby extension and of the additions to the power plant in Fair Haven. With the new stock issue the absorption of the Winchester Avenue system will be substantially completed.

SIOUX CITY, IA.—It is said that control of the Sioux City Traction Company and the Sioux City Gas & Electric Company has passed into hands that will effect a consolidation of the companies.

SPRINGFIELD, ILL.—E. W. Clark & Company, of Philadelphia, are reported to be negotiating for the purchase of the Springfield Consolidated Railway Company. It is also said that Clark & Company are anxious to purchase the local electric light plant and that a consolidation of the railway and lighting interests of the city is planned.

PADUCAH, KY.—The reorganization of the Paducah Street Railway Company has been effected. The company will issue $600,000 in bonds and will make extensive improvements. Officers have been elected as follows: George C. Thomas, president; George C. Wallage, vice-president; A. L. Rich, of Cincinnati, secretary-treasurer; H. L. Porter, of Cincinnati, superintendent.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company has obtained the sanction of the city to issue $2,500,000 bonds. The company has voted to issue the bonds, but its franchise requires that the assent of the city shall be secured before the bonds are placed.

CARROLLTON, MO.—The electric lighting, waterworks and street railway interests of Carrollton have been consolidated by the Carrollton Water, Light & Railway Company. The company is capitalized at $100,000. The officers and directors of the company are: Herndon Ely, president; T. L. West, vice-president; P. E. Trotter, secretary; J. T. Marshall, treasurer; W. R. Painter, auditor; L. B. Ely and V. D. Ely, both of St. Louis, directors.

ST. JOSEPH, MO.—The property of the St. Joseph Railway, Light, Heat & Power Company, which includes the street railway system, an electric lighting plant, steam heating plant and other utilities, has been sold by F. H. Harriman, of New York, to Seligman & Company, of New York, and E. W. Clark & Company, of Philadelphia. The company is bonded for $3,500,000. There will be no change in the local management, President W. T. Van Brunt remaining in charge, it is said.

SCHENECTADY, N. Y.—The Schenectady Railway Company has begun work at Ballston on its Schenectady-Ballston branch.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

May.	1902	1901
Gross receipts	$1,156,344.84	$1,075,576.47
Expenses, including taxes	730,152.44	715,161.32
Net receipts	$426,192.40	$360,415.15
For eleven months ending May 31.		
Gross receipts	$11,624,417.09	$10,920,174.38
Expenses, including taxes	8,220,062.31	7,237,894.12
Net receipts	$3,404,354.76	$3,682,280.26

CLEVELAND, OHIO.—An arrangement for financing the Lake Shore Electric Railway which will result in relieving the road of a receiver is said to have been effected. The company will issue bonds to the amount of $5,000,000. Two-thirds of the sum will cover floating indebtedness, underlying bonds and receivers' certificates; $1,000,000 will be used in completing the road, and another $1,000,000 will be held in the treasury for future emergencies. The capital stock is also to be $6,000,000. This will be divided into $1,500,000 preferred stock and $4,500,000 common stock.

CLEVELAND, OHIO.—The Cincinnati, Dayton & Toledo Traction Company has filed in the several counties traversed by its line a trust mortgage for $5,000,000, given to the Cleveland Trust Company to secure an issue of $5,000,000 5 per cent. twenty-year bonds. The mortgage covers all the property recently consolidated to form the company mentioned. A portion of the money derived will be used for the purpose of absorbing other lines to complete the through line from Toledo to Cincinnati.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., June '02	67,681	36,546	31,041	11,121	17,081
	1 " " '01	58,191	32,123	25,069	13,066	15,940
	5 " May '02	251,306	148,773	102,533	......	......
	5 " " '01	210,776	132,335	78,441	......	......
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,722	*317,473	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., May '02	131,371	91,393	40,977	23,476	17,501
	1 " " '01	73,725	61,955	11,790	19,001	†7,170
	11 " " '02	1,347,143	928,159	418,983	239,390	179,694
	11 " " '01	1,214,749	836,460	378,289	219,334	158,955
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., May '02	17,194	9,119	8,075	......	......
	1 " " '01	15,678	9,341	6,337	......	......
	10 " " '02	187,058	103,986	83,072	......	......
	10 " " '01	169,756	94,355	75,401	......	......
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,969,406	7,336,897	3,532,509	2,896,350	636,559
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,840	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,139	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,887	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., May '02	1,156,845	*730,153	426,192	......	......
	1 " " '01	1,075,576	*715,161	360,415	......	......
	11 " " '02	11,624,417	*8219562	3,404,855	......	......
	11 " " '01	10,930,174	*7237884	3,692,290	......	......
	12 " June '01	13,185,359	*7216028	4,919,331	1,341,764	577,568
	12 " " '00	11,768,550	*7106373	4,662,177	4,185,406	588,772
BUFFALO, N. Y.						
International Tr. Co.	1 m., May '02	264,181	146,787	117,398	97,330	20,068
	1 " " '01	291,666	161,077	130,589	92,030	38,559
	1 " " '00	209,309	115,487	93,823	78,250	15,572
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	6 m., May '02	300,578	208,932	191,646	75,926	115,422
	6 " " '01	245,743	159,423	86,320	76,714	9,607
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., June '02	17,750	7,065	10,685	......	......
	1 " " '01	17,253	6,196	11,057	......	......
	6 " " '02	78,940	38,021	40,919	......	......
	6 " " '01	65,461	34,403	31,058	......	......
Lake Street Elevated	12 m., Dec. '01	736,402	398,790	337,668	......	......
	12 " " '00	757,264	378,061	379,203	......	......
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	......	......
	1 " " '01	2,445	3,016	†571	......	......
	12 " Dec. '01	47,976	*32,002	15,974	13,023	2,951
	12 " " '00	49,646	*33,272	16,374	13,294	3,080
Cleveland & Eastern	1 m., Feb '02	4,916	3,616	1,300	......	......
	1 " " '01	3,525	4,037	†512	......	......
	12 " Dec. '01	90,390	52,022	38,368	43,678	†4,310
	12 " " '00	62,893	36,672	26,221	36,148	†9,927
Cleveland El. Ry. Co	1 m., May '02	217,863	......	......	......	......
	1 " " '01	187,049	......	......	......	......
	5 " " '02	962,890	......	......	......	......
	5 " " '01	854,594	......	......	......	......
	12 " Dec. '01	2,306,898	1,265,953	1,040,945	344,231	796,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., June '02	25,198	13,026	12,172	......	......
	1 " " '01	22,236	9,736	12,501	......	......
	6 " " '02	129,362	77,720	51,601	......	......
	6 " " '01	107,167	64,259	42,768	......	......
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,696	102,597	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., June '02	17,747	9,380	8,367	......	......
	1 " " '01	15,748	8,035	7,714	......	......
	6 " " '02	73,537	41,670	31,857	......	......
	6 " " '01	65,449	36,224	29,225	......	......
DENVER, COL.	12 " Dec. '01	164,951	*87,102	77,892	72,500	5,392
Denver City Tramway Co.	12 " " '00	141,112	*69,592	71,520	72,500	†980
	1 m., Apl. '02	124,516	66,553	57,963	32,863	26,119
	1 " " '01	116,357	62,868	53,489	31,304	22,185
	4 " " '02	481,348	251,118	230,230	131,250	98,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,307,258	818,521	488,963	393,190	305,743
	12 " " '00	1,302,464	723,455	579,059	374,191	215,548
DETROIT, MICH.						
Detroit United Ry	1 m., June '02	321,470	*139,333	182,137	......	......
	1 " " '01	280,109	*159,412	120,697	......	......
	6 " " '02	1,600,675	*997,044	693,631	395,739	297,892
	6 " " '01	1,364,191	*775,817	588,334	345,119	243,715
	12 " Dec. '01	2,919,177	*1596783	1,322,146	652,977	670,139
	12 " " '00	2,576,277	*1459056	1,130,219	610,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	16,392	11,219	10,568	651
	1 " " '01	26,877	16,062	10,816	9,692	1,124
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., June '02	45,497	22,136	26,361	9,656	16,705
	1 " " '01	39,265	20,076	19,189	9,188	10,001
	6 " " '02	245,406	132,413	112,993	57,844	55,149
	6 " " '01	208,430	119,600	88,730	54,765	33,970
ELGIN, ILL.						
Elgin, Aurora & Southern Tr	1 m., May '02	35,119	20,348	14,770	8,333	6,439
	1 " " '01	29,616	16,097	13,519	8,333	5,186
	12 " " '02	379,952	216,017	163,235	100,000	63,235
	12 " " '01	330,578	208,823	131,755	100,000	31,755
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,045	12,589	7,500	5,089
	1 " " '01	23,580	14,405	9,185	7,500	1,685
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	301,704	166,737	136,946	90,000	46,946
LONDON, ONT.						
London St. Ry. Co.	1 m., May '02	12,234	7,886	4,348	2,410	1,938
	1 " " '01	10,001	6,818	3,183	2,076	1,107
	5 " " '02	51,421	34,609	16,812	11,306	5,507
	5 " " '01	46,195	31,854	14,341	9,886	4,355
MILWAUKEE, WIS.						
Milwaukee El. Ry & Lt. Co.	1 m., June '02	222,450	107,193	115,257	66,015	49,242
	1 " " '01	202,416	94,480	107,936	62,729	45,207
	6 " " '02	1,274,669	612,304	662,365	389,554	272,771
	6 " " '01	1,123,765	580,463	537,302	365,328	171,976
	12 " Dec. '01	2,442,847	1,186,551	1,256,306	756,189	501,000
	12 " " '00	2,220,698	1,129,787	1,090,911	804,665	286,947
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., May '02	296,991	136,964	160,028	58,733	101,294
	1 " " '01	251,946	114,340	137,606	56,633	80,971
	5 " " '02	1,356,856	649,003	707,853	293,041	414,752
	5 " " '01	1,178,857	563,564	614,393	273,000	311,496
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., May '02	178,608	86,780	91,828	18,672	72,956
	1 " " '01	161,265	90,766	70,519	11,683	58,866
	8 " " '02	1,257,518	766,268	491,250	104,907	386,373
	8 " " '01	1,174,060	743,667	430,412	75,996	354,417
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,034,485	1,404,977	1,628,468	738,135	890,329
	3 " " '00	2,728,598	1,340,606	1,387,992	749,837	638,045
	12 " Sept. '01	10,455,672	5,328,649	5,127,023	2,682,182	2,444,091
	12 " " '00	9,950,783	5,196,312	4,754,469	2,698,644	2,056,779
Metropolitan St. Ry	3 m., Dec. '01	3,887,086	1,738,078	2,148,964	1,151,140	997,824
	3 " " '00	3,796,090	1,699,649	2,096,391	1,138,467	917,911
	12 " June '01	14,720,767	6,755,181	7,965,586	4,484,098	3,481,567
	12 " " '00	14,437,134	6,631,254	7,805,880	4,445,730	3,360,160
OLEAN, N. Y.						
Olean St. Ry. Co	1 m., Mar. '02	3,994	2,411	1,584	1,146	438
	1 " " '01	2,885	2,043	1,792	1,187	604
	9 " " '02	41,735	21,611	20,124	12,343	7,781
	9 " " '01	39,270	19,376	19,904	11,086	8,818
PHILADELPHIA, PA.						
American Railways	1 m., May '02	97,701	......	......	......	......
	1 " " '01	73,409	......	......	......	......
	11 " " '02	909,856	......	......	......	......
	11 " " '01	784,560	......	......	......	......
RICHMOND, VA.						
Richmond Trac. Co.	1 m., Sept. '01	20,901	15,089	5,822	3,196	2,196
	1 " " '00	20,727	10,770	9,957	3,843	6,115
	12 " " '01	218,599	139,542	79,057	38,618	40,410
	12 " " '00	203,067	108,196	94,869	37,609	57,250
ROCHESTER, N. Y.						
Rochester Ry	1 m., June '02	89,236	46,800	42,436	24,764	17,672
	1 " " '01	80,227	45,814	30,413	26,708	12,709
	6 " " '02	567,742	298,016	239,787	148,606	91,180
	6 " " '01	498,246	306,956	188,239	147,137	41,102
SCHENECTADY, N. Y.						
Schenectady Ry. Co	3 m., Dec. '01	84,061	46,949	37,112	13,434	23,656
	3 " " '00	30,876	14,517	16,359	6,087	10,272
SYRACUSE, N. Y.						
Syracuse R. T. Co	1 m., June '02	60,863	34,799	26,064	19,005	7,059
	1 " " '01	56,952	30,942	26,010	18,947	7,063
	12 " " '02	663,251	384,255	289,019	208,246	80,773
	12 " " '01	621,289	340,830	280,459	223,918	56,550
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., May '02	117,006	*60,246	56,759	......	......
	1 " " '01	101,255	*55,067	46,218	......	......
	5 " " '02	548,601	*298,224	250,377	......	......
	5 " " '01	485,027	*249,479	235,548	......	......
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,102,517	*616,945	485,572	409,061	156,511
W. NEW BRIGHTON, N. Y.						
Staten Island Ry	3 m., Mar. '02	38,189	46,906	†8,717	8,778	†17,495
	3 " " '01	25,897	28,288	†2,391	8,217	†10,608

Street Railway Journal

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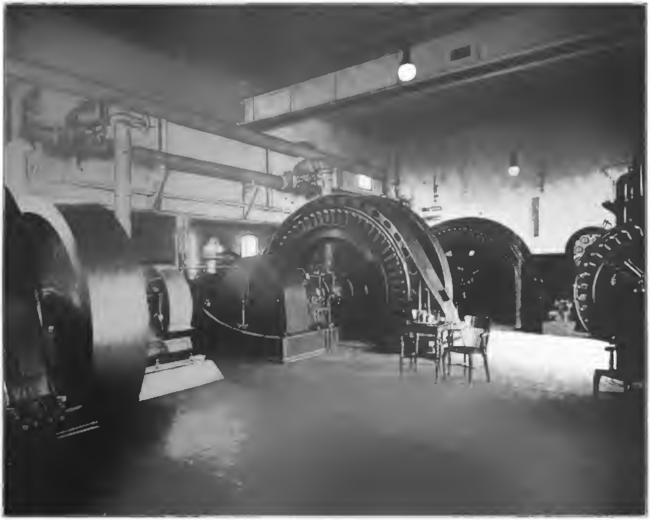
THE SYSTEM OF THE YOUNGSTOWN-SHARON RAILWAY AND LIGHT COMPANY

An excellent example of modern electric interurban railway construction in this country is shown by the road recently completed near the State lines of Ohio and Pennsylvania. The Youngstown-Sharon Railway & Light Company was incorporated under the laws of the State of New Jersey a year or two ago, and has combined as one property, by buying up all the securities of the Youngstown Consolidated Gas & Electric Company, the Youngstown-Sharon Street Railway Company, the Sharon & Wheatland Street Railway Company, the Shenango Valley Light Company, the Sharon Gas & Water Company, the Sharpsville Electric Light Company and the Valley Street Railway Company. To these it has added the Sharon & New Castle Railways Company by the purchase of all the stock of that property. This combination owns and controls, therefore, all of the electric lighting business and manufactured gas lighting business in Youngstown and its suburbs and in the neighboring towns of Sharon, Sharpsville and Wheatland. The street railway portion of the property consists of the local system in Sharon, which runs to Sharpsville, and is known as the Valley Street Railway, and a smaller local system from Sharon southward to Wheatland; an interurban line connecting Sharon with Youngstown, and a branch from the central portion of this interurban line extending to New Castle. The total length of single track is about 40 miles, exclusive of turnouts. The companies originally operated, before consolidation, some five electric power houses, but since



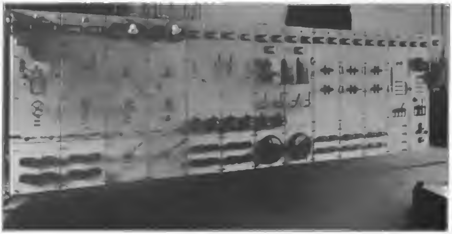
GENERAL VIEW IN MAIN POWER STATION

control has been obtained by the Youngstown-Sharon Railway & Light Company a single power house in Youngstown has been substituted. This new central station has a capacity of over 2000 kw, and generates two-phase, 60-cycle alternating current, at 2250 volts, which supplies the entire territory for lighting, power and the railway purposes. The acompanying map gives an excellent idea of the district served by this undertaking, showing not only the railway lines, but the territory covered by the lighting circuits of the company.

ONE OF THE CROSS-COMPOUND DIRECT-CONNECTED UNITS

POWER STATION

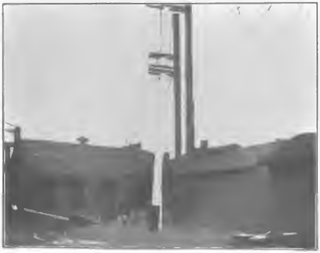
The new power station is located on North Avenue, Youngstown, and is an L-shaped brick structure, 194 ft. long by 90 ft. wide. It is divided into two sections by a brick fire wall. The smaller one is 94 ft. x 69 ft. 6 ins., and the larger, 98 ft. x 86 ft. 3 ins., the latter being used as a boiler house and the other as an engine and dynamo room. The building is built on concrete foundations, and this same material is used in the foundations of the boilers and generating units. The roof is of steel girder construction, upon which 2-in. planking is laid with tar and gravel covering. This building has been completed only a short time. The boiler house contains six 400-hp water-tube boilers, supplied by the Babcock & Wilcox Company, of New York, and equipped with Rooney stokers, made by Westinghouse, Church, Kerr & Company, of New York. Natural draft is obtained by a self-supporting steel stack, 180 ft. high by 10 ft. in diameter. The coal and ash handling is all done by machinery, the conveyors having been supplied by the Link Belt Engineering Company, of Nicetown, Philadelphia. Coal can be brought to the yards by either the Erie or the Lake Shore Railroads, both of which systems have connections with the power house switch. The normal steam pressure carried is 150 lbs. Water for boiler purposes is obtained from the city mains. The engines are now run non-condensing, but the plant is so designed that it can readily be put on a condensing basis if it is thought desirable.



SWITCHBOARD IN MAIN POWER STATION

In the engine room are four direct-connected units. Two of these are horizontal cross-compound engines, 23 ins. and 40 ins. x 36 ins., built by the International Power Company, of Providence, R. I., each direct connected to a 600-kw, 2-phase, 60-cycle generator. One is a horizontal cross-compound engine, 22 ins. and 36 ins. x 26 ins., built by the Harrisburg Foundry & Machine Company, and direct connected to a 400-kw, 2-phase, 60-cycle generator. The fourth is a vertical Williams cross-compound engine, 17 ins. and 30 ins. x 20 ins., built by William Tod & Company, of Youngstown, Ohio, direct connected to a 350-kw, 2-phase, 60-cycle generator.

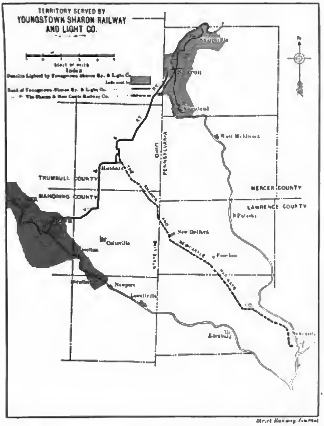
The generators are of the revolving field type, 2200 volts, 2-phase machines, and were built by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. The switchboard, which is of marble, was furnished in part by the Westinghouse Electric & Manufacturing Company.



EXTERIOR OF POWER HOUSE

and in part built on the premises, and carries instruments of Westinghouse, General Electric, and Wagner make.

The engine room is traversed for its entire length by an overhead traveling crane, which was furnished by the Cleveland Crane & Car Company, of Cleveland, Ohio.



MAP OF SYSTEM, SHOWING TERRITORY SERVED BY TRACTION AND LIGHTING CIRCUITS

The business of the company has so far exceeded the estimates originally made and has grown so rapidly that the management are contemplating the installation of additional boilers and another generating unit, of probably 1000-kw capacity.

About 35 tons of coal are required, at the present time, per day for the operation of this plant, and the daily output, including lighting and power, is approximately 20,000 kw

OBTAINING FILLING FOR GRADING THE ROAD

hours. The fuel used is, in general, bituminous slack. All the units are operated in parallel, in times of heavy load, to carry the lighting, power and railway business, and this together with the introduction of storage batteries at the sub-stations gives a very satisfactory load diagram. At times, when the load is comparatively light, better results

LONG BRIDGE CROSSING STEAM RAILROAD TRACKS

are obtained by operating the lighting separately from the railway and power currents.

Situated on the power house lot, about 100 ft. from the

CONSTRUCTING THE OVERHEAD LINE WITH OLD CAR

main building, is a brick building containing the step-up static transformers. Current is supplied to them at 2200 volts, 2-phase, and is raised to 10,000 volts, 3-phase, for transmission. There are installed four 375-kw and four 150-kw oil-cooled transformers for this purpose, furnished by the Westinghouse Electric & Manufacturing Company. The current is transmitted by two three-wire circuits, of No. 4 copper, to the static transformers at the rotary sub-stations. Ample protection from lightning is afforded by Westinghouse low-equivalent lightning arresters. The two transmission circuits are so arranged that they may be operated independently or in parallel, as the conditions demand.

SUB-STATIONS

There are three sub-stations. No. 1 is situated at McGuffey Street, in Youngstown, a little over a mile from the terminus of the road. In this sub-station there are installed two 200-kw rotary converters, with the necessary step-down transformers to reduce

the voltage from 10,000 volts, at which it is transmitted, and a storage battery consisting of 288 type 9-F chloride accumulator cells, having a capacity of 160 amp.-hours, with a differential motor-driven booster. Sub-station No. 2 is located in Sharon, has two rotaries and a storage battery similar to those described above, excepting that the

COMBINED SUB-STATION AND CAR HOUSE

storage battery has thirteen type F cells, having a capacity of 240 amp.-hours. Sub-station No. 3 is on the Newcastle division, and has two 200-kw rotaries, but no storage batteries.

Each rotary has mounted on one end of its extended shaft an alternating-current starting motor, and on the other end a differential booster, which supplies current to a feeder running from the sub-stations, about 5 miles before it is tapped into the trolley and feeder lines. This arrangement insures the maintenance of not less than 500 volts under all conditions of service. The rotaries are normally operated at 650 volts, direct current.

TRACK AND OVERHEAD CONSTRUCTION

The terminus of the line in Youngstown is in the center of the city, and after passing over the streets for a few blocks, goes upon private right of way, crossing by subways under the tracks of two steam railroads, and a little further on crosses over some fifteen steam railroad tracks

VIADUCT CROSSING STEAM RAILROAD

by a viaduct furnished by the bridge department of the United States Steel Company. Almost immediately there-

ONE OF THE BRIDGES

after the line goes upon private right-of-way, and except when passing through the village of Hubbard, and in one

CAR HOUSE AT SHARON

or two other places, the major portion of the interurban line is entirely out of the streets. On approaching Sharon the line again enters the highway and passes up the principal streets to the center of Sharon, where transfers are given to the cars operated on the local system. The line is single track thoughout, turnouts being located at intervals of about 3 miles on the interurban line.

In the streets of the towns 95-lb. girder rail is used, and on the private right of way the track is constructed of 70-lb. T-rail, A. S. C. E. section, the rail joints being furnished by the Continuous Rail Joint Company of America, Newark, N. J. Under the plates at each joint are placed two 0000-protected railbonds; crossbonds being used every 500 ft. The special work was furnished by the Pennsylvania Steel Company, Steelton, Pa.; the Lorain Steel Company, Lorain, Ohio, and the William Wharton Company, of Philadelphia, Pa. The rails are laid so that they break joints at one-third and two-thirds of their length, this method of laying preventing any tendency on the part of the cars to teeter laterally. The rails are laid on oak and chestnut ties, placed 2 ft. from center to center, and resting on 6 ins. of crushed stone or broken blast furnace slag ballast. The maximum grade is 5 per cent, but this is for a very short distance, being at one of the points where the tracks cross under the Erie Railroad. The sharpest curve is 45 ft. radius, and is in the street in the center of the village of Hubbard, at a point where the cars make regular stops. The roadbed is an example of the most up-to-date methods of railroad construction, and is a most important feature; no legitimate expense having been spared to make the roadbed equal to standard steam railroad construction. All railroad crossings at grade were avoided by the use in Youngstown of three under-crossings and one viaduct, above referred to, and in Hubbard by a viaduct over the tracks of both the Erie and Lake Shore roads.

Double trolley wire is used throughout; the wire being 00 gage, Fig. 8 section. In Youngstown steel poles with span wires are generally used, and in Sharon and Hubbard similar construction with chestnut poles. Elsewhere bracket construction is used, the chestnut poles being 35 ft. long, with 7-in. tops as a minimum. In addition to the trolley wires the road is amply provided with feeder of 250,000, 300,000 and 500,000-circular mils. capacity.

A GOOD EXAMPLE OF THE TRACK CONSTRUCTION

CAR HOUSES

There are two car houses situated near Sharon; one of these is 150 ft. x 100 ft., and the other 150 ft. x 50 ft. There is also in the sub-station at McGuffey Street, in Youngstown, a shed which is large enough to hold two of the large cars of the company, which are left there after the last night trip, to be used for the first morning trip, thus saving much empty car mileage. Like the power station and sub-stations the car houses are constructed of brick with steel roof trusses. There is a water tower, containing a tank of large capacity, placed near the car houses and connected by water mains to hydrants and hose distributed through the buildings. Chemical extinguishers are also provided to give further protection against fire. The car houses are heated by steam.

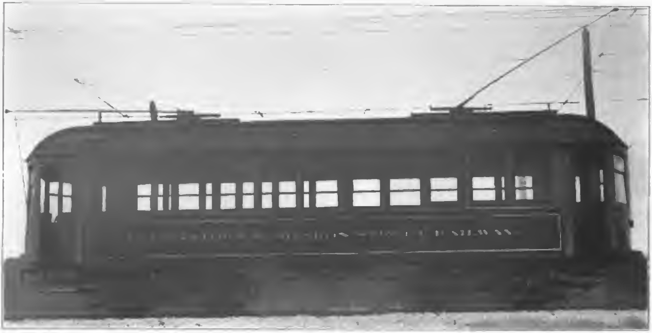
Adjoining the car houses is the repair shop, 150 ft. long

by 30 ft. wide, containing a complete equipment of machine shop and wood-working tools for making all ordinary repairs to the rolling stock.

ROLLING STOCK

The road operates twenty-one closed and eighteen open cars of various types. These were built by the Jewett, Wason, Jones and Stephenson Companies, and are equipped with trucks made by the Peckham Manufacturing Company. The largest cars, which are 50 ft., vestibuled interurbans, weigh 25 tons, and, as seen from the accompanying illustration, are first-class examples of the modern heavy electric railway car. There are also 30-ft. vestibuled cars. The open cars are of various sizes, having 10, 12 and 15 benches apiece. There are 16 4-motor equipments for the larger cars, consisting of Westinghouse-56 motors. The remainder of the motor cars all have 2-motor equipments, Westinghouse 12-A motors being used for the smaller and No. 56 for the larger cars. The closed cars are equipped with electric heaters, made by the Consolidated Car Heating Company, of Albany, N. Y. The interurban cars have registers, made by the Ohmer Car Register Company, of Dayton, Ohio, and the city cars have registers made by the New Haven Car Register Company, of New Haven, Conn. The Ohmer register is so arranged that several different classes of fares can be rung up, and includes in its mechanism a device by means of which a printed record of all the business done by the car can be made at the end of each trip on a roll of paper contained in the case and a slip which is torn off at the end of the day contains this record.

CAR HOUSE AT SHARON



STANDARD INTERURBAN VESTIBULED CAR

The cars which are used in the city service have in addition to the usual brakes, a Peckham emergency brake, operated by a wheel mounted on a concentric brake staff immediately below the ratchet handle. Twelve of the interurban cars are equipped with the Price momentum friction brake, supplied by the Peckham Manufacturing

Company, New York, and four with air brakes and motor-driven compressors, built by the Christensen Engineering Company, of Milwaukee, Wis. There is one freight locomotive, built by the Wason Manufacturing Company, of Springfield, Mass., mounted on Peckham trucks and equipped with four No. 56 Westinghouse motors, and Westinghouse independent motor-driven air brakes. It has standard hose and couplings, and can couple to and handle a number of standard steam railroad freight cars. This locomotive is supplied with detachable noses, so that it can be used as a snow plow. In addition, there is a Wason shear plow, equipped with 12-A Westinghouse motors.

GENERAL REMARKS

The cars are operated within the city limits at from 12 miles to 15 miles per hour, but on the interurban lines a maximum speed of 45 miles per hour is frequently attained. The regular running time for the interurban cars from the center of Youngstown to Sharon, a distance of about 15 miles, is 50 minutes. The average car mileage per day is from 2000 to 2500, but this will shortly be considerably increased, as it is expected that the Newcastle branch will commence operation this month. All the lines of the company pass through a rich, well-settled and prosperous country, and are doing a very large amount of business at the present time. The interurban line between Youngstown and Sharon commenced operation about Nov. 1, and the earnings thus far prove that the estimates originally made were exceptionally conservative. The engineers for the property, who have had general charge of construction since its inception, and who, it is understood, are in control of the entire properties, are Sanderson & Porter, of New York. The officers of the road are: President and general manager, Randall Montgomery; vice-president, Charles S. Fairchild; secretary, Leighton Calkins; treasurer, O. W. Bright, and superintendent of railway department, Godfrey Morgan.

The Bridgeton & Millville Traction Company, of Bridgeton, N. J., has accepted an ordinance giving it the right to extend its line from Cedarville to Bivalve. The road now reaches Cedarville, and, when the extension is completed, will be 25 miles long, paralleling the Port Norris branch of the New Jersey Southern Railroad.

Results of the Tests on the Berlin-Zossen Experimental High-Speed Line

The best information which is at present available concerning the results of the tests made last fall on this celebrated German experimental line, is contained in a paper

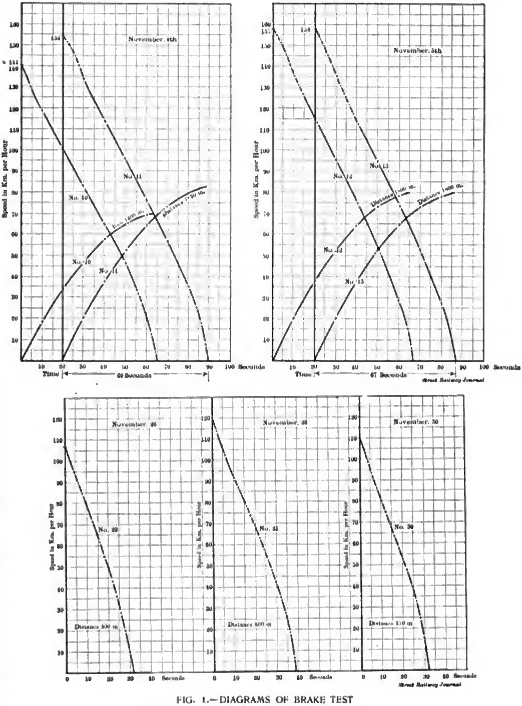


FIG. 1.—DIAGRAMS OF BRAKE TEST

read by Geheimer Baurath Lochner, on April 8, 1902, before the Berlin Society for Railroad Engineering, which was printed, with several valuable diagrams, in Glaser's Annalen, May 15 and June 1.

In the first half of the paper the author gives the programme, according to which the trials were made, and describes the construction of the old roadbed which proved unsatisfactory at the higher speeds, and notes in what respect it will be improved; he also describes the measuring instruments used in the tests, and the whole electrical

equipment of the line and the two cars. In this part of the paper the author scarcely gives anything that is new to the readers of the STREET RAILWAY JOURNAL. A large amount of new information, which has not before been published, is, however, contained in the second half of the paper, in which he sums up the results.

The two motor cars have run, altogether, 3000 km (1860 miles). In the first trials the minimum speed was 100 km (62 miles), which was then increased to 130 km (80 miles) per hour. The voltage was 6000 to 8000 and the frequency, 25 to 30 in these trials, which were made for the purpose of determining and examining the methods of measurements and of getting data on starting and braking. Afterward the voltage was increased to 10,000 and up to 13,500, while the frequency was also varied up to 48. These later trials were made to determine the highest

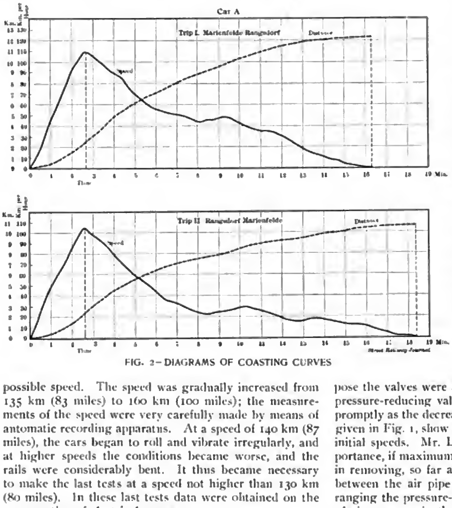


FIG. 2—DIAGRAMS OF COASTING CURVES

possible speed. The speed was gradually increased from 135 km (83 miles) to 160 km (100 miles); the measurements of the speed were very carefully made by means of automatic recording apparatus. At a speed of 140 km (87 miles), the cars began to roll and vibrate irregularly, and at higher speeds the conditions became worse, and the rails were considerably bent. It thus became necessary to make the last tests at a speed not higher than 130 km (80 miles). In these last tests data were obtained on the consumption of electrical energy.

MAXIMUM ACCELERATIONS

A speed of 100 km (62 miles) was obtained within 2000 to 3200 meters (1.2 to 2 miles) in 138 to 220 seconds. This corresponds to an average acceleration of 0.13 to 0.2 meter (5 to 8 in.) per second per second. Without any doubt, much higher accelerations would have been possible, as the motors can give about 3000 hp for a short time, while this acceleration required only 700 to 1000 hp. Higher accelerations than 0.2 meter per second per second were, however, not tried, because the generating sets in the power station were not adapted to rapid variations of load. Moreover, a very high acceleration is not of great importance for long distance, high-speed railroads without many stopping places.

BRAKING

Of much greater importance is the possibility of rapid and effective braking, because the safety of operation greatly depends upon this. Both motor cars were provided with Westinghouse air brakes, with hand brakes, and with counter-current brakes. The motor car of the Allgemeine Elektricitäts-Gesellschaft also had a special electric brake for which a storage battery on the car was provided.

At an air pressure of 6 atmospheres in the brake cylinders, the pressure upon each of the 24 brake-shoes was about 6000 kg, hence the total pressure upon all of the brake-shoes was 144,000 kg, or 156 per cent of the weight of the car. When the force acting on each handle of the hand brake was 40 kg, the pressure upon each brake-shoe was 3640 kg, giving a total pressure upon the brake-shoes of 87,360 kg, or 95 per cent of the weight of the car.

In order to be able to regulate the air pressure in the brake cylinder of the air brake at will, according to the different speeds, a "pressure regulator" was provided which could be set for different pressures within certain limits. Besides this a pressure-reducing valve was used to reduce the pressure in the brake cylinders during the time of braking, according to the decreasing speed.

Careful measurements were made of the air pressure, the time of braking and the distance within which the car was stopped. The first brake tests were unsatisfactory, as the distance in which the car could be stopped was much greater than had been expected from former experience with air brakes. Different means were, therefore, tried to secure a quicker increase of the air pressure in the brake cylinders at the beginning of the braking. For this purpose the valves were altered somewhat. Nevertheless the pressure-reducing valves could not be set to act quite as promptly as the decrease in speed required. The diagrams, given in Fig. 1, show some of the brake tests with different initial speeds. Mr. Lochner lays great stress on the importance, if maximum braking efficiency is to be obtained, in removing, so far as possible, all difference in pressure between the air pipe and the brake cylinder, and in arranging the pressure-reducing valves so that the decrease of air pressure in the brake cylinder during the time of braking depends upon the decrease of the speed. In this way the friction between the brake-shoes and the wheels could be kept at the point of greatest braking effect without becoming so great as to skid the wheels.

It was also found that both the brake-shoes and the wheel tires became very hot when the brake was repeatedly applied. Experiments were therefore made with hollow brake-shoes filled with water for artificial cooling. The heating of these brake-shoes and the wheel tires then become less, but was still considerable, and might be so much greater at higher speeds that there would be danger that the tires might slip. For this reason Mr. Lochner suggested that the brake be so arranged that the shoes should not act directly upon the wheels, but upon especially provided brake discs mounted on the axles.

The author then gives the following formula:

$$f D + W + g M a = p \quad (M + R)$$

where f the coefficient of friction.

D the total pressure upon the brake-shoes.
M the mass of the car.
R the rotating mass, referred to the wheel circumference.
W the resistance of the car, including air friction.
a the grade of the road.
g the acceleration of gravity.
p the retardation in meters per second per second.

In the present case $M = 9300$ and $R = 790$. The total pressure D upon the brake-shoes is different for different speeds on account of the decrease of the air pressure in the brake cylinders, due to the pressure-reducing valve; he gives the following values of D:

for $v = 20$ km per hour, $D = 100{,}000$ kg
for $v = 60$ km per hour, $D = 110{,}000$ kg
for $v = 100$ km per hour, $D = 120{,}000$ kg

The resistance, W, at these speeds is so small, compared with the resistance obtained by braking, that it is of no great importance how W is calculated. If the usual formula is employed, viz.:

$$W = (2.5 + \frac{v^2}{1300}) \frac{Mg}{1000}$$

then the brake tests give the following results:

$v = 20$, $p = 1.7$, and $f = 0.17$*
$v = 60$, $p = 0.75$, and $f = 0.064$
$v = 100$, $p = 0.6$, and $f = 0.042$

As these examples show, the calculations give smaller values of the coefficient of friction than those found by Gaston and Westinghouse in 1878 and 1879, and by the careful experiments of Wichert in 1887 and 1888.

It is possible that the actual brake pressure was not fully up to that calculated, and this may have caused a discrepancy. Besides this, the material of which the steel tires and brake-shoes are made affect the value of the co-efficient of friction.

The hand brakes fulfilled what had been expected of them. At an initial speed of 100 km (62 miles) the car could be stopped within about 720 meters (2360 ft.) in 42 seconds, which corresponds to an average retardation of 0.66 meter (2.2 ft.) per second per second.

With the car of the Allgemeine Elektricitäts-Gesellschaft experiments were made repeatedly with the counter-current brake, but no great effect could be accomplished thereby. It is expected that this brake will act in a more effective way at higher speeds. However, this method of braking should only be used in an emergency, as its operation entails risk of damaging the motors.

Attention is called to two experiments, made on Nov. 28, with the car of the Allgemeine Elektricitäts-Gesellschaft, the car being allowed to come to a rest without an application of the brakes. The results are given in Fig. 2. When the current was cut off the speed was 109 km and 106 km per hour, respectively. The experiment was made first on the trip from Marienfelde to Rangsdorf, and then repeated on the return trip. The distance which the car ran before it came to rest was 9600 m the first time, and 8300 m the second time. The corresponding time was 817 seconds and 952 seconds. The wind (11.4 m. per second) had such a direction that the air resistance was greater during the return trip than on the first trip.

He takes the mean values of the above figures:

$v = 107$ km per hour
$t = 885$ seconds

and assumes that the speed decreases uniformly; he thus finds that the retardation is constant

$$p = \frac{v}{t} = 0.033 \text{ m per second per second.}$$

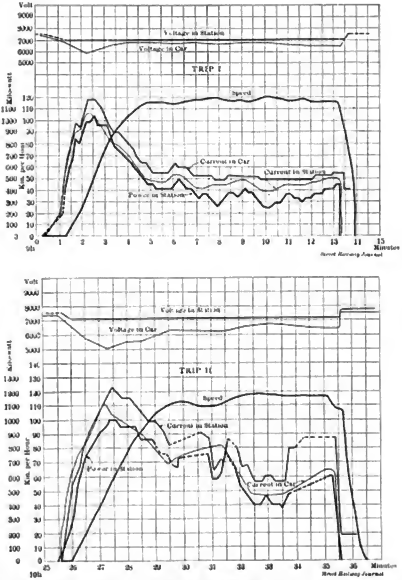


FIG. 3—SPEED, CURRENT, VOLTAGE AND POWER OF CAR "A" IN ZOSSEN TESTS

The resistance of the car, which is assumed to be constant, then becomes

$$W = p \quad (M + R) = 0.033 \times 10{,}090 = 333 \text{ kg.}$$

For 1 ton of train load he then finds

$$w = 3.6 \text{ kg.}$$

He says that this value seems small, if compared with the value calculated by one of the usual resistance formulas. From the formula mentioned before

$$w = (2.5 + \frac{v^2}{1300}) \frac{Mg}{1000}$$

he gets

$$w = 5.4 \text{ kg}$$

which is 50 per cent greater than the above value 3.6. In this resistance formula the figure 2.5 may be assumed to be

* The author says $v = 20$, $p = 1.7$, and $f = 1.7$. But this is evidently a misprint. The above value, $f = 0.17$, has been calculated from the above formulas, under the supposition that $p = 1.7$ is correct.—[EDS.]

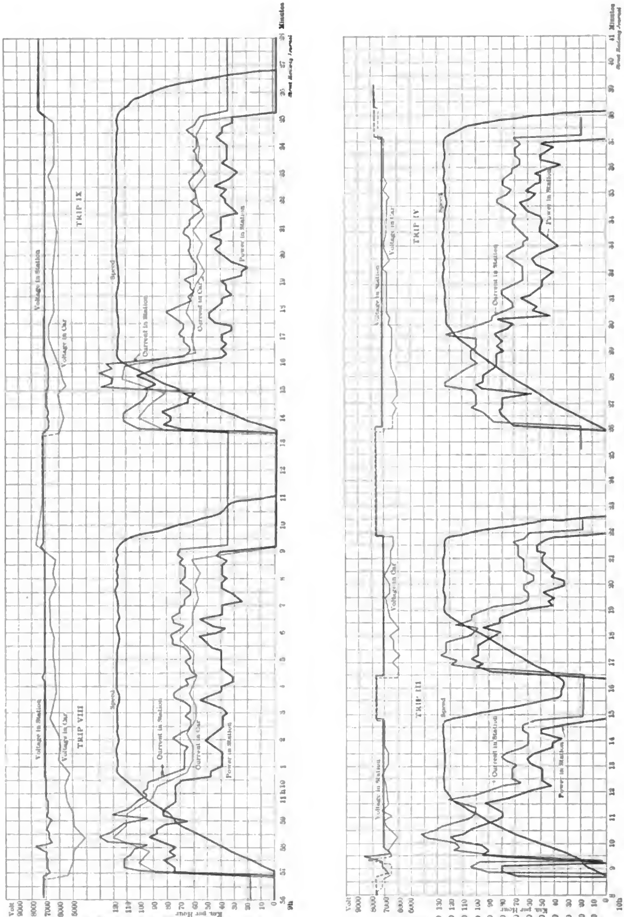


FIG. 4.—SPEED, CURRENT, VOLTAGE AND POWER OF CAR "S" IN ZOSSEN TESTS

correct, and the discrepance can only be due to the second term $\frac{v^2}{1300}\frac{Mg}{1000}$. The discrepancy may be explained when one considers that the car is very heavy and that the air resistance (to which the term $\frac{v^2}{1300}$ mainly refers) depends less upon the weight than upon the volume of the car. The volume is the determining factor and should be taken into account in calculating the resistance. It has been known before that the above formula gives too high values for high-speed trains with heavy cars.

TOTAL POWER CONSUMPTION

Very careful measurements of the power consumption were made on the motor cars, as well as in the central station. The latter were more reliable, as, in the readings of the instruments on the cars, there could be errors due to the vibrations. In starting with an acceleration between 0.1 and 0.2 meter (0.3 to 0.7 feet) per second per second, the power consumption in the car was between 400 kw or 544 hp and 740 kw or 1000 hp. In runs at uniform speed, the power consumption in the car was 184 kw or 245 hp at a speed of 140 km (87 miles). The power consumption increases very rapidly with increasing speed, owing to the increasing air resistance. It is expected that at a speed of 200 km (124 miles) the power consumption will probably be above 1100 hp, which value had been calculated from the preliminary experiments.

In the diagrams, Figs. 3 and 4, curves are given for speed, voltage, current, and power. These diagrams are self-explanatory. The efficiency of the whole installation was poor, because the power plant was situated at a distance from the road, so that the drop of voltage in the line from the plant to the road was greater than that along the whole road. The power factor of the motors was very poor—between 0.5 and 0.6—the motors being never fully loaded.

AIR RESISTANCE

The results given concerning the air resistance are identical with those published in the STREET RAILWAY JOURNAL of June 7.

The principal measurements were made on the front of the train. Pipes of different diameters were passed through the front wall of the car and were connected to pressure gages. An investigation was first made as to whether the form and length of these pipes had any influence upon the reading of the pressure. For this purpose one of the pipes was provided with a funnel, this funnel was bent to the side, the length of the pipe was varied, etc. It was found that the form and position of the pipe had no influence upon the reading, as long as the pipe was not longer than about 3.4 m. This indicated that a uniform cone of compressed air was pushed ahead in front of the car, and that this cone had a length of about 3.4 m.

Other results were obtained at the sides of the car. The air pressure was then considerably smaller than at at the front end, and depended mostly on the direction and pressure of the wind; it was nearly independent of the speed. Under certain conditions of the wind a considerable suction action was observed.

At the rear end of the car a very considerable suction action had been expected, but it was found to be only small and to increase only a little with increasing speed.

The curves obtained in these tests have already been given in our issue of June 7, and the author does not give anything more in this respect.

The air pressure increases with the speed, according to the formula

$$p = 0.065\ v^2$$

where v is the speed in meters per second and p the pressure in kilograms per square meter-surface perpendicular to the direction of the train. At least this relative holds approximately good up to pressures of 150 km per hour (93 miles per hour).

The Studien Gessellschaft intends to investigate in tests to be made in the future what will be the best form of the front end of the car. It is certain that this form has a greater influence upon the air resistance than is generally supposed.

SAFETY PRECAUTIONS

The author describes the special safety devices and signals. He states that at higher speeds—above 120 km (75 miles) per hour—the signals could not be recognized in time to bring the cars to a stop before the signal with the available brakes. This was the case when the sky was clear, and it was much worse when there was fog or rain. In rain the water trickling down the window-pane made it impossible for the eye to penetrate more than 200 or 300 m (660 or 990 feet) ahead on the track. It is suggested to make the signals very large and clear, and to provide optical and acoustic signals (electric bells) which are set in operation automatically in the car itself.

CONCLUSIONS

The author sums up the results briefly as follows:

The method of supplying high-tension alternating currents from the trolley wires, through the contact bows to the cars at high speed, has proven so thoroughly successful that there is no doubt that it can also be used successfully at higher speeds than those which have been tried up to the present.

There are no practical difficulties in using polyphase motors for high-speed runs; by cooling with air, dangerous temperatures of the motors can be prevented.

The tests do not allow a decision as to what is the best method of mounting the motors on the cars; or what type of rheostat is preferable.

The braking arrangements have proven to be insufficient; alterations of the present brakes and the introduction of an effective electric brake are necessary.

The measurements of the air resistance at different speeds are not yet complete; exact information is still missing concerning the air pressure on the sides and the rear part of the cars.

The measurements of the power consumption are not sufficient to base upon them exact estimates on the economy and cost of electric high-speed traction.

Mayor Low was not disheartened by the action of the Board of Aldermen in rejecting the Pennsylvania Railroad tunnel contract, which had been approved by the Rapid Transit Commission, but he proceeded immediately to pave the way for an amicable understanding. Several conferences were arranged between the city officials and railroad representatives, and, as a result, it is again announced that the contract, slightly modified, will be approved by the aldermen. It is said, however, that some of the members will insist upon having incorporated in the contract the following provisions: (1) Eight hours must constitute a day's work on the tunnel. (2) Laborers must be paid $2 a day. (3) New York workmen must be employed on the New York section of the work. (4) Instead of paying the city a fixed rental, which in the rejected contract was about $100,000 a year for twenty-five years, the railroad must pay into the city treasury a percentage of its gross receipts.

The Electric Third Rail

BY W. B. POTTER

The third rail as a means of conducting current to the car is a simple, unobtrusive method, easily installed and inexpensive to maintain. In yards and terminals and for high-speed or heavy service it is generally preferable to the overhead trolley, the absence of superstructure and its large section both for conducting and collecting the current making it particularly suitable.

RAILROAD YARD, SHOWING PROTECTED THIRD RAIL

While in some cases there may be no objection to its installation without a protection, there are places where a guard or protection is advisable as a safeguard to employees and others from accidental contact, or the liability of being burned by short circuits, caused by careless handling of track tools.

It is especially desirable that this guard be of such form as to protect the third rail from ice and sleet, as ice on the top of the third rail is a very troublesome feature and difficult to remove.

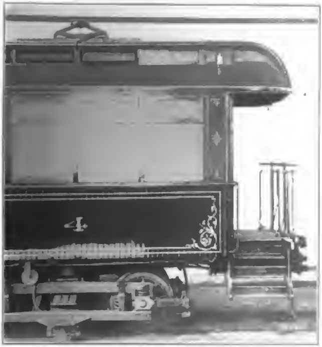
The third-rail protection which is here described is simple in construction and very effective for every purpose for which protection is needed. The protection consists of a channel iron or plank supported by brackets directly over and about 2½ ins. above the third rail, as shown in cuts of end view and side elevation. A slight gap is left between the ends of each length of the protection when of metal, to separate them electrically.

As it is often essential that steam locomotives should run over the same tracks, the distance and height from the running rail as shown is recommended as providing the necessary clearance for even the large low-pressure cylinders of compound steam locomotives. The center of the third rail is 28 ins. from the gage line, and the top 3 ins. above the top of the running rail. It is not advisable to locate the third rail lower than 3 ins. below the top of the track rail,

CONTACT SHOE ENTERING PROTECTED THIRD RAIL

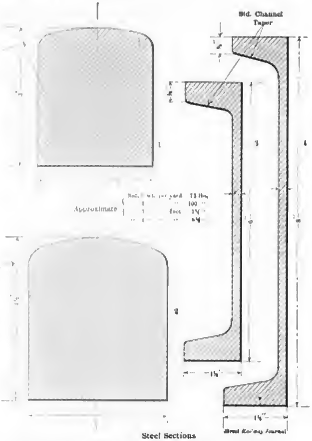
for, if lower, the contact shoe, which ordinarily drops 1 in. lower than the third rail, would be in danger of touching the track rails at frogs and switches, causing a short circuit.

The third rail being so low, and the maximum distance to ground being desirable for insulation, it is advantageous to use a section giving the maximum conductivity. There being no special advantage in using the standard T-rail section, a rectangular section with rounded top is recommended. This section is convenient to bend and bond, and can be easily aligned by a fish-plate on the bottom.



CAR EQUIPPED WITH OVERHEAD CONTACT SHOE AND SHOE FOR PROTECTED THIRD RAIL

It is advisable to use a special composition of rail, containing a relatively small amount of carbon and manganese, in order to obtain high electrical conductivity. The main consideration with steel rails for ordinary use is to obtain long life in service, and they are usually made as hard as is consistent with the toughness necessary to withstand shocks and strains, while in a third rail there are no strains and the wear amounts to practically nothing. Manganese appears to be the element most affecting the conductivity, carbon being next. The resistance of an ordinary track rail high in carbon and manganese will often be found to be twelve or thirteen times that of copper for the same section.



SUGGESTED SECTIONS OF THIRD RAIL AND CHANNEL IRON PROTECTION

MOTOR CAR ON PROTECTED THIRD RAIL

The following composition for a third rail is suggested as not being difficult to obtain commercially, while providing a reasonably high conductivity:

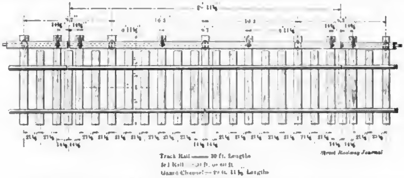
	Per cent
Carbon, not to exceed.......	12
Manganese, not to exceed...	15
Phosphorus, not to exceed....	10
Sulphur, not to exceed......	05

The electrical conductivity of a third rail of this composition will be about 60 per cent higher than that of an ordinary running rail of the same cross section; that is, a third rail of this special composition would weigh only 63 per cent of a track rail of ordinary composition for the same conductivity, and would have about 7.5 times the resistance of copper.

The third-rail insulator here shown is a block of wood or vitreous material with a slot in the top into which the third rail is laid, no clamps or bolts being required to hold the rail in place.

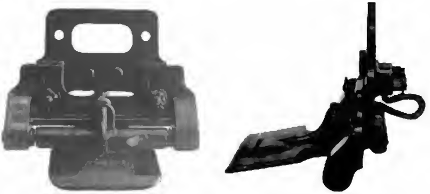
The third-rail shoe used with this form of protected

third rail is a plate of cast-iron hinged at the point of support and carried by brackets adjustable for height to allow for wear of the wheels. These brackets are bolted to an insulating timber attached to the truck journal boxes. A guard or protection of wood may be placed over the shoe and support, preventing accidental contact with the shoe on the side opposite the third rail.

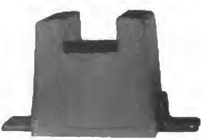


SUGGESTED HEIGHT OF RAIL AND GUARD, AND SPACING OF SUPPORTS

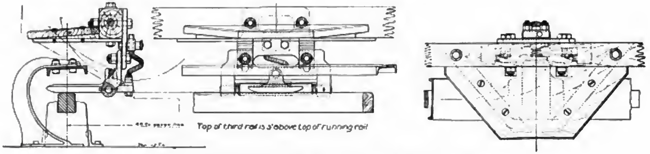
This form of protected third rail as installed on the yard and tracks of the General Electric Railroad has been operated with marked success during the last winter, with less trouble from sleet and snow than previously experienced with any other form of third rail tried. The protected third rail, as with the ordinary form of exposed rail, is located on either side of the track as convenient. Gaps in the continuity being necessary at switches and crossings, each car is equipped with four shoes, one midway, each side of both trucks.



FRONT AND SIDE VIEW OF CONTACT SHOE FOR PROTECTED THIRD RAIL



THIRD-RAIL INSULATOR



PLAN AND ELEVATION OF CONTACT AND PROTECTED THIRD RAIL

In specially complicated slip-switches it may be found difficult to locate the third rail so that the gap may be spanned by the shoes, and in such cases a short length of rail or wire may be installed overhead, a length of 50 ft. being generally sufficient. Current from this overhead section may be collected by a low pantagraph shoe mounted on top of the car.

The location of the third rail with reference to the track rails is a detail deserving careful consideration. Uniformity in this respect is as desirable as any standard, particularly if cars of different companies are likely to operate over each other's lines. Some of the variations in third-rail location are shown by the following partial list of third-rail installations, which include some of the most interesting examples in this country and abroad:

	From top of third rail to top of track rail	From track gage line to center of third rail
General Electric Railroad, Schenectady...	3"	28"
Met. West Side Elevated, Chicago.......	6¼"	20⅛"
Lake Street Elevated, Chicago...........	6½"	20⅛"
South Side Elevated, Chicago...........	6¾"	20⅛"
Northwestern Elevated, Chicago.........	6½"	20⅛"
Brooklyn Elevated, Brooklyn...........	6"	22¼"
Manhattan Elevated, New York	7½"	20¾"
Albany & Hudson, New York...........	6"	27"
Boston Elevated, Boston................	6"	20⅛"
Aurora, Elgin & Chicago, Illinois........	6 5-16"	20⅛"
Columbus, Buckeye Lake & Newark, Ohio.	6"	27"
Columbus, London & Springfield, Ohio...	6"	27"
B. & O. R. R., Baltimore................	2¾"	24"
N. Y., N. H. & H. R. R., Connecticut....	1½"	Center
Central London, England...............	1½"	Center
Paris-Orleans, France..................	7⅞"	23⅝"
Gallarate, Italy..........................	7½"	26⅝"

Local conditions may in many cases influence the location, but the ultimate advantage in the interchange of

service is such as to warrant the early adoption of what may at least be called the standard location for a third rail.

The cost of a protection for the third rail will vary, depending upon the material or weight of channel used and the price per ton. The cost of the conductor rail would also depend upon its weight and price per ton.

The following estimated costs, which are based on the weights and prices given, may be of interest:

APPROXIMATED ESTIMATED COST OF 1 MILE OF SINGLE TRACK OF PROTECTED THIRD RAIL

6" Channel Iron Protection.	
5260'—75-lb. 3" x 2½" conductor rail at $43 per ton (66 tons)	$2,840.00
528 —Reconstructed granite insulators, clamps and lag screws at 40 cents per set	211.00
352 —No. 0000 GE 9" Form B bonds at 38 cents	134.00
	$3,185.00
5280"—31½-lb. 6" channel iron guard for conductor rail at $45 per ton (27.71 tons)	$1,248.00
792 —Malleable iron guard rail supports at 36 cents	286.00
176 —Malleable iron fish-plates and bolts at 25 cents	44.00
	$1,578.00
Approximate labor for installation, including drilling rails and channels	$900.00
Total cost	$5,663.00
8" Channel Iron Protection.	
5280'—75-lb. 3" x 2½" conductor rail at $48 per ton (66 tons)	$2,840.00
528 —Reconstructed granite insulators, clamps and lag screws at 40 cents per set	211.00
352 —No. 0000 GE 9" Form B bonds at 38 cents	134.00
	$3,185.00
5280'—48-lb. 8" channel iron guard for rail at $45 per ton (42.24 tons)	$1,900.00
792 —Malleable iron guard rail supports at 36 cents	286.00
176 —Malleable iron fish-plates and bolts at 25 cents	44.00
	$2,230.00
Approximate labor for installation, including drilling rails and channels	$900.00
Total cost	$6,315.00
8" Wood Protection.	
5280'—75-lb. 3" x 2½" conductor rails at $43 per ton (66 tons)	$2,480.00
528 —Reconstructed granite insulators, clamps and lag screws at 40 cents per set	211.00
352 —No. 0000 GE 9" Form B bonds at 38 cents	134.00
	$3,185.00
5280'—Ash plank 1½" x 8" at $48 (M board feet) in the rough, 5280 board feet	$253.00
792 —Malleable iron guard rail supports for wooden guard plank at 39 cents	308.00
176 —Malleable iron fish-plates and bolts at 25 cents	44.00
	$605.00
Approximate labor for installation, including drilling rails	$750.00
Total cost	$4,540.00

It is said that a syndicate has secured the lease of the Cincinnati, Lebanon & Northern Railway, a steam road operated by the Pennsylvania Company, which will afford an entrance to Cincinnati from Lebanon to complete the line now practically complete from Columbus to Lebanon. The steam road is in fine condition and the electrical equipment could be installed so that the through line could be in operation this year. The acquisition would afford fine terminal facilities in Cincinnati. In steam railroad circles the reported lease is discredited, as it is claimed the Pennsylvania some time ago placed a price of $8,000,000 on the property, which is figured to be almost prohibitive for traction purposes.

Failure of Municipal Ownership in England

BY HON. ROBERT P. PORTER.

PART I.

The timely and instructive article by "A City Auditor," printed in the STREET RAILWAY JOURNAL of April, and analyzing the accounts of ten municipal tramways in Great Britain, gives anything but a flattering picture of the financial working of municipal enterprise in England. In their anxiety to convince the ratepayer of the wisdom of municipal ownership of public utilities the British officials have been guilty of reckless financiering, and in many cases, as shown in the accounts of these enterprises, have used tramway revenue in aid of taxes which was in no sense real profit. It is not the intention of this article to examine into the individual budgets of British cities and towns, but rather to give a brief history of a movement which has been inaugurated in England in opposition to municipal ownership—or municipal trading, as it is termed there—a movement which bids fair to give us considerable valuable information on a subject of great importance to the people of the United States. There can be no doubt that after twenty-five years of experiments in municipal trading, in which the city and town officials have had a free headway with the ratepayers' money, the British public has awakened to the fact that the extension of municipal trading is prejudicial to the interests of the country. The awakening came in a variety of ways. About four or five years ago private enterprise promoted some large power-distributing companies for the purpose of utilizing waste coal in the great coal districts and by the aid of electricity proposed to distribute cheap power to large districts in several parts of the United Kingdom. The promoters of these enterprises, some of which have subsequently been authorized by Parliament, found themselves strongly opposed by the town clerks of the municipal corporations which the companies had proposed to supply with power, on the ground that the price per unit proposed by private enterprise—less than one-half of the rate which the municipalities were as a rule charging—would seriously handicap "municipal enterprise." In consequence, municipalities organized a relentless, bitter, and, from the American point of view, unlawful, opposition, and by concentrating municipal political influence in Parliament for a time defeated all progress along these lines. The contest over these power bills in Parliament may be said to have inaugurated in England the campaign against municipal trading, which at last took a new and more permanent form, in the shape of the first public meeting of the Industrial Freedom League, an association recently formed in England "to free private enterprise from undue interference and rate-aided competition." The contest over the power bills in 1898 brought out an address by Dixon H. Davies, a well-known jurist, before the London Society of Arts, in which he presented the issue with so much strength and brilliancy that his paper must always remain the earliest classic in the literature against municipal trading. That address, together with the Royal Statistical Society's exhibits showing an alarming increase of local indebtedness due to the epidemic of municipal trading, had much to do with the appointment of a select joint committee of the two houses, who have commenced an inquiry. The supporters of municipal trading are afraid of the light and have prevented the continuation of the inquiry. The volume of testimony taken and already published gives valuable data on the subject, though we may have to wait some time for the completion of the inquiry and the final report of the committee. The testimony taken by the joint select committee of the British Parliament on municipal trading has developed important

facts in relation to tramways and other industrial enterprises worked by the local authorities of the United Kingdom. It has also very clearly demonstrated that the backward condition of the electrical industry in England is in a very large measure due to the operation of the tramway act of 1870, which enabled municipalities to come in at the end of twenty-one years of operation by private enterprise and practically confiscate the property. That some of the municipalities have succeeded in making this sort of one-sided municipal trading pay is not a matter of surprise when we ascertain the conditions under which they gain control of the property. For example, where, as is often the case, a municipality has become possessed for half its capitalized value of a tramway undertaking that has been worked for twenty-one years by private enterprise and has been brought to a high state of development and highly organized, it would be strange indeed if it could not make it profitable.

In the preparation of this article for the STREET RAILWAY JOURNAL I have read with care the entire volume of testimony taken by the select committee of both houses. In submitting a summary of it to your readers I have endeavored to classify it under the several heads of tramways, electric power distribution, electrical lighting, gas undertakings and other enterprises which English municipalities have undertaken to promote. There was much testimony given before the committee on the increase of local debt and taxation on account of these trading propensities of the English municipal corporations, but I have preferred to take the more recent figures on this branch of the subject under discussion as brought forward at the meeting of the Industrial Freedom League, held in London April 22, 1902.

TRAMWAYS.

The official returns made about a year ago on which parliamentary testimony was based indicate that, including the County Council of London, the municipalities of the United Kingdom owned about 240 miles of tramways. An expert witness before the committee, William Martin Murphy, in speaking of London alone, said: "I maintain that if the tramway act was not there to block the way or if the municipalizing of all these undertakings was not dominating the situation there would be room for 500 miles of profitable tramways to-day worked by electricity." A superficial glance at the situation in England shows that the electrical tramway mileage for the whole of the United Kingdom should be at least ten times greater than it is at the present moment.

With the purchase act hanging over them a few years ago all the tramway enterprises of the kingdom were in a moribund condition. They could do nothing themselves, because their time was running out. The municipal corporations having got possession on "structural value terms" of all the profitable ones did not take the action that would have been taken had individual effort been allowed full play. The effect of this naturally retarded greatly the development of electrical enterprise and progress of electrical manufacture in the country. It is impossible to make comparisons in England with municipal tramways and tramways run by private companies, because the private companies have nearly all been absorbed by the municipalities in the way here described. To find a good illustration we may go to Dublin, as the general act of 1870 fortunately did not apply to Ireland. In consequence of this the Dublin United Tramways, consisting of the amalgamation of four old horse-car companies, came under one control and proceeded to electrify the railway much as we would have done in the United States. It is said they had a great struggle to overcome the prejudice and secure the consent of the municipality which cost them two years of delay, but the company finally secured the necessary power and went to work. The whole of the city is now equipped with an up-to-date electric traction system which has been running nearly three years. The street car company compromised with the city and agreed to sell to the Corporation of Dublin the whole undertaking at the end of forty-two years on the terms of the tramway act of 1870, with 33 per cent added for good will. In the meantime they are required to pay the local authorities about $50,000 a year as a way leave. In fact, the agreement gave individual effort a chance, and the result has been satisfactory. Fares have been reduced more than half, while the passengers are carried double the distance for the lower fare. The number of cars has been doubled and speed greatly increased, ten minutes being saved every half hour. Dublin is the only place in the United Kingdom where electric tramways have been worked on a large scale by a private company in this way, because it is the only large city in the kingdom outside of Bristol in which the tramways are in the hands of a private company.

The British public, whether represented by municipal corporations or by private street railway companies, will never understand the difference between English and American street railway business until they grasp the idea of uniform rates and low fares for the long haul. It has been adopted on the Central London Railway, running from the Bank of England to Shephard's Bush, and is perhaps one of the reasons for the phenomenal success of that enterprise. If the American capitalists now shaping to such an extent the transportation facilities of the metropolis only have the courage of their convictions on this point they will teach the British a useful lesson and reap a bountiful harvest. London abounds on all sides with beautiful suburbs, but the cost of getting in and out is almost prohibitory to the workingman. A uniform fare of 5 cents, or 2½d., would indeed be a boon to London. The following table, taken from an official report by S. Allen Baker, of the London County Council, shows the fare and distances carried on the street railways of the larger cities of the United Kingdom:

TRAMWAY FARES AND DISTANCES IN ENGLAND

City and Fare	Miles Carried
Glasgow, 6 cents	5.37
Liverpool, 10 cents inside or 8 cents outside weekdays, 12 cents inside and outside on Sundays	6
Dublin, within city limits 2 cents; 10 cents	8
Birmingham, 2 cents for stages of about 1 mile each.	
Belfast, 6 cents	5
Edinburgh, 14 cents	8
(Workingmen's fares, limited to certain hours, are 2 cents for 2 miles and 1 cent every additional mile.).	
Manchester, 16 cents	8
2 cents inside or outside	1⅜
4 cents inside, or 2 cents outside	2½
London, Moorgate to Wood Green 4 cents; round trip 6 cents.	7
Moorgate to Highgate, 4 cents; round trip 6 cents	4¼
Blackfriars Bridge to lower Tooting, 6 cents	6½
Leeds, 2 cents	1 11-12
1 cent (charged on same basis for distance)	1

Compare these fares and distances with the following table of street railways in the United States:

FOR A FIVE-CENT FARE

Cities	Miles.
Brooklyn	22
New York	18
Chicago	15
St. Louis	15
Buffalo	13.75
Cincinnati	13.44
Minneapolis	12.94
San Francisco	12
Philadelphia	11.75
Denver	11.75
Boston	10
Cleveland	10

From the foregoing it will be seen that long-distance traveling is much cheaper in the United States than in England. The municipalized tramways have not entered into the spirit of the American street railway, which is to relieve the congested parts of the city, carrying the population out as far as possible for a low fare and building up health-giving suburbs. That is a broader problem and one which the English municipalities will be many years, if ever, in solving, because to do so in England one municipality must be common carrier for other local divisions. For example, there is an electric street railway system centering in Boston which radiates by connections and arrangements through three States and probably sixty or seventy subdivisions, carrying throughout a great industrial district of New England the boon of cheap and quick transportation. Such extension would be impossible under the system of municipal ownership. Manchester and Glasgow are having a hard time of it extending their railway enterprises into a few of the towns in their respective localities. An enterprise such as the one referred to in Massachusetts, which probably comprises half a hundred minor companies, is, on the contrary, economically and satisfactorily worked by one great private company, receiving its powers direct from the State and contributing largely in the taxes it pays and in other ways to the public exchequer for rights of way and franchises.

In England, attempts on the part of municipalities and private companies to extend electric tramways into districts outside their local area have met with stupendous obstacles, and yet to limit street railways to the municipal area of one town and not to allow extension to the suburbs creates great inconvenience. The jealousy existing between adjoining authorities, though sentimental, is a real obstacle. It is difficult to get them to discuss joint schemes and more difficult to get them to carry them out. There will be differences about routes and even about the types of cars to be adopted. There is a case in which four local authorities held up an enterprise of this sort on the last question alone —that of the car to be adopted—and the Board of Trade had to interfere and settle the matter. Then the matter of gage is embarrassing. Private enterprise has forethought enough to see that the gage shall be the same, because electric traction is capable of vast extension. Yet we find Leeds, Bradford, Halifax and Huddersfield, all of which are adjacent towns and should form part of a large system such as the Massachusetts combination already mentioned, each with a different gage. Each of these cities insists on its own gage, and enterprise must wait and wait and wait.

Another source of delay for these large enterprises is the fact that the franchises for the small sections of tramways expire at different times, and thus extensive consolidation schemes are blocked by cities refusing to negotiate for these leases before expiration. None of these municipalities has any comprehension of the potentialities of electric traction and few of them ever look beyond their own district. The terms insisted upon by some of these municipalities, such as the purchase of electric power at an exorbitant rate of the municipal corporation and of other arbitrary demands, often breaks off negotiations with private enterprise and make improved transportation impossible.

GAS DISTRIBUTION

Important and interesting testimony was taken by the select Parliamentary committee on municipal trading in relation to the operation of company, or private, and corporation, or municipal, gas plants in England. The claim of the advocates of municipal ownership in the United States has persistently been that municipal gas works not only produce better and cheaper gas, but that reduction in price and many other advantages—including reduction of rates by the profits of those industrial undertakings—flow from municipalization of gas supply. A careful perusal of the testimony, however, shows that, with the exception of two or three exceptionally well-managed municipal gas plants, the British corporation plants are neither so well nor so economically managed as the private plants, nor do they serve the public as advantageously. In the first place, it was shown that, according to Field's Enlarged Analysis of Gas Accounts, the average reduction in the price of gas made between 1883 and 1899 in the case of companies is a trifle over 12 cents per 1000 cubic feet of gas, but the average reduction made in the case of municipal gas works is hardly 8 cents per 1000 cubic feet. These comparisons were made upon an adequate scale and were not controverted by the town clerks of the cities included in the calculation.

In England, private enterprise still controls considerably more of the product than municipalities. The latest available returns, those of 1899, show 439 private gas companies dealt with selling 80,077 million cubic feet, and there are 222 local authorities owning gas works selling 47,287 million cubic feet. While the reduction in price of gas made by private companies in England has been as great, if not greater (as we have seen in the only comparisons practicable), the price charged by companies under similar conditions is less than the price charged by municipal corporations.

There is no reason why municipalities should not sell gas cheaper than private companies, but the facts show that they do not. Taking all these corporations in Field's Analysis for 1899 we find the charges for interest and depreciation and sinking fund in the case of corporations 8.79 cents per 1000 ft. sold, and for English provincial gas companies it is 14.92 cents for interest on capital, so that the municipalities have an advantage of over 6 cents. With this advantage municipal gas should cost less, not more, than gas supplied by private enterprise. The fact is, the municipalities, once entrenched and able to keep out all newcomers, veto all schemes for cheaper light, whether gas or electric, and have really no inducement as companies have to supply the public at the cheapest rate. They are simply influenced in fixing their price by comparison with the prices of companies and other corporations in their immediate neighborhood. If the companies in their vicinity are selling gas at a much lower price than they are they will try to come down to the companies' price, because otherwise unfavorable comparison might be made. As the corporations always have the ratepayers' money and credit at their back they can, of course, reduce if necessary. For instance, the consumers in Leeds might say, if the Leeds corporation were charging much more than the company in Sheffield, "Why are we paying more than in Sheffield?" That would be a stimulus for the corporation to come down to the company's price. This inquiry established the fact that in England the private companies set the pace in enterprise, quality of gas and in price. It was shown that all enterprise in this industry has come from companies, not corporations, because the companies have greater motive for enterprise.

Looked at from whatever point of view we please, whether in gas, electric lighting or tramway service, the vigorous life of private enterprise does not exist in these municipally managed undertakings. They may follow private enterprise; they have never been known to lead. So far in England the municipalities have pounced upon profitable and well-organized and managed enterprises just as the franchise expired and have carried on the work, excluding absolutely all competition. In many cases they have employed the same manager. With a capital cost for producing gas one-half of that paid by private individuals and the right to tear up the streets at will, and even stop

up thoroughfares for the purpose of laying or preparing gas mains, it would seem strange if the results were not equal to that of private companies. Yet the testimony before the select committee demonstrates the results are not so good. In England, even handicapped as the companies are at present, with the higher charges of capital, they can, as we have shown, generally beat the municipal corporations. The claim that companies are more likely to tear up the streets than corporations was also disposed of by the testimony, because it was shown that the London County Council devoted three weeks to street work which an ordinary contractor would be compelled by the local authorities to perform in one-third of the time. In short, the inconvenience to the public is less under company than under corporation management. The companies as a rule are held to strict accountability by the local authorities, whereas the local authorities have no restriction and often close whole streets.

ELECTRIC LIGHTING

Having disposed of the claims of the advocates of municipal ownership and trading in respect of the manufacture and supply of gas in England, it is proposed to take up the subject of electric lighting, of which one of the chief advocates in the United States, Edward W. Bemis, says: "In the case of electric lighting, the superiority of public ownership is remarkable." Let us examine some of the facts upon which Mr. Bemis bases his somewhat sweeping assertions both as to gas and electric lighting. Mr. Bemis seems to have taken for the foundation of his article a return submitted to the House of Commons last session of the accounts of different trading undertakings in the hands of the boroughs. As a test of the efficiency or otherwise of municipal management the figures of the gas works taken over by the boroughs are not of great value, for these reasons: the municipalities devoted to gas wait before taking over a gas works until the concern has been shown by long experience in private hands to be one of established success, so that a process of selection is at work which picks out the plums for the municipalities and saves them from all risk in such enterprises. In all these claims for municipal gas works with which we have been deluged in America the corporations have simply taken over old-established businesses already worked up and which have as nearly as possible attained finality. It therefore needed nothing further than that the existing organization should be kept going upon the old lines—a task perhaps within the resources of British officialism. Then so long as the corporation controlled the development of electric light, as unhappily it has done in England, the gas supply enjoys a monopoly, and therefore in this case also the consumer is compelled to purchase at a non-competitive price, with the result that in any surplus it is impossible to distinguish between business gains and what is merely a disguised form of indirect taxation. The return from which Mr. Bemis derives his facts has been carefully examined by a committee of the London Chamber of Commerce, and this committee has afforded me the opportunity of examining the results of its labors—results, by the way, which point to precisely opposite conclusions from those claimed by Mr. Bemis in the extravagant statement quoted.

In the course of its labors this committee took out the figures in the return relating to electric lighting undertakings for the purpose of ascertaining the "net profits;" that is, it endeavored to show what the ratepayer received in return for the risk he takes in guaranteeing the undertaking. The report of the London Chamber of Commerce committee begins with a summary which for electric lighting gives us the interesting facts found in the following table:

TOTALS AND AVERAGES FOR ALL THE BOROUGHS IN ENGLAND AND WALES

Total capital inclusive of borrowed capital provided by corporation	$17,083,555
Amount of capital borrowed	15,542,565
Amount of capital borrowed which has been paid off...	542,240
Balance of capital borrowed which was outstanding at March 31, 1898	14,952,910
Amount in sinking fund, or loans fund at March 31 1898, in respect of capital borrowed	508,210
Average annual income for the five years ended March 31, 1898, (or, if the undertaking commenced during that period, from date of commencement)	1,522,495
Average annual working expenses from the period mentioned in preceding item	843,775
Average annual net profit for the same period	686,600
Average annual amount paid during the same period in respect of principal and interest on capital borrowed	633,295
Average annual amount set apart for depreciation	18,735
Financial result—Average annual surplus	53,305

It will be observed that the average amount allowed for depreciation ($18,735) is about one-eighth of 1 per cent per annum and that the average annual margin of surplus, inclusive of this $18,735, is only equal to one-third of 1 per cent per annum on the total capital expended. What have our municipal ownership friends to say to this statement of facts? Is there anything "remarkable" in such meager results? As we have seen, the case of electric undertakings is somewhat different from gas, because the electric industry has not yet reached conditions so far fixed as to enable it to be conducted on a strict system of routine without the combination of push and caution which is the essential feature of private trading. Taking the figures of the electrical trade thus given we see that the surplus receipts over the whole of the municipal electric stations of Great Britain amount to an average annual sum of $53,305. Of this they put the miserable sum of $18,735, or about one-eighth of 1 per cent, to depreciation account, and the ultimate balance of profit is only equal to one-third of 1 per cent per annum on the total capital expended. Even this beggarly result would be wiped out if it was not for certain little tricks of accountancy, such as charging the law expenses and accountant's fees to other heads in the corporation budget. Of course, such an item as the amount of taxes relinquished by the municipalities by reason of becoming their own capitalists is never included in the comparisons. If it was we should have an actual loss instead of a tiny profit.

As to Mr. Bemis' calculations of the comparative cost of making gas by public as compared with private plants, these conclusions are absolutely controverted by competent statisticians in England who gave their testimony before the joint select committee of Parliament. The conditions of one gas works as compared with another render any generalization through such figures wholly worthless on one side or other of the controversy. The same criticism of course applies to any attempted comparison of the cost of electric light production. Everyone who has studied the subject of electric light production knows that the great element is the extent to which the average utilization of the machinery can be brought up to the maximum reserve necessary to be kept in store—the "load factor," as it is called. The same process of selection which gives a corporation the most remunerative water and gas works of course also gives them the highest load factor for their electric works. But what controversalists like Mr. Bemis will not see is that all these arguments on relative cost of private against public production do not touch the fringe of the objection which is entertained by the economists and by the commercial classes in England to the employment of public funds in trading concerns. The sum you pay for municipal enterprise is not so many millions of debt or so

much in the dollar on the rates, but a price which is much more serious, namely, the stagnation of commercial development, which inevitably results, and which impoverishes all classes of the community. You cannot have a more complete and deplorable exemplification of the stagnating tendency of municipal enterprise than the case of the electric industry in England. Up to the beginning of the eighties the British municipalities had been gradually buying up the gas works all over the country. They had ousted private enterprise, and numerous officials were congratulating themselves upon having established themselves in various snug little berths in the purchased undertakings. They were thrown into a terrible state of consternation by the discoveries made about that date which rendered the distribution of electric light a practical success. The municipal trader in England can never face competition, but whenever such a possibility arises goes whining to Parliament and begs for a monopoly. So when electricity came along the gas-owning municipalists got serious and said, like the man in the parable, "This is the heir; come, let us kill him and the inheritance will be ours." They therefore proceeded to pass what is known as the electric light act of 1882. This act purported to codify the conditions on which local authorities and private traders should obtain electrical concessions, but it provided that if in any particular locality two applications came forward, one from a private source and the other from a local authority, the local authority should always be preferred. Further, it provided that a private trader wishing for a concession must give notice in June, but a local authority might give notice in November, and notwithstanding that the two applications should be considered as contemporaneous. The result, of course, was that no private trader was allowed to have a "look in." Local authorities played the dog in the manger, and absolutely nothing was done in England in electrical matters for five or six years. Then the backward condition of the country became such a scandal that a royal commission was appointed, and Parliament passed another act less restrictive on private enterprise but still leaving local authorities every possible advantage, including the right to buy up the concern of any electric lighting company without any allowance for the cost of educating the consumers or for good will.

The result is shown in the return to which Mr. Bemis has alluded. A few undertakings have been started in almost every case by private enterprise and the municipalities have gradually bought them up, and the returns show that the total undertakings of the boroughs of Great Britain in 1899 represent a capital of under £3,500,000 sterling, or about $17,500,000. This ridiculously inadequate provision for the electrical needs of the most densely populated industrial communities in the world is a flagrant example of the paralysis which results from the system of municipal ownership. In a discussion in the House of Commons this state of things was admitted by both sides. Mr. Ritchie, then president of the Board of Trade, told the House that "the electrical enterprise of Great Britain was in an exceedingly backward condition. It was inferior both in regard to light and conveyance of power to many European countries, and it was greatly inferior to North America and Canada. It might almost be said that there were villages in North America which were in possession of advantages in connection with electricity which some of our largest towns did not possess." Mr. Brice, the president of the Board of Trade in the last Liberal government, concurred with Mr. Ritchie, and stated that "of all manufacturing countries we are nearly at the bottom in the matter of electrical supply, and that was an injury to the amount and cost of production which affected the prosperity of all industries."

The present president of the Board of Trade, Gerald Balfour, reiterated these sentiments last month (July, 1902) at the opening of the International Tramways and Light Railways Exhibition, and his remarks, I have no doubt, were reported in America.

That the House at large concurred in these opinions, and in attributing this disastrous condition to the interference in the industry of the municipal authorities, was sufficiently proved by their passing (as they did without a division, in spite of the hysterical protests of the municipal traders) the four electric power bills of private companies, which were a direct departure from the municipal control at present existing. Mr. Bemis himself appears to admit the want of enterprise in municipal undertakings in England, but puts it down to the fact that "Great Britain is far less progressive than Yankeedom." I think that is so; but are the English less progressive than the continental countries of Europe, such, for instance, as Spain, which is far ahead of England in electrical matters? This stagnation, as pointed out in a recent number of Engineering, is a condition of affairs that has scarcely ever obtained in England before. "British engineers and mechanics," says that journal, "build the early railways, gas works and waterworks, in all countries of the world, having first gained their knowledge in similar enterprises at home. We have to go back a couple of hundred of years to find instances of foreign engineers coming to England to undertake work which we could not do ourselves. But now we meet them or their agents at every turn. American and German companies are established here, and orders for hundreds of thousands of pounds' worth of machinery are being sent abroad, and many more must follow. On the other hand, British exports of electrical machinery are quite insignificant even to the colonies."

The fact that the municipal officials were so unperceptive of this most serious condition of things as not only to sit still and do nothing, or practically nothing, to keep up to date this important branch of industry which Parliament had so unwisely committed to their hands, but to go further and to strain every nerve of political interest which they possessed and to spend public money like water in order to stop private traders providing facilities for lack of which many trades in England are going to the dogs, is surely the most damning evidence of the pernicious effect of municipal trading, evidence compared with which ingenious compilations of figures such as those of Mr. Bemis fade into worthless insignificance.

In the last debate in the House of Commons on this important question, a debate which ended in a parliamentary defeat for the municipal traders, Mr. Seton-Karr said "that he strongly supported the bill. He had not the slightest personal interest in the bill beyond the fact that he was a member of the House, a member of a large industrial body which the bill affected and a British citizen concerned in the industrial progress of the country. Lancashire contained thirteen county boroughs, eighteen boroughs, eighty-six urban districts and twelve rural districts. Of these local authorities only sixteen had electric works in operation and supplied electricity only on a small scale and at high charges. In ninety-one districts, or something like two-thirds of the area affected by the bill, no step had been taken with a view to obtaining powers to carry out such works. This year there was not a single application for a provisional order to erect electric works from Lancashire. It was therefore probable that if the people had to wait for the local authorities to supply them with electricity the day of judgment would see them without it. The private speculator had been sneered at in the course of debate. Was it the private speculator or the municipal corporation that had founded our railways? Private speculators had established

and carried on the industrial prosperity of this country. In his opinion the supplying of electricity in bulk was far too large an undertaking for municipal corporations. Local authorities could not afford to sink the ratepayers' money in such works. It required the generation of a large amount of electricity and the distribution of it over a large area to make the undertaking pay. In America, which was a hundred years ahead of us in the supply of electricity, the average charge was one half-penny per unit. In Manchester the charges for electricity were 5d. per unit for lighting, 1½d. for motive power and 2d. for public lighting. Yet the corporation of Manchester was using the ratepayers' money to prevent electricity from being supplied at something like the American rates to Manchester. The only compulsory power sought for by the bill was the power to go through a non-consenting district in order to reach a consenting district. Was it reasonable that a consenting district should be deprived of the advantages of a supply of electricity because an intervening non-consenting district objected to have their streets torn up? The opposition of the Association of Municipal Corporations to this bill was very largely a question of officialism, he ventured to think. He was entirely hostile to municipal trading except in certain limits. It would be most dangerous to the prosperity of the country if they allowed the municipalities to go outside their proper province and usurp the functions of private enterprise. It was impossible to exaggerate the advantages which would accrue from cheap electricity, and it was because he believed that the principle of this bill was one of enormous importance to the industrial development of the country by its means that he asked the House to pass the second reading."

Returning to the report of the committee of the London Chamber of Commerce of these electric lighting returns, it may be well to quote its exact language, after having carefully examined all the facts: "On the face of the summary it appears that, as the result of incurring a debt of $15,500,000, the ratepayers generally, over the whole of the undertakings, have a surplus of only $53,300 when they have divided for the payment of interest, etc., on their loan capital. That is to say, the amount distributable in aid of the rates is about one-third of 1 per cent only. A cursory inspection of the returns will show that the surpluses are earned in every case in the very big towns and that the general result among towns of moderate size must have been a deficit met out of the rates, while as for small towns, the results are even more unpromising."

This is a liberal way of looking at the question, and it is doubtful whether there is even this small profit made by large towns in electric lighting. It all turns upon whether the gradual paying off of the loan capital is sufficient to more than make up for the depreciation of the machinery. It is claimed by some that the life of an electric plant is ten years. The period for which the loans are contracted ranges from ten to forty-two years, the average about twenty or thirty years. At this session of Parliament these municipal trading influences actually tried to increase this period in some classes of loans to one hundred years. If it is true that the plants need renewing in ten or fifteen years the sinking fund does not balance depreciation. "It is evident," says the London Chamber of Commerce committee, "that this at once disposes of the argument which is so frequently heard that the result of a corporation undertaking electricity supply itself is to present the borough about twenty-five years hence with a central station, etc., gratis. It is clear, as a mere matter of accountancy, that an item cannot be carried to two places at once, and that if the sinking fund is applied to balance the depreciation account it cannot also be carried to capital account as an increase of valuable assets." The question therefore of validity of even counting as profits ridiculously small surpluses earned in the larger towns really turns upon whether the debt is paid off before the machinery and plant requires renewal or whether the reverse is the case.

The fact is there exists a convenient looseness of finance in dealing with those trade municipalities that makes exact comparison impossible. There is no possibility of a corporation's accounts getting into the hands of whatever would be the municipal equivalent of the "official receiver," that is, so long as there remain any ratepayers from whom a rate can be collected to bolster up these disastrous speculations with the public funds. In a recent Parliamentary hearing on the question of local indebtedness a witness, to show that examples of "vanishing assets" are by no means uncommon in municipal accounts, cited from a table of the electric light investments of sixty English towns in each of which a loss was made upon the working for 1901, notwithstanding the generally high rates charged for current, as stated in the table. This loss aggregates, after due allowance for depreciation, $1,364,170 in the year.

THE TELEPHONE

The backward condition of the telephone industry of England has been a hindrance to commerce, a source of annoyance to private communication, the subject of investigation by Parliament and a topic of endless discussion and controversy by those interested in both sides of the problem of municipal ownership. The advocates of municipal trading and of State appropriation of public utilities have vociferously maintained that the cause of this lack of enterprise may be traced to the fact that until recently the telephone service was wholly in the hands of a private company. On the other hand, the friends of the company declare with equal force and a strong array of facts that the real cause of the trouble comes from the unreasonable interference and unjust demands of the British Government, which have made it impossible for private capital and enterprise to push ahead, apply the latest inventions and increase the service by reduction of price and extension alike of public and private exchanges. A glance at the history of the telephone in England strongly indicates that the government has played a fast and loose game with those who have undertaken to establish it, with the result that its progress has been retarded because the company never quite knew where it stood. In the first place, the learned electric savants of the postoffice declared the telephone, after it was in full operation, an ingenious toy but of no value for commercial purposes. Later on, when its establishment between such large centers of industrial energy as Liverpool and Manchester began to make inroads into the Postal Telegraph revenues, the postoffice department interfered, and it was decreed by the courts that the telephone was a telegraph and that telephones worked for public purposes came under the telegraphs act and that therefore the government had a monopoly of them.

This was naturally a severe blow to the National Telephone Company and one calculated seriously to impede its enterprise. As the government was not prepared or not sufficiently sure of the financial success of the telephone to take it over bodily as it had done the telegraph, it licensed the National Telephone Company to work under the telegraphs acts at a 10 per cent royalty on the gross receipts. The licenses were restricted because they were contingent upon the consent of local authorities who could place obstacles in the way and prevent the laying of wires and otherwise obstruct the system's installation. For some years the telephone people seemed to have struggled along, having little faith in the final outcome, until in 1892 the government of the day came to a general arrangement in reference to the telephone business of the country.

STREET RAILWAY ACCOUNTING

CONDUCTED BY J. F. CALDERWOOD, ASSISTANT TO THE PRESIDENT BROOKLYN RAPID TRANSIT COMPANY, AND MEMBER INSTITUTE OF SECRETARIES OF LONDON

Growing Necessity for Reserve Fund

The discussions on the matter of a reserve fund which have been going on in this department recently are of such vital importance and are so closely related to the welfare of the entire electric railway business that consideration of them should extend beyond the accountant's office, and they should be thoughtfully taken up by the manager, the president, the director, and the stockholders. The question of how much of a reserve and sinking fund should be set aside to insure the future safety of the stocks and bonds of an electric railway company is a matter upon which there is considerable variety of opinion and practice. It is, perhaps, the natural tendency of human nature to provide too little for the future rather than too much. The desire to get rich quick at the expense of the future is probably stronger in America than in any other country, and this characteristic crops out everywhere in connection with American financial methods.

The papers that have already been presented upon the subject have treated of several features, most of them closely connected with the accountant's side, but there is a broader view that should appeal to those entrusted with framing the policy of street railway companies, and directing the management of these properties. With the rapid development of the industry new problems have come up, the conditions have materially changed, and the importance of the properties has increased in proportion to the advance in values. Consequently the entire situation has changed, and it is still changing, and because of this fact the matter requires serious study. Therefore, everything considered, there is no subject which needs a more thorough discussion at this time than the creation of reserve and sinking funds.

There are those who go so far as to assert that no street railway company in the United States would be, to-day, making money if a proper amount was set aside for depreciation and reserve funds after paying operating expenses and the interest on bonds. This, of course, represents the extreme pessimistic view of the situation. That investors generally do not share this view is demonstrated by the prices at which street railway securities are sold on the stock exchange. While market prices of securities are not, by any means, absolute indications of their real value, they, nevertheless, represent the consensus of opinion of a large number of investors, and, consequently, are probably nearer the truth than the opinions either of the extreme pessimist or optimist. If street railway companies are guilty of paying out in dividends that which should be laid aside for reserve fund, the same thing might be said of almost any other industry carried on by corporations in America, including the steam railroad companies. We have not yet arrived at the conservative way of conducting financial matters that prevail in older countries. Economic conditions here have not required it, because the country is comparatively new and the rapid growth of business, in the majority of cases, has compensated for many actions which would be financial folly under more settled conditions. The usual American financial method is to pay out in dividends to the stockholders all of the profits over and above operating expenses and fixed charges, less, perhaps, a sinking fund to pay off the bonds at maturity and a nominal reserve to meet extra expenses. The day comes when the property becomes sufficiently run down physically to require a thorough overhauling, but in the meantime extensions must be made, for the business has grown until the old equipment, even if made new, could not begin to take care of it. Probably by this time, also, if it is an electric railway, the old power houses, cars and tracks have become obsolete as well as nearly worn out, and no one would think of replacing the track and rolling stock with duplicates of what was purchased when the road was new, even if a reserve fund had been created to do it. The progress of the art calls for new modern equipment, new and larger power houses, larger and more comfortable cars, and heavier rails. In other words, there must be a thorough physical reorganization of the property, along with extensions of lines, so as properly to adapt the system to the increase both in mileage and traffic which should belong to it. Perhaps, too, consolidations have materially changed the situation. Now the common American method of procedure is to reorganize the company or increase the capital stock, or both. In any event additional securities are issued and the improvements are made from the proceeds. The property is, therefore, loaded with liabilities in the shape of stocks and bonds, covering not only the first cost of the road but costs of renewals and general overhauling. If a reserve fund could have been created of sufficient size to cover all or a part of the costs of all these improvements and replacements, there would, of course, be no necessity to issue more securities save for the cost of extensions, but the places where this was practical in the past were, doubtless, few.

There are very few railway properties in the United States where a reserve fund large enough to pay for all of these replacements, together with a sinking fund to provide for stock and bondholders at the expiration of the franchises, has been maintained for any considerable length of time, though a notable effort is being made now in that direction in many quarters. Wherein lies the essential difference between "the reserve fund method" as against "the pay dividends as you earn them" method? The reserve fund method pays the stockholder handsome dividends after a long period of unproductiveness. In the case of new companies and new and growing territory, it may be that many years would elapse before any dividend should be paid out, but when once the time arrived where something over and above the proper reserve fund was earned, it is evident that the dividends will be much larger than on a recapitalized property, because of the lower capitalization upon which interest must be paid. It must be remembered, however, that, in order to make a fair comparison, compound interest must be figured on the dividends in one case and on the reserve fund in the other. Were it not for the great load of liabilities which the common American financial methods lay upon a property, the two plans would probably be but little different in the long run. In one case the stockholder is paid his dividends as fast as they are earned and has the money for immediate use, and is, furthermore, given the first and most profitable chance to pay what he has received in dividends back into the property whenever there is an increase into the capitalization. In the other case the company keeps the money, as a trustee for the stockholders, as it were, until such time as it shall be needed for improvements. The average Ameri-

can stockholder likes to see quick dividends, however, and the average investor will give more for a dividend-paying stock with a very uncertain future than a stock which gives no promise of dividends for many years, but upon which good returns are assured, if the stockholders will only wait long enough for them. Few directors have the moral courage to pass dividend after dividend for the sake of future generations of stockholders, provided the company is earning anything at all available for dividends. The future is thus left to take care of itself, and the notable thing about business operations in America in the past has been that the future has, in most cases, taken care of itself remarkably well, and this has led capitalists to invest blindly in securities of all kinds which are paying well at the present time, without inquiring into their future. That thousands of enterprises of all kinds in this country have not come to financial grief as a result of periodical reorganization and increase of capital liabilities every time extensive overhaulings of a property become necessary, is due simply and solely to the fact that the growth of business has usually been large enough to enable these enterprises to carry the additional burdens put upon them, and it has only been when promoters have over-reached themselves in discounting the possibilities of a property and loading it too heavily with securities that disaster has come.

The excellent showing that was made by several street railway companies in Massachusetts when it was proposed to permit savings banks to invest in this class of securities is convincing proof of the wisdom of adopting and pursueing a conservative course in the matter of dividends and reserve funds.

Americans are noted for the creation of scrap heaps by the throwing away of obsolete machinery and the introduction of modern methods and apparatus. It is undoubtedly a fact that the natural increase of business and improvements in economy brought about by the creation of the scrap heap have counterbalanced the cost of high-priced scrap heaps in this country, and to these things the prosperity of its industries and railway companies is due. As conditions become older and more settled, and as the limit of population and traffic, and the limit in the reduction in operating expenses in electric railways is reached, the necessity for different financial methods will become apparent, and it is for this reason that the various notes of warning have been sounded in the columns of this department as to the coming of a time when a larger reserve fund will be necessary. It is evident that with the shorter time franchises that are now becoming popular with city governments and with the expiration of franchises now enjoyed, there is reason for more and more serious attention to the creation of funds for either paying off the securities at the expiration of franchises or reconstructing extensively under new grants, as the case may be. Not only do the stability and prominence of street railway investments require this, but it is due to the welfare of the business in general that the profits be not represented as larger than can reasonably be maintained. Now, that street railway companies are being so heavily taxed, and large compensation is sometimes being asked for renewals of franchises, it is of no benefit to anyone but the stock speculator, with securities to unload, to have it advertised far and wide that the profits of street railway operation are two or three times what they really should be were proper maintenance, reserve and sinking fund deducted from the earnings.

The Utility of Reserve Accounts

BY A. O. KITTREDGE, C.P.A.

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The penny-wise and pound-foolish policy is nowhere more strikingly demonstrated than in the crippled physical condition of certain railroads. The payment of dividends at the expense of maintenance has brought several of the great steam railway systems to bankruptcy, and even in these days of general prosperity numerous street railways are failing to provide for the stormy days that are bound to come. The depreciation of plant and equipment is something which must be duly considered in railway accounting, and the maintenance of adequate reserves is, therefore, a matter of vital consequence.

THE PRINCIPLE OF RESERVES

The principle of reserve accounts may, perhaps, be most clearly illustrated by considering them in connection with their antitheses, commonly called suspense accounts. A suspense account is a record of expenses paid or incurred in one fiscal period, the cost of which in equity belongs to one or more subsequent periods. For example, insurance premiums are usually paid yearly in advance. Any business conducted on the plan of monthly fiscal periods would, therefore, not charge the entire premium to the first month but prorate it over the twelve months of the year. In other words, a suspense account, called Insurance Premiums, would be opened, which would be debited with the whole amount of the premium paid. Thereafter, this account would be credited each month with the periodical prorata, which amount would be charged into current expenses.

Reserve accounts are the antithesis of suspense accounts and are maintained to receive periodical credits offsetting payments made at some later date. If the amount of such later date payments could be definitely determined in advance, reserve accounts would be as simple as suspense accounts, being merely a matter of prorating over two or more fiscal periods; but as reserve accounts are largely matters of estimate, opportunity is offered in connection therewith for the highest type of business judgment.

The operation of the reserve principle may be shown in the matter of taxes, which are usually paid at the end of each year. It would be manifestly unfair to any business to have the taxes for a whole year charged to the individual month in which payment is made. The logical plan is to charge each month, assuming again that the business is conducted on the plan of monthly fiscal periods, with its prorata of the year's taxes. Since no bill is rendered, nor can one be obtained until the taxes are due, it is necessary to estimate the amount in the light of experience and to charge the proper prorata monthly to general expenses, and credit the same to the reserve account provided for taxes. When the time comes for the actual payment of the taxes thus provided for, an amount will have accumulated equal to the amount of the taxes, and the tax reserve account hitherto credited with such accumulation is thereupon debited with the payment made.

ESSENTIALS OF MANAGEMENT

In the foregoing remarks it is presumed that the business is conducted on the plan of short fiscal periods—preferably monthly in the case of a railroad—as on no other basis can be brought before the management the facts essential in formulating plans of operation. Accounting statistics must be up-to-date in order to be of any practical value, and comparisons are most urgently desired with the business of the month immediately preceding and with the corresponding months of previous years. Such informa-

tion can only be obtained through the maintenance of reserve accounts, which fact gives added value and interest to the form as well as the substance of this feature of accounting. The continuous wear and tear of machinery and equipment which will ultimately result in considerable outlay for repairs and final replacement must, therefore, be added to costs of operation. Wear and tear are cumulative costs which begin the moment power and equipment are put in motion. The time of making repairs may be early or late, as necessities determine, but depreciation begins at the very beginning, and substantial provision should be made accordingly. Reserves for repairs and ultimate replacement are, therefore, primary considerations, and in any plan of accounting intended to furnish facts essential to management, such reserves should be separate and distinct, complete and up-to-date at the end of each monthly period, and at all times and under all circumstances liberal.

RESERVES FOR REPAIRS

Reserves for maintenance naturally divide into two general classes, reserves for repairs and reserves for depreciation or replacement. These two general accounts may be subdivided as much or as little as may be desired for purposes of management. Repairs are not always or even generally made when the wear and tear actually occur, but rather during some moderation of business or when the wear and tear have progressed to such an extent as to render further postponement of repair work impossible. In some cases repairs are put off for financial reasons. The necessity for repairs, however, beginning with the introduction of any new building or piece of machinery or equipment and increasing in a progressive ratio, is an ever present operating cost, and it is only fair that each fiscal period should be charged with its due proportion of this accruing expense. A charge for repairs should, therefore, go into each period from the outset, based upon an estimate of the actual wear and tear of the property.

In the subdivision of reserve accounts for repairs where different classes of motive power are employed, it is desirable to maintain separate and distinct records of each. It is, likewise, desirable to maintain a distinction between repairs of track and roadway, and repairs of equipment. Buildings, fixtures and various other forms of plant may also be entitled to separate repair accounts, and reserves should be maintained accordingly. An examination of the cost of repairs in the past will afford a basis for the respective reserve accounts. Subsequent observation of actual costs for repairs, as contrasted with the reserve amounts provided therefor, will show whether the estimate, as provided, is too large or too small.

RESERVES FOR DEPRECIATION

In addition to repairs, provision must also be made for the ultimate replacement of most of the physical assets of a railroad. No matter how much they may be repaired, the time comes, sooner or later, when they must be replaced by something more modern, and sufficient money should be periodically set aside to meet the inevitable expense of replacement when it comes. A story is told of an old lady who insisted that she never needed any new stockings, for the reason that she knitted new feet upon her old ones every fall and new legs upon the old feet every spring. Such a theory of repairs may be applied for years to street railway buildings, tracks and roadways, but radical inventions and changes of methods will some day require new feet and legs at the same time. The displacement of cable systems by underground trolleys is a case in point. Such a change scarcely comes under the head of repairs.

In equipment inevitable change is even more conspicuous. From bobtail horse cars to the ponderous electrical vehicles of modern systems is a radical change, but it is an evolution as well as a revolution. The history of street railways during the last ten years abundantly illustrates the necessity of liberal reserves for maintenance, and who will venture to say that the next ten years will record any less degree of material progress? Progress is a good thing, but mighty expensive, as many can testify.

If the life period of power plants, tracks and cars were positively known in advance, it would be an easy matter to write off at the end of each fiscal period a sufficient amount to balance the account at the end of the time limit. The fact is, however, that such life periods can only be estimated. Some estimates will be too long; others too short.

LIFE AND REPAIR HISTORY

While the life period of any individual piece of machinery or equipment is uncertain, this very uncertainty is worthy of record in the light of its duration and cost of repairs. Depreciation and repairs are taken care of through general reserve accounts, made up of classes of units rather than the individual units themselves, yet it is often desirable to maintain subsidiary accounts for the purposes of management. Therefore, the record of the life and repair history of important machinery in power plants and the similar history of cars or classes of cars becomes of considerable importance. This can only be done through a reserve account for each article or class of articles. The first entry in the account of life history would be the inventory value, which would, of course, be a debit. The credits would be the reserves for depreciation. In the repair record the credits would be the periodical reserves for repairs and the debits the actual costs of repairs as made. Similarly, in the depreciation record the credits would be the reserve for depreciation, and the debits the cost of actual replacements as made.

RESERVES FOR EMERGENCIES

While reserves for repairs and depreciation must be based upon estimates, the facts are obtainable to make such estimates sufficiently exact for practical purposes. There are other expenses, however, in the nature of emergencies, which cannot be estimated with very satisfactory approximation, but which must, nevertheless, be taken into account. Accidents and damage suits are something which every railroad must, sooner or later, face, and it is the part of wisdom to make due provision for such emergencies. From the viewpoint of logical accounting, it would be manifestly unjust to charge to any single period the cost of a destructive accident or to charge to subsequent individual periods the expenses of any damage suits that might happen to be decided therein against the railroad. Such a course would derange the statistical history of the company for purposes of comparison and management.

The more reasonable and satisfactory way of providing for emergencies is through a reserve account which would be credited month by month with such an amount as might be deemed sufficient to meet such extraordinary expenditures. The offsetting charge would be to operating expenses. According to this plan proper charges to the expenses of operation would be made as time passes and a fund thereby accumulated with which to make good the value of property when destroyed by accident, and also to pay claims for damages as adjusted.

The very idea of an accident is that it is something unexpected, and while any estimate covering such emergency must of necessity be vague, due provision must be made therefor. The disastrous Johnstown flood was certainly not anticipated in any specific way by the Pennsylvania Railroad. There could scarcely be a better illustration, however, of the wisdom of the Pennsylvania's policy in maintaining large emergency reserves, for the enormous expense resulting from the Johnstown disaster had no appreciable effect upon the resources of the railroad.

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That the city of Chicago is in earnest in its endeavor to settle upon some solution of its rapid transit problem and one which will be satisfactory to the citizens of that city and just to the present railway companies is evinced by the action of the city in sending a delegation of its Aldermen to inspect other cities and report upon their transportation systems. This committee, which visited New York, Boston and a few other cities last month, was composed of some of the leading business and professional men of Chicago, who, while in New York, devoted themselves to a thorough and intelligent study of the transportation conditions in this city. The report of the committee and its engineer will, of course, not be presented for several months, but, whatever the decision reached, the action of the city and that of the Aldermen in personally investigating in other cities the transportation methods which they consider adopting, is a very creditable one. It is too often the tendency, especially with municipal bodies, to attempt to solve all questions relating to local transportation with no more data or information than is available without leaving their own city, and with often a very incomplete knowledge of the subjects upon which their decision is required. The results of this policy are usually to defeat the very objects which the city wishes to secure. Chicago has followed the opposite policy, although the only one which would be adopted by any private corporation in planning an important piece of work, and we trust that this example will be followed by other public bodies in any important action affecting public service corporations and public service.

One of the most annoying troubles in electric railway maintenance is the wear of the motor bearings. These bearings in wearing away allow the armature to approach the pole-pieces and are usually condemned after a certain distance limit is reached, for if this limit is exceeded there is danger of the armature striking the pole-piece and injuring its structure so severely that rewinding will not repair the armature. Many devices are used at present to detect the wearing away of motor bearings and keep track of the armature clearance, which, of course, is made as great as magnetic conditions will permit. The modern railway motor design has provided armatures with large teeth which are stronger and will not be so seriously injured by striking the pole-piece, and in general the design of the railway motor has been perfected to such an extent that from an electromagnetic standpoint but little more can be done with reference to the dimensions of the iron parts to minimize the trouble.

The motor bearings, however, have not been given as much attention. They have, of course, been designed with a view to maximum length and permanency, and when newly sent out are filled with a first-class quality of bearing metal which frequently lasts longer than any subsequent bearing lining which is installed by the electric railway management. The fact that poorer grades of bearing metal are used is almost never the fault of the engineering department, but is due to the fact that there are innumerable cheap grades of bearing metal on the market which are attractive to those who are anxious to make a good showing on the maintenance account. The best metal that can be had is none too good, for the conditions are such that the bearing must be discarded before it is really worn out from a mechanical point of view. The chief cause of the wear is due to dust and grit of the roadbed. Every possible precaution should be taken to protect bearings from this most unwelcome intruder. The commutator bearing of the motor on many of the older types is very rarely capped, and, its end being exposed in this way, it suffers quite severely from grinding by dust particles. The conditions under a railway car are such that a dust cap over the end of the motor bearing often trenches upon space which is needed for brake-rods and braces, or even side frames. A device to be recommended in such motors as this is to sacrifice an eighth of an inch of the end of the shaft, trimming down the bearing correspondingly so that it will not cut a groove, and secure a perfectly flat metal cap over the orifice by three or more screws. This cap should preferably be felt gasketed and can be fastened to the bearing shell. Felt guards around the motor shaft on either side of the bearing will materially assist in preventing the wear. In fact, railway motor makers and maintainers will do well to study methods employed to exclude dust from modern bicycle bearings, as the difficulty has there been appreciated and ingeniously met in many ways.

The cost of renewing the bearing metal is, of course, the smallest item in replacing a bearing. The most expensive part is the necessity of dismounting the equipment and placing it out of commission for a longer or shorter time in order to renew the worn bearing shell. Adequately protected railway motor bearings should run very much longer than the more exposed types, and by employing these means the wear limit can then be set at a point much closer than before and the bearings much more nearly worn out, thereby minimizing the periods of dismantling the motor for renewal.

WE are fortunately able to present this month an abstract of the results obtained in the Berlin-Zossen tests, with curves showing the actual power consumption on some of the high-speed runs. These data, although somewhat meager, are of great value, as definitely checking the train resistances, about which there seems to have been recently considerable doubt. A glance at the curves reveals the fact that the power taken to maintain speed against air and track resistances was very moderate indeed. We have all along contended that the weight of evidence indicated that the power consumption at high speeds would prove to be much less serious than was feared, and that the track resistances at high speed were very moderate. Now, when a 90-ton car is drawn at a sustained speed of 87 miles per hour, with a power expenditure of less than 500 hp at the generating station, and less than 300 hp at the car, there is simply no room for either large track resistance or large net air resistance, and no amount of theorizing from coasting data will make any room, and that is the end of the matter.

Another very important consideration is the success of the current-collecting devices employed. There has been some, perhaps justifiable, doubt as to the feasibility of collecting current at enormous speeds from a very high-voltage trolley wire, doubts strongly voiced by Huber in his recent paper. The results at Zossen appear to indicate that the difficulty of current collecting has been over estimated, and that high-voltage trolley wires do the work with a very encouraging degree of success. On the other hand the braking seems to be far from easy, and the power brakes did not prove entirely satisfactory. Evidently this part of the high speed problem is none too easy and requires much study and experiment for its solution. The signals, too, involve a serious source of anxiety, which may be somewhat relieved when the braking is improved. Most of all the track requires close attention, and it is clear enough that common track is not good enough to serve the purpose. Broadly, the difficulties encountered are mechanical rather than electrical, as we have steadily contended would prove to be the case. Given a first-class track and adequate braking facilities, and the mere matter of high speed is comparatively simple. There is no doubt whatever that a speed of a hundred miles an hour involves no particular difficulties from the electrical standpoint. The feasibility of such speeds commercially turns upon the demand for them, and upon sound track construction and attention to mechanical details. When there is a definite call for such a fast express service the work can be carried out successfully by means even now at hand. But, as we have more than once pointed out, there is little object in trying for such speeds over anything but considerable distances. Time is money, but it is not yet so valuable as to make a schedule speed approaching 100 miles per hour important except on rather long runs between important centers. It is possible that one-hour trains between New York and Philadelphia might be worth the while, but such speed would be more valuable between New York and Washington or Boston, and still more valuable between New York and Chicago. Railway speed has a slow natural growth, and even now that we have experimental data to serve as a basis for commercial work, it may be a long time before the pressure of public demand is sufficient to produce definite results. Electric traction on a large scale is sure to come in time, but the growth is quite likely to be gradual. It is better, in fact, that it should be so, and that the way should be cleared experimentally before any great enterprise is initiated. But the Zossen tests have laid a solid foundation for further improvements.

It must be apparent to every close observer of public affairs that the drift of opinion in England and on the Contienent for years has been favorable to municipal ownership and governmental control of public service works, including street railway properties, and it is the general belief that the tendency is still in that direction, especially in Great Britain. But Mr. Porter, in his article on "The Failure of Municipal Ownership in England," the first part of which is presented elsewhere in this issue, holds out promise of a change of sentiment in that country based apparently upon the recent Parliamentary investigation and the agitation of abuses under the present system.

The idea of municipal ownership of the transportation facilities of a city, or even the ownership without operation, has never been of much more than academic interest in this country. There has been, of course, a certain amount of agitation on the subject, and the demand for municipal ownership has been made the slogan of one side or the other in a great many political battles. It has also been used very effectively on occasions as a means of attacking or fighting local street railway companies to secure some coveted end. But there are many reasons why the municipal ownership propaganda as an actuality has amounted to nothing in the United States. In the first place most students of our political methods appreciate the fact that our system of government is not such as to encourage the hope that public service corporations would be efficiently and economically administered. Again, few, if any, cities of this country have been, or are prepared, to engage in extensive municipal enterprises requiring capital, as they have no money available to buy or to build, nor can they borrow money under the constitutional limitations upon city indebtedness. Consequently they have had to look to private capital to undertake these great public works. The benefits in this co-operation are to-day enjoyed alike by the community at large and the corporation, and we believe that there is general satisfaction with the result.

In England a diametrically opposite course has been pursued, and as a result a number of the largest tramway systems in that country are not only owned, but operated directly, by the municipalities. The roads have been well built, as a rule are well managed, and there seems to be a stability and absence of politics from their operation which could hardly be expected in this country. The great development of municipal tramways in Great Britain has been due partly to a greatly restricted suffrage by which better

and more businesslike local government is assured, partly to the absence of constitutional limitations on indebtedness by which no financial obstacle was put in the way of acquiring and equipping the roads, and partly also to the fact that during the last ten years many of the franchises of the larger tramway systems in the United Kingdom have expired, so that an easy opportunity has been presented by which the municipalities could acquire the tramway systems. For this reason, Mr. Porter's article on the subject of the results secured by this policy in Great Britain is of the greatest interest, and, although Mr. Porter has long been known as an advocate of private ownership for quasi public enterprises of this character, his knowledge of the condition of affairs abroad and at home and his high reputation as an authority on statistics and all public matters, make his testimony of the greatest value.

Judging from Mr. Porter's paper, the municipalities which own their own tramway systems have, perhaps naturally, devoted their energies more toward providing a low minimum fare than toward providing facilities for a cheap maximum ride, and thus encouraging people to live in the suburbs outside of the municipal boundaries and beyond the tax limits. It is right in connection with this question of suburban extensions that we have one of the strongest objections to municipal ownership, namely, the difficulty so far experienced in Great Britain of extending the operation of each city's system much beyond its corporate limits. That this obstacle is irremovable we do not believe. The legal questions can be settled by action of Parliament, but this will not and cannot remove what Mr. Porter considers the most serious difficulty, viz., the unwillingness of several adjoining municipalities to unite upon the standards of equipment necessary for a through line, and waive the control and management of the lines within their own jurisdictions in favor of one central management. This fact will continue to act as a stumbling block in preventing the extension of the municipal systems to neighboring small towns, and the construction of such a network as would be possible by private enterprise. As an example of what may be accomplished under private control, Mr. Porter calls attention to the electric railway systems centering in Boston, which radiate by connections and arrangements through four States and probably sixty or seventy subdivisions, carrying through that great industrial district the boon of cheap and quick transportation.

The subject is such a broad one, and one which affects so vitally electric railway development that all the light which can be thrown on the subject is of the greatest value. The electric road is so important, not only to the cities, but to the development of the country at large, that its growth should be planned upon such comprehensive lines that it shall meet no serious interference. We do not intend to withhold any portion of praise to the managers of the municipal systems which have been built up in Great Britain, and which is due them. But will the Common Council of a city, to whom, of course, the tramway manager is subordinate, have the breadth of view to undertake the solution of this question, in all its phases, in the broadest manner? We already have in the article, the first half of which is published this month, the important testimony of Mr. Porter in favor of private ownership. Can some advocate of the oposite policy give more weighty reasons in favor of municipal control?

Interurban Car Despatching

Train despatching by telegraph on steam railroads has reached a high state of perfection, as is but natural, considering the years of experience that have figured in the solution of the present system. When the electric interurban line began to assume a length and importance that demanded some system of despatching whereby all cars might take orders from one man, the telegraphic system of steam railroads was the only practical example available from which to devise a system for electric interurban work, but it proved too cumbersome to meet the average conditions of electric interurban railway operation, and something new had to be worked out, just as in many other departments of this new railroad art. The first thing that suggested itself was naturally the telephone as a substitute for the telegraph for giving orders. The use of the telephone for this purpose on steam roads has made very little headway. Without discussion as to whether the telephone is or is not the proper means of communicating train orders on steam roads, it can be said truthfully that it meets remarkably well the requirements of electric roads. It is essential that the means of communication be such that motormen can talk with the despatcher at any siding. The maintenance of telegraph operators at all stations where cars may meet was one of the cumbersome and expensive features of steam road operation which had to be eliminated in the operation of electric roads. It has been urged against the use of the telephone in train despatching that there is more chance for error in receipt of messages than by telegraph. It is hard to see that this objection has much weight. If desired messages can be written down and repeated back for approval to guard against error, as in telegraph messages. However, these points are hardly worth arguing, because the telephone has now become generally used and recognized as the proper instrument for despatching on electric interurban roads. This article, therefore, resolves itself into a review of the methods of using the telephone in train despatching.

The first thing to consider is, of course, the construction of the telephone system and whether communication between trainmen and despatcher is to be by means of telephones placed in booths or boxes along the road at the sidings or whether each car is to carry its own telephone instrument and connect with the despatcher's telephone circuit at sidings or other points along the line. Both plans have many advocates. The main point in favor of booths is that instruments located permanently at stations are not so likely to be disabled by hard usage and jolting as are instruments on a car. It is also found that there is some chance for poor contact at the plug or hook which is used to connect with the telephone circuit, where car or portable telephones are employed. Neither of these objections, however, have proved insurmountable. The plan of having a telephone for every car in operation is much more flexible than the other, and the investment is likely to be less to secure the same results if the telephone instruments are placed on the cars rather than in booths, because of the large number of telephone instruments and booths or boxes that must be installed if communication is made convenient from any point along the road.

Whichever system is used, or if the two systems are used in connection, it must be remembered that for despatching purposes it is important that a construction be adopted

which will be free from obscure line and instrument troubles. If telephones are placed in booths or boxes along the line things should be so arranged that both terminals of the telephone instrument will be absolutely disconnected from the line when the instrument is not in use. This can be done by a common double-pole knife switch closed before using the telephone and opened when through, but as this is likely to be forgotten or neglected some precaution is desirable which will automatically enforce the rule. A spring can be put on the switch which will hold it open except when the person talking holds it shut, or the closing of the door of the box or booth can be made to open the telephone circuit, or the weight of a person standing on a platform in front of the telephone can be made to close the circuit. This precaution of keeping the telephones out of circuit when not in use is important for two reasons. In the first place, talking is clearer if only one instrument besides the despatcher's is bridged across the telephone line. If a number of telephones are bridged across at once each takes a certain portion of the talking current, and if the battery of the transmitting instrument is weak very poor results may be obtained. In the second place, the telephones should be normally disconnected from the line because of possible damage to them by lightning. Since nothing is to be gained by having the instruments bridged across the line when no one is at a booth, there is everything to gain and nothing to loose by disconnecting them. Further than this, there is the chance that short circuits in one instrument would disable the whole despatching line were the instruments all normally bridged across the line. In such a case the quick location of the fault might be difficult. If the telephones are carried on the car the points to look out for especially are the selection and location of instruments so that they will not be injured easily, and the manner of connecting into the line so as to avoid trouble either from poor contacts or from short circuits in the contact device. Experience has demonstrated that plain, simple connecting devices with parts so open as to make short circuits both unlikely of occurrence and easy to see if they do occur, are more desirable than more compact jacks and plugs, which, although neat in appearance, may pull apart, leak or become short-circuited a dozen times where some plain, home-made contact device would never give trouble. With a form of connection switch in which the contacts are so wide apart as never to cause short circuits or leakage, the possible telephone despatching line troubles will be practically reduced to breakages of the line wires or other wires falling across them, and when an instrument is defective it is readily known.

Next comes the question as to how the despatching circuit is to be operated and whether it is to be used for business other than despatching. Probably the most advanced practice is that of certain large interurban systems which have two telephone circuits the entire length of their lines. One of these is used exclusively for despatching and the other for general business. On one of the roads referred to the despatcher has a head telephone like a central-office telephone operator, and this is kept constantly at his ear. When motormen call the despatcher for orders they simply connect in on the line and speak without ringing. In this case the ringing is not only unnecessary, but would be a nuisance, because of the liability that some motorman would ring for the despatcher just as some other man was talking. As it is he is obliged to listen before talking, and no confusion can occur. The line being used exclusively for despatching, the despatcher's head telephone is the only one permanently bridged across the line, and consequently the line is very clear talking and free from sources of possible trouble. When a road has not the advantage of a telephone circuit used exclusively for despatching business, and must, in addition, transact the general business of the road over the same wires that are used for despatching, it is necessary to have some ringing for signaling and numerous instruments bridged across the line, all of which interferes with the efficiency of the despatching system, but must be put up with in some cases.

For an interurban road with fast schedules the time that must be consumed in order to get orders from the despatcher must be considered. For this reason the latest and best practice in telephoning from the car makes it possible to receive despatcher's orders and be in motion in ten seconds from the time of coming to a stop. This is done by having the connection box so that it can be reached from the motorman's cab window. The car is run up beside the connection box, and the conductor makes the connection while the motorman receives the order. While the car is being slowed down the conductor is getting the flexible connection ready and the window open so that the instant the motorman has stopped the car he can step to the telephone and talk to the despatcher. As soon as orders are received the conductor disconnects while the motorman starts the car.

This explanation will illustrate a very important advantage which this system possesses, a feature of the greatest value in the handling of high-speed trains, and one which need not sacrifice the accuracy of transmitting orders or the safety of operation, which, being the most important factor, must, of course, be considered before all others.

As regards the manner of giving and receiving orders there is a great diversity of practice. To be secure against mistakes in understanding orders some roads have the motorman or conductor write the order down on blanks for the purpose where the order is anything more than a regular "O. K." giving permission to proceed on regular time to the next regular reporting point. In such case when a written order is taken it is read back to the despatcher for his "O. K." Other roads require orders to be simply repeated to the motorman by the conductor when standing at the telephone in the hearing of the despatcher.

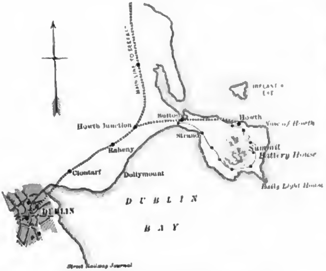
It has been remarked that men with steam-road training are much more likely to be watchful and obedient to rules in connection with train despatching than those with street railway experience, where no such rules are needed. Surprising as it may seem, cases have occurred on very high-speed electric roads where both motorman and conductor have left a regular passing point without orders and without meeting the opposing car, simply through carelessness and forgetfulness on the part of both trainmen simultaneously. These men were recruits from city railway service.

Of course, if conditions are such that station agents along the line can take and deliver train orders, steam-road methods can be followed, but on the majority of electric interurban roads such is not the case, and it is to this majority that the ideas expressed in the foregoing paragraphs apply.

The Sutton and Howth Tramway

The Great Northern Railway Company of Ireland recently opened an electric railway in the vicinity of Dublin, which is intended for use as a feeder to the trains on the Sutton and Howth branch line.

The railway line from the city skirts Dublin Bay, passing through Clontarf and Raheny, and, after leaving the main line to Belfast at Howth Junction, runs through Sutton and finally terminates at the little village of Howth, close to the harbor.



MAP OF THE SUTTON AND HOWTH RAILWAY

The Hill of Howth, which rises to 578 ft. above the sea level, affords a commanding view of Dublin Bay and its picturesque surroundings, from Kingstown and Dalkey in the south, to the Mourne Mountains in the north. It has for a long time been a place of resort for Dublin holiday makers, and the opening of the electric line furnishes a cheap and easy method of enjoying one of the most beautiful sea views to be obtained in Ireland without the fatigue formerly attending the hill climbing.

The tramway starts from the railway station at Sutton, and, while gradually ascending, skirts the Hill until the summit is reached at 3½ miles, then, with a descent of 1¾ miles into Howth, makes connection with the main line railway into Dublin.

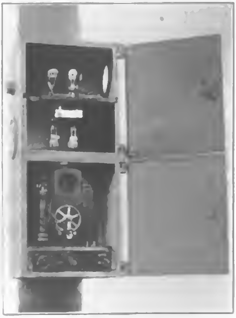
The chief difficulties that had to be encountered were in

SUTTON RAILWAY STATION AFTER ARRIVAL OF TRAIN FROM DUBLIN

connection with the steep gradients on the Howth side of the Hill, where long S-shaped curves have been constructed in order to reduce the rise to one in twenty, which is continuous for the whole of the 1¾ miles from the railway station to the summit.

The work was designed and completed under the supervision of W. H. Mills, the railway company's engineer-in-chief. Dr. Kennedy was consulted and entrusted with the electrical equipment.

STEEL BRIDGE CARRYING TRAMWAY INTO RAILWAY STATION AT HOWTH



COMBINED SIGNAL AND TELEPHONE BOX

The power house is situated at Sutton, and is a handsome red brick building faced with white stone, and contains the generating plant, installed by Ernest Scott & Mountain, of Newcastle. This equipment consists of three vertical compound non-condensing steam engines, running at 350 r. p. m., coupled to direct-current, compound-wound generators. These units have a capacity of 125 kw

at full load, and supply current to the line at a pressure of 550 volts. Over each machine is fixed a sliding contact switch for varying the compounding by altering the number of coils in series.

A boosting set, composed of two negative boosters, driven by a motor is installed. The field coils of the boosters are separately excited, and the necessary variation in voltage is obtained by regulating resistances.

Two return feeders are connected to the rails at points approximately two miles distant, through which the boosters draw a part of the return current. The boosters are bipolar, and have a capacity of 160 amps., at 100 volts.

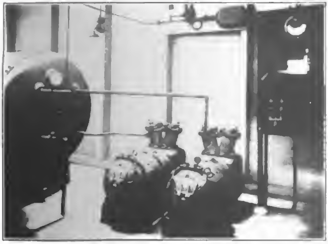
The switchboard, made by the General Electric Company, consists of three feeder, three machine, and two battery panels; the instruments are of the Kelvin and British Thomson-Houston pattern.

Three Lancashire boilers, 30 ft. long by 8 ft. 6 ins. in diameter, supply steam at a pressure of 160 lbs. per sq. in., and are fitted with drums in order to ensure the supply of dry steam. The main flue is built above ground, the sections increasing toward the shaft, so as to permit of further extensions. The shaft is 120 ft. high, with an internal diameter of 8 ft. 6 ins., and contains a firebrick lining built clear of the outside walls.

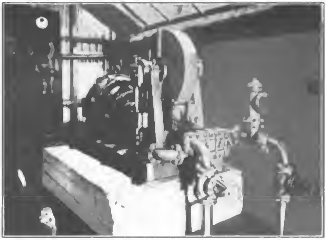
An injector and two 3-throw electrically-driven pumps have been provided for supplying water to the boilers, drawing from a 4000-gallon tank placed outside the boiler house, 17 ft. from the ground. A reserve supply of water has been provided by the erection of a tank with a capacity of 20,000 gallons, 20 ft. from the ground. The pipe connections are designed so that water may be drawn from these tanks in case of fire. The boiler feed pumps supply the necessary pressure, and as these are electrically driven, they can be put in use at any time in the day or night, current being always available from the main generators or the battery station.

The tanks are supplied with water from

TRAMWAY STATION ON ROAD TO SUMMIT, WITH VIEW OF IRELAND'S EYE



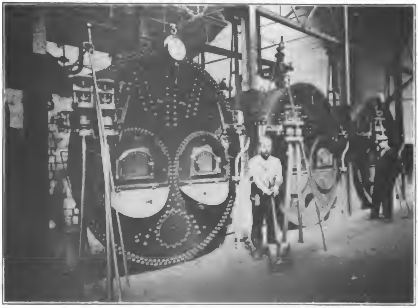
WESTINGHOUSE AIR COMPRESSORS FOR CHARGING CAR BRAKE RESERVOIR



ONE OF THE SCOTT & MOUNTAIN ELECTRICALLY-DRIVEN BOILER FEED PUMPS

ENGINE ROOM, SHOWING SCOTT & MOUNTAIN GENERATING SETS

a well by means of Pulsometer and Worthington steam pumps. This water is exceedingly hard, and water softening apparatus of the Archbutt-Deley type is in course of erection, capable of dealing with 1600 gals. per hour. A feed heater of the vertical type is connected to the exhaust pipe from the engines.



LANCASHIRE BOILERS IN POWER HOUSE

The car house at Sutton is a substantial frame building, in which three tracks are laid, and accommodation provided for 15 cars. Here are situated the workshops, fitted with electrically-driven machine tools, so that repairs may be made without delay.

The rolling stock consists of double-deck cars, with seating accommodation for 67 passengers. The cars are carried on double-bogie Brill trucks, fitted with two 37½-hp Westinghouse motors. Three brakes are provided, namely, the ordinary hand brake, an electric brake, fitted to the B 18 British Thomson-Houston controller, and a Westinghouse air brake. The Westinghouse brake is operated by air at 75 lbs. pressure per square inch, which is obtained from storage reservoirs, consisting of long cylindrical drums placed under the car seats. The cars are charged from a storage reservoir in the car house, which is fed by motor-driven compressors, supplied by the Westinghouse Company. The car reservoirs, when fully charged, contain sufficient air to make forty stops, with a reduction in pressure of 25 lbs.

The overhead construction consists of a single 0000 trolley wire, with double construction at passing places every half mile along the route. The current is fed to the line at every quarter of a mile, and section insulation is provided at every half mile.

A signalling system has been established throughout the line, by means of which any section, between two loops, can be blocked on or off by means of electric lamps controlled by suitable switches. The lamps are contained in combined signal and telephone boxes, which are erected along the route at each loop. These boxes consist of two compartments, one containing the telephone and the other the signalling lamps, with the necessary operative switches. Perforated holes allow the heat from the lamps to circulate through the telephone compartments, and so keep the instruments in good condition and free from moisture.

SWITCHBOARD IN POWER STATION

STELLA MARIS VIADUCT ON SUTTON SIDE OF HILL, 400 FEET ABOVE SEA LEVEL, BAILEY LIGHT IN THE DISTANCE

There are two feeder cables, supplied by the British Insulated Wire Company, consisting of paper insulated, lead covered and armored conductors, feeding round the Hill in opposite directions—No. 1 from Sutton, along the tramway to the battery station, and No. 2 along the railway line, passing up the hill to the battery house, via Howth station.

Leaving Sutton railway station the tram line runs on the company's own land to the Sutton cross roads, where the Dublin United Company's system is crossed. The gage of the track is 5 ft. 3 ins., and consists of 72-lb. bullhead rails, carried on cast iron chairs, on sleepers placed 2 ft. 8 ins. apart. The work is substantial in character and similar to the company's standard practice on its main line. Passing

the gates of the Golfers Hotel, lately erected by the Irish Tourist Development Company, the line runs on the right-hand side of the road, on a track raised 6 ins. above the road level, and close to the sea, which is left behind half a mile farther on, where the ascent of the hill commences. As the ascent is made there are varying gradients up to 1 in 16.7, and as the height increases a magnificent panoramic view opens out, with the city of Dublin in the distance and the narrow isthmus joining the Howth peninsula to the main land in the foreground, while far away to the north the Mourne Mountains, in County Down, may be seen beyond a stretch of 50 miles of sea, and to the south and west the waters of Dublin Bay, with the Wicklow Mountains in the background. The sea view is uninterrupted, and higher up opens out to the west when the Baily Post Office is reached, 2¾ miles up the line. The route now enters the company's ground, and after running along a steep embankment overlooking the Baily lighthouse, and crossing the Stella Maris Viaduct, a handsome structure in masonry, again joins the main road, which is skirted for a distance of 200 yards at a height of 400 ft. above the sea level, when private ground is again entered, and with a continuous rise of one in twenty the summit is reached, after a trip of 3¾ miles.

At this point is situated the sub-station, equipped with a battery of 255 Tudor cells of 200-amp hours capacity, with the necessary booster for charging and attendant switch gear.

The railway company has bought land at the summit, which is being ornamentally laid out as a park. A pretty tea house has been erected for the accommodation of visitors, upon a point which allows the finest views being enjoyed from its verandas.

On leaving the summit the line runs entirely through the company's grounds, and with a continuously-descending gradient of one in twenty, during which many sharp curves are encountered, Howth is reached after crossing a fine steel bridge leading into the railway station.

The railway company has spared no expense to ensure the comfort of visitors, and to make the line attractive to them. The railway stations at Howth and Sutton have been furnished throughout with electric light, which has also been installed at the cross roads and passing places along the route.

It is announced that the traffic arrangements are in the hands of Henry Plews, the general manager of the company.

Tunnel Franchises

One tunnel under the East River, connecting the Borough of Manhattan with Brooklyn, is now assured, and another is in contemplation. On advice of counsel that it might be illegal and would be unjust to accept a bid for the Brooklyn tunnel which included the construction of an underground road from Forty-Second Street to Union Square, because such an offer had not been invited, the Rapid Transit Commission last week accepted the Belmont-McDonald syndicate's proposal to build the Brooklyn extension for $2,000,000. Undoubtedly the alternative bid would otherwise have been accepted and was put aside with regret, as the commission regards that proposition favorably and will be pleased to have it renewed in proper form at an early day, when a line north from Union Square, connecting with the proposed crosstown tunnel to the Pennsylvania Railroad will be added to the original system.

According to the plans of the Rapid Transit Commission the tunnel will be burrowed from Broadway and Ann Street, New York, to Flatbush and Atlantic Avenues, in Brooklyn. Ann Street is where the Manhattan-Bronx line has its downtown end. After leaving that street the new tunnel will run down Broadway to Bowling Green, with stations at Fulton and Wall Streets. At Bowling Green the Brooklyn line proper will diverge, while an additional loop will go under Battery Park and furnish an outlet to the ferries at the foot of Whitehall Street. When the course of the Brooklyn line leaves Bowling Green it will strike the East River east of Whitehall Street. Under the river the construction will be similar to that being used in going beneath the Harlem at Lenox Avenue and 148th Street. There will be two steel tubes, each with a track in it, lined and covered with concrete. The tubes will be connected, and they will enter the Borough of Brooklyn at the foot of Joralemon Street, after which the line will extend to Fulton Street, to Flatbush Avenue, and out to the junction of Flatbush and Atlantic Avenues, where the station of the Long Island Railroad is situated.

Upon the completion of the discussion of the original tunnel plan and its award to the Belmont-McDonald syndicate by the Rapid Transit Commission, a resolution was introduced providing "that the chief engineer be directed to prepare and submit to the board routes and a general plan for a rapid transit railroad which shall, as directly as practicable, connect the general region of the City Hall Park, in the Borough of Manhattan, with the general region of Borough Hall Park, or some other equally convenient passenger transportation center in the Borough of Brooklyn." President Orr offered the following explanation: "It is the intention and desire of the board that the amount of money for municipal rapid transit construction which has been saved to the city by the bid of the Rapid Transit Subway Construction Company for $2,000,000, instead of for the estimated actual cost of such construction, being the sum of $8,000,000, shall, if practicable, upon reasonable terms be applied to some rapid transit connection between the Boroughs of Brooklyn and Manhattan, which shall secure to the maority of the citizens of Brooklyn who do business in Manhattan, and are not adequately served by the other rapid transit facilities, rapid transit service between their homes in Brooklyn and the business section of Manhattan for the single fare per entire trip not exceeding 5 cents." The resolution was accordingly adopted.

The East Side branch of the rapid transit subway system is now practically assured, as it is the intention of the Rapid Transit Commission to take up the subject, together with the proposed extension through Broadway from Forty-Second Street to Union Square, in the autumn. Borough President Haffen, of the Bronx, says that he has "received positive assurances from all the city authorities that the East Side subway will not only be constructed, but that its authorization is of the very immediate future."

A public hearing by the aldermanic committee on bridges and tunnels in reference to the approval of a route for the New York and New Jersey company to build and operate a tunnel from New Jersey to New York, with a terminal about Christopher and Tenth Streets, was held last week. No one appeared against the proposition. Former Assistant Secretary of the Navy William McAdoo, as counsel for the corporation, spoke in favor of the route. The committee will give another hearing.

Trolley Omnibus Line Between Nice and Upper Monte Carlo

The auto-trolley system of omnibuses finds favor in many parts of Europe, where the authorities will not permit the laying of rails and the employment of the usual methods of operation. One advantage is that these cars may move freely from the extreme of one side of the street to the other, whether the roadway be wide or narrow, and without reference to the relative location of the overhead wires or the pole line. This is a very important factor for localities in which public authorities hesitate to make over any special portion of the road to transportation companies, and it overcomes, at once, the objection to the ordinary street railway and the double-trolley omnibus system, for while the latter provides for a possible side deviation of ten feet, it is pointed out that it might be very difficult in practice to handle these cars in case of emergency and in crowded streets. For instance, whenever a sudden turnout is to be made at a sharp angle from the overhead line, there is great risk of the ordinary trolleys leaving the wire. This would, of necessity, disable the car altogether, as a failure to apply the brakes promptly would result in the vehicle going too far away from the overhead wires, thus cutting off its current supply until it could be hauled back into position to reach the line. On the other hand, it is claimed for the auto-trolley that the flexible cable provides against such contingency, and meets all the requirements of the public authorities in France and other European countries where similar conditions obtain, as it is free to turn to either side in as short a space as an ordinary automobile, and is entirely independent of its relative position, so far as its overhead connections to the trolley wire are concerned.

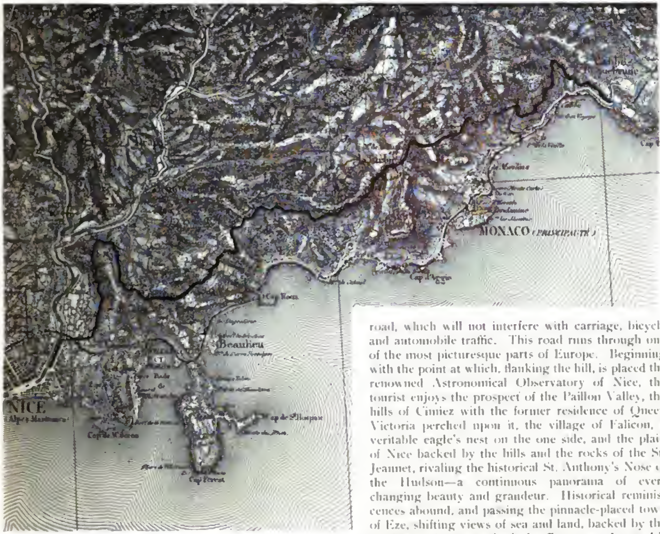
In the accompanying views, these features are very clearly illustrated. Reproductions from photographs are presented, showing 'buses of this kind in operation under widely varying conditions. One of these shows a car in normal position passing along a boulevard or driveway where there is a straight road; another shows the 'bus in a crowded, narrow court obstructed by carts and trucks, among which it must slowly thread its devious way, while a third shows the operator in the act of making a quick, sharp turn. A view is also presented showing one of these cars in what would be called, in this country, an alley-way, passing a two-wheeled cart in a road where there is barely room to turn out. Here the pole line is carried along the fence or garden wall, and the overhead wires are suspended from brackets attached to the poles. These views show very clearly the great flexibility of the system for which such strong claims are urged by those familiar with its operation, and they also afford an excellent opportunity of forming an opinion as to the appearance of the overhead construction.

AUTO-TROLLEY OMNIBUS IN NORMAL POSITION ON STRAIGHT ROAD

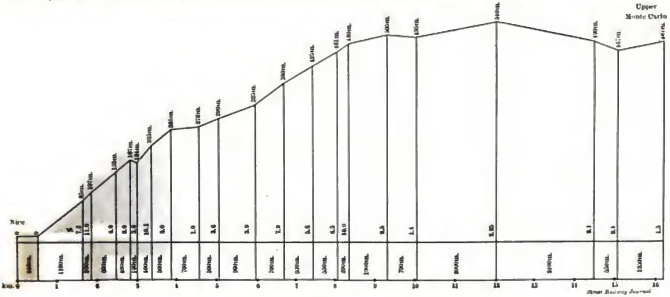
Trackless trolley lines can only be utilized to the best advantage along well paved streets, but it is not difficult to find thoroughfares that will answer the purpose in most European countries, even in out-of-the-way places and along the mountain roads. This is especially true in localities much frequented by tourists, where a trolley line, similar to those common in America, would be generally opposed, on the ground that it would be liable to detract from the natural beauty of the scene. In such places, the auto-trolley omnibus may find a distinctive field. It has already been installed in France at Fontainebleau, and at Eberswalde near Berlin in Germany, and now it is proposed to install an important line along the Corniche Road from Nice to Upper Monte Carlo. This, undoubtedly, will be the most important undertaking of this character that has yet been attempted, and will be of interest not only to

street railway men, but to American tourists and European travelers.

The Corniche Road was built by Napoleon I. and has been made famous by renowned writers, but it has been practically inaccessible, excepting to tourists who have had almost unlimited facilities, both in time and money. Consequently, it offers an exceptional opportunity for a well-built, properly-managed and luxuriously-equipped electric road, which will not interfere with carriage, bicycle and automobile traffic. This road runs through one of the most picturesque parts of Europe. Beginning with the point at which, flanking the hill, is placed the renowned Astronomical Observatory of Nice, the tourist enjoys the prospect of the Paillon Valley, the hills of Cimiez with the former residence of Queen Victoria perched upon it, the village of Falicon, a veritable eagle's nest on the one side, and the plain of Nice backed by the hills and the rocks of the St. Jeannet, rivaling the historical St. Anthony's Nose of the Hudson—a continuous panorama of ever-changing beauty and grandeur. Historical reminiscences abound, and passing the pinnacle-placed town of Eze, shifting views of sea and land, backed by the kaleidoscopic atmospherical effects on the multi-colored rocks of the Riveria and the cerulean Mediterranean form a trip of variety and of æsthetic attraction, unequalled elsewhere, in the opinion of travelers who have been so fortunate as to have made it.



AUTO-TROLLEY OMNIBUS LINE BETWEEN NICE AND UPPER MONTE CARLO BY THE FAMOUS CORNICHE ROAD



PROFILE OF ROAD BETWEEN NICE AND UPPER MONTE CARLO

Because of the historical associations and the surpassing beauty of the scene, the French people and the French Government have persistently refused permission for the building of a trolley line or other railroad that would necessitate cutting up the roadway, but consent was readily obtained for the establishment of an auto-trolley omnibus system of the Lombard-Gerin type, and a concession, or fifty-year franchise, was granted by the government to G. Sacco Albanese, an engineer of Nice, who has undertaken the completion of the road before the end of the present year. It is proposed to procure current for the operation of the line from the Mediterranean Power Company, which has an electric power station at Nice, and others at convenient points where water power is available for driving generators. This will greatly simplify the problem, as it will be necessary only to provide for the transmission and distribution of power, and no delay will be experienced on account of the building of a power house. Current will be furnished by the Mediterranean Power Company at 10,000 volts, and it will be transformed at sub-stations located at each end of the line and one midway, and then delivered at 500 or 550 volts to the motors. The overhead construction will be designed with a view to detracting as little as possible from the natural beauty of the scene. Special ornamental iron poles will be used within the city limits and wooden poles along the road out of town. The details of line construction are clearly shown in the accompanying cuts.

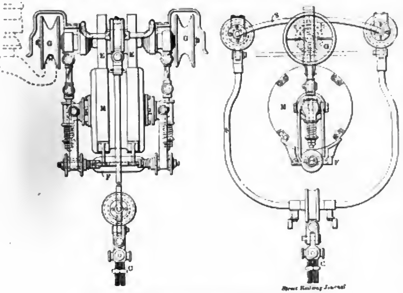
CHANGING CONNECTIONS WHILE PASSING

When the line is opened, the first of the year, twelve omnibuses or cars will be operated, and each car will be arranged to carry sixteen passengers, twelve seated and

IN A NARROW AND CROWDED COURT

four standing. On other lines, larger cars have been used, the capacity of which was twenty-two, sixteen seated and six standing, but, in this connection, it was decided to keep the weight of the cars as low as possible, owing to the heavy grades all along the road. Mr. Albanese, who has furnished the information about this installation, estimates that the cost of construction for 20 km of line, including three sub-stations and equipment, car shops, twelve cars and all accessories for the operation of the system, will not exceed $200,000.

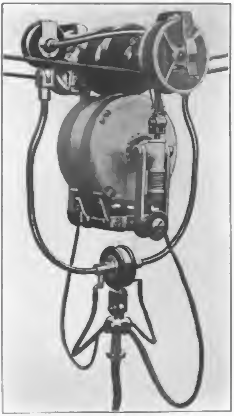
The system to be installed is a development of the Lombard-Gerin auto-trolley system of Paris, the principal feature of which is the auto-trolley attachment, or current



DETAILS OF LOMBARD-GERIN COLLECTOR

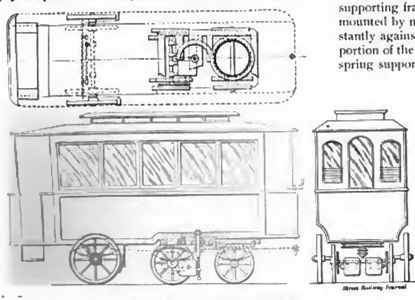
collector, which comprises a small three-phase motor suspended between the two conducting trolley wires, set twelve inches apart and supported by ears fixed on a ∩-shaped double suspension, which, as in ordinary underrunning trolley construction, is either hung between span wires or supported by a bracket. The motor is hung on a frame which supports, at the same time, two trolley wheels. It is of the fixed armature type, and its pole pieces impart a rotary movement through fibre friction wheels to the two trolleys which are on the same axle and run over the trolley wires. An even friction adjustment is obtained by the regulation of special suspension springs.

The design, construction and application of the collector

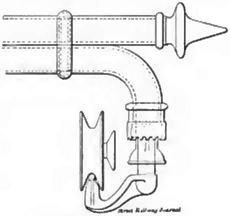


CURRENT COLLECTOR ON THE LINE

are clearly shown in the half-tones and diagrams herewith presented. It will be noticed, by reference to the diagrams, that on the shaft which carries the trolley wheels, *G*, and between these and the hard rubber discs, *E*, is the supporting frame of the motor, *M*, on which the motor is mounted by means of springs which press the motor constantly against the hard rubber driving discs. The outer portion of the motor, and not the inner one, revolves. Two spring supports carry the armature shaft with which they are rigidly connected. The motor is very light, weighing with its accessories only 40 lbs., and is supported by two aluminum plates. The shaft revolves in ball bearings. Beneath the motor are four movable shoes, *F*, carried by an iron core supporting an induction coil, which is connected to the brake contact point of the controller. When



DETAILS OF CAR CONSTRUCTION



OVERHEAD CONSTRUCTION

current is sent into this coil the shoes are magnetized, and are attracted toward the revolving motor-frame, thus preventing it from turning. This, in turn, will clamp the collector spools and will prevent the contact carriage from rolling back, should the current be suddenly cut off while ascending a grade or when it is desired to stop on steep grades.

A flexible cable leads the current from the main line to the car and the three-phase current from the car to the little trolley motor, which is fed from the motors which run the vehicle. This is done by means of taps taken at the back of the armature and connected to three collector rings fixed on the shaft, as is usually done in ordinary rotaries.

As the speed of a three-phase motor is synchronous with the current feeding it, it is evident that the trolley motor runs automatically at a speed proportional to that of the motor on the vehicle. In this special case, the proportion of gearing has been so calculated as to allow the trolley motor a little lead over the car itself, in order to have the flexible cable at the proper tension, and this characteristic has earned for it the name of "blindman's dog," which describes, graphically, the respective positions of the trolley motor and the vehicle itself.

MAKING A SHARP TURN

Some very interesting data upon the design and construction of the Lombard-Gerin type of auto-trolley omnibusses has been contributed in a paper by Thomas Marcher, as a result of his practical experience with this apparatus. He points out that the cars for such systems partake of the characteristics of the omnibus and the ordinary street car, differing from the latter, principally, in being built much lighter and, of course, in a modified form so as to permit steering like the ordinary road wagon or automobile. The body should be constructed of wood and the frame partly of tubing and partly of wood. In distributing the load it has been found that the forward platform should be reserved for the exclusive use of the operator, and it is usually shut off entirely from the interior of the car, while the rear platform is only big enough to hold four to six persons, when the seating capacity is twelve and sixteen, respectively. This precaution is deemed necessary, so as not to cause an uneven pressure on the springs, which rest on the axle bearings. In order to get a uniform distribution of the weight in a varying load, compound springs, that is, spiral and leaf springs, are used. On account of these springs and because of the fact that the axles and the car body do not always occupy the same relative position toward each other, the power is not transmitted by means of gears, but by a chain. It has been found advisable to use seperate motors for each axle, and in this way the speed of each wheel is entirely independent of the others, while a wide range in speed regulation may also be obtained. Generally, series motors are used. They are built of light cast-steel, and, in the main, resemble ordinary street car motors. Both electrical and mechanical brakes are provided. The controller occupies the usual place on the front platform that it does on a street car, and it is operated in the same way by the motorman.

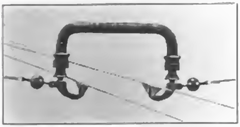
The wheels have wooden spokes and rims from 16 to 20 mm in thickness, and are supplied with rubber tires. It is common, however, to cover the wheels with ropes composed of aloe fibres, which insure good adhesion, especially on smooth roadways. The rear wheels are generally larger than those on the front axle, which are used for steering, and consequently have to pass under the car body. Two methods of steering are employed, namely, the common method of turning the axle about a king-pin, and the individual wheel method. A modification is shown in the equipment of a car, the details of which are illustrated herewith. In this arrangement it will be seen that a small pinion meshes into the large wheel, which has teeth cut around a part of its circumference, and is held in the car frame. A track is built around the king-pin under the car body. The vehicle is steered by means of the front axle, which is operated by the attachment mentioned.

The trolley wire can be suspended freely in the center of the street or on poles and brackets, the latter being, of course, the cheaper method. There may be either two or four trolley wires, including the return. On single-line roads, overhead switches are provided, or the cable may be exchanged when two cars pass each other, as is being done on two of the cars shown in one of the accompanying cuts. For this purpose there is a pin contact at the lower end of the flexible cable. It is proposed, on the Turbie line between Nice and Upper Monte Carlo, to have the trolley poles constructed so that they may be lowered, and thus the conductor will not be obliged to climb on the roof. When the traffic is heavy, a double line is installed. The lowest point of the trolley wire is 5 m above the ground and the pole is generally 8 m high. The normal

distance between poles is between 35 m and 40 m. The span and anchor wires are made of 5 mm steel, having a tensile strength of about 70 kg per square meter, while the copper trolley wire has a strength of 40 km. The insulators are designed especially for this service to stand heavy pull and pressure, and not absorb moisture. Soldering of the trolley wires is avoided, as special sleeves are used for connectors. The details of the overhead construction are very clearly shown in the accompanying cuts.

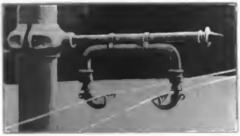
The cars are equipped with signal bells and the collectors are lighted by colored lamps, so that the direction in which the car is moving can be readily distinguished.

Mr. Marcher has made a series of tests of the amount of power required for operating cars upon trackless trolley lines, with the view of comparing the actual cost with that of systems employing rails, and he is convinced that auto-trolley cars must be built as lightly as possible in order to make a satisfactory showing by comparison. If the weight



OVERHEAD CONSTRUCTION, SUPPORTED BY SPAN WIRES

of a bus is as great as that of an ordinary trolley car, say 9 tons, three times as much power would be required to operate it, and for a wagon weighing as much as a car for



BRACKET SUPPORT

AUTO-TROLLEY LINE ON ROAD TOO NARROW FOR STREET RAILWAY

mixed service, namely, twelve tons, four times as much power would be consumed. The report of these tests indicates that accumulator cars are not adapted for trackless roads, and this assumption has been borne out by the records of performances in actual practice elsewhere.

Mr. Albanese has furnished some data upon the cost of operation of the experimental line at Fontainebleau near Paris, where a car was in service 110 days over 2.5 miles of road, making a total of 5,428 car miles, for which the following operating expenses were charged against it:

Cost of power at 3 cents per kw-hour.	$162.84 or .0300 per car mile
Repairs and care of cars and sheds, etc.	155.19 or .0286 per car mile
Employees (one man per car)	91.20 or .0168 per car mile
General expenses	61.51 or .0113 per car mile
Total	$470.74 or .0867 per car mile

The total receipts were $995.14 or 18.3 cents per car mile, and as the expenses were 8.6 cents per car mile, this left a surplus amounting to 9.7 cents per car mile to take care of interest and depreciation and pay dividends. The rate of fare charged, the possible earning capacity of the equipment under these conditions, and other items that would have a bearing on the problem are not given, but it is to be presumed that this is a fair showing, at least, for the plant.

Another installation, described by Mr. Marcher in his paper, offers some data of interest. This road is 5 km in length, and there are twelve cars operated under ten-minute headway on week days and five-minute headway on Sundays. The cost of construction and equipment is given as follows:

Five km of overhead construction	$15,000
Twelve cars	22,500
One car house and small office equipment	6,500
Transport, packing, interest, superintendence and incidentals	2,500
Totals	46,500

The following statement of the expenses and receipts for a year are given:

Expenses.	
1.—Salaries:—	
One superintendent and inspector	$750.00
Twelve motormen at $300	3,600.00
Two car cleaners at $225	450.00
One machinist	300.00
2.—Office expenses, material and lighting of cars	500.00
3.—Repairs on cars and line	625.00
4.—Sinking fund and 10 per cent interest	4,650.00
5.—Taxes, uniforms, sick fund, etc.	375.00
6.—Current:—	
(a) Sundays and holidays: 6-hp x 14 hours x 12 cars x 70 days x 2½ cents	1,764.00
(b) Week days: 5-hp x 14 hours x 6 cars x 295 days x 2½ cents	3,097.50
Total	$16,111.50
Receipts.	
(a) Sundays and holidays	$11,025.00
(b) Week days	12,390.00
Total	$23,415.00

Meeting of the Association of Municipal Tramway Managers of Great Britain

The organization of the above association, which has already been announced in these pages, was completed last month, when the new association held its first annual meeting, July 3, in the Royal Agricultural Hall, in London. There was a large and very representative attendance. Mr. Young, of Glasgow, who had been elected president of the association, outlined in his presidential address the extent of the municipal tramway business in Great Britain and the plans and scope of the new association. Among other things he said:

"Municipalities in Britain now own and operate about 1200 miles (single track) of tramways, and have invested over £15,000,000 in these undertakings. This year, again, there are bills and orders before Parliament for further extensions of municipal tramway systems.

"What should be the objects of this association? First, I would say, the association is not formed in opposition to any other tramways association. On the contrary, I feel sure our desire, as individuals and as an association, is to work cordially alongside of other managers and associations so far as we have interests in common. I don't think there is, and there never should be, any jealousy or exclusiveness among managers, municipal or otherwise, in connection with the construction and working of tramways. So far as my experience goes, I should say the courtesy and readiness to impart information shown by tramway men is above all praise. And I mean the compliment to be international."

Following the presidential address C. R. Bellamy, of Liverpool, read a paper on "Some Traffic Problems." An abstract of this and the other papers presented at the meeting follow:

SOME TRAFFIC PROBLEMS

BY C. R. BELLAMY,

General Manager of the Liverpool Corporation Tramways

"In Liverpool under horse traction in 1897 (the last year of company management), with but few exceptions, a twopenny fare was the minimum, with an average stage of 2½ miles; to-day penny stages are in operation, covering, practically, the same distances. Under the general Act of 1870 Parliament imposed an obligation on promoters to carry workmen at a minimum fare of 1 penny per mile. Under recent powers conferred upon local authorities for the electrification of their tramways the rate is reduced to 1 halfpenny per mile, with a minimum fare of 1 penny. In Liverpool and other towns it has been found possible to apply this rate, or something better, to all classes of passengers, but still the public are asking for more.

"The question of how far a workman resides from his work is of no moment; the important considerations are: How many minutes need be occupied in covering the distance, and the cost of doing it. If we accept the principle that a wider distribution of the inhabitants in large towns is desirable, it is important that long-distance passengers should be specially considered, and that they should be carried to the outskirts, where land is plentiful, as cheaply and as speedily as possible. The cost is governed by the unit fare, and the speed, unfortunately, by the Board of Trade regulation, which I will deal with later.

"Dealing with the unit fare, it is reasonable that the short-distance rider in the heart of the city should pay relatively more for his ride, seeing that valuable time is saved to him as a result of the concentration of the cars from all routes in the central area, where there is always one at his disposal to travel from point to point in the business zone.

"It is frequently urged that if a passenger can be carried at the rate of 2 miles for 1 penny he can be carried for 1 mile at a cost of 1 halfpenny, and there would be weight in the contention if it were not for the considerations I have referred to.

"I have gone carefully into the question of the effect of the introduction of a halfpenny 1-mile stage on the traffic receipts in Liverpool for the purpose of arriving at a definite conclusion in the matter. I caused a census to be taken of the distance traveled by each passenger on a typical route over a short but fairly representative period.

"I found that of the total passengers traveling 91 per cent paid penny fares; of this number 30 per cent rode less than 1 mile, and 30 per cent less than 1½ miles. Of the latter it is fair to assume that under half-mile stages at least half the passengers in that group would take advantage of them by walking to the halfpenny limit, and I may, therefore, reasonably calculate that under such stages 45 per cent of the present penny passengers would pay halfpenny fares. On my present revenue this would mean a diminution of over £84,400 per annum.

"The principal argument in favor of halfpenny fares is that a great number of short-distance passengers are secured who would not pay a penny fare. I do not know whether an accurate measure has been obtained to substantiate this view, but as the result of my investigation, the figures prove that under such reduction an increase of 40 per cent, or 40,000,000 passengers, would be required to maintain the present traffic receipts; but having regard to the fact that a large increase in the rolling stock, staff and maintenance charges would be involved, it is not unreasonable to assume that an increase in the number of passengers carried of at least 50 per cent would be necessary to counteract the falling off in receipts.

"Having regard to the fact that we are carrying considerably over 1,000,000 passengers per track mile per annum in a city, the business center of which is on the river, with 200,000 people on the other side who are carried by boat, it is exceedingly unlikely that any such increase could take place, and the inevitable result would be that the long-distance passenger could not be given the advantages which he is allowed under the present system.

"I do not advance any strong objection to half-mile halfpenny stages, but I am convinced that, if they were introduced, the force of public opinion would make it impossible to resist the argument that halfpenny stages should approximate *pro rata* in length to the penny stages, and the disastrous results which I have proved would follow, and would certainly render it necessary to increase the fares very considerably on the longer stages. I submit the proposition that the unit fare and stage should be fixed, so as to secure that the passenger traveling to the outskirts of a large town, a distance of four or five miles, can be carried for a fare not exceeding twopence, and that this cannot be done with a halfpenny-mile unit.

"I have earlier pointed out that one of the main considerations in the minds alike of business men and workmen in selecting a residence is the time occupied in going to and from his place of business or work center.

"Under the present restrictions imposed by the Board of Trade one of the great benefits of electric traction—viz.: rapid transit—is very much reduced. I have frequently pointed out to official inspectors (whose individual courtesy and consideration I gratefully acknowledge) the unreasonable limitation of speed of electric tramcars, which are confined to a definite track, with brake appliances capable of bringing them to rest under almost any conditions in about twice their own length, to 6 miles, or 8 miles, or 10 miles per hour, whilst horse-drawn vehicles, which are entitled to use any part of the road, commonly travel at 10 miles or 12 miles an hour, and motor cars are allowed a limit of 14 miles an hour; and everyone is familiar with the cyclist, who is practically free from all speed restrictions

"What has been very aptly described by Mr. Trotter as 'journalistic sensationism' has induced the popular belief that electric tramcars are a source of untold danger to pedestrian traffic, and has filled the Patent Office with appliances, generally wrongly designed, to prevent accidents, which statistics have shown to be so rare as to be almost negligible.

"In Liverpool, with about 5000 cars running in and out of the city daily, and carrying well over 101,000,000 of passengers per annum, there were only during last year nine fatalities directly attributable to the running of tramcars, the ratio to passengers carried being one in 11,250,000, whilst under horse traction, in 1898, the ratio was one in 6,000,000; and I have no hesitation in affirming that the comparative risk to pedestrians has actually been reduced by the introduction of electric traction, and it certainly is noteworthy that as compared with nine persons killed by tramcars in Liverpool in 1901—each incident having a long and very often sensationally exaggerated press notice—thirty were killed during the same period by other vehicles, of which the public knew little or nothing, as they were scarcely referred to.

"As you are all aware, the Board of Trade has been approached on the subject of speed limitations, and I hope the members of this association will, after discussion, agree with me, as a result of their experience, that a maximum limit of from 15 miles to 20 miles per hour and a minimum of eight, excepting on crossings, curves and junctions, is safe and expedient.

"The third problem, which I think may be usefully discussed, is the question of—how best to secure greater comfort for outside passengers in inclement weather. When electric traction was introduced in Liverpool it was thought desirable to follow the Continental and American practice of adopting single-deck cars. The two main arguments in their favor were (first) that the speed would render outside traveling dangerous, and (second) that too much time would be occupied in ascending or descending the staircase. The first objection can only apply to one-half of the year, and the second was entirely met in Liverpool by adopting a staircase which enables conductors to refuse to stop the car excepting to the order of a person actually on the lower deck, as

the staircase can be safely used whilst the car is traveling at any speed.

"The fourth problem which I shall submit for your consideration, and which I shall make the last, having regard to the limits of human patience, is how to secure a full and speedy collection of fares. I think there is a general consensus of opinion that the box system has failed for the obvious reasons, among others, that no voucher is given for the fare, and no system of inspection can disclose whether a passenger has or has not paid.

"The bell punch and tickets, with a proper system of inspection, affords very great protection, but careful observation will disclose that a great many fares are missed, due either to the carelessness or cupidity of conductors or passengers.

"I have been very much impressed with the general honesty and care displayed by the majority of conductors, but in every large body of men there is sure to be a proportion that will take advantage, where possible, of any system, and I have found, unfortunately, that a small section of the public must be placed in the same category. Such persons soon familiarize themselves with the methods of open checking commonly in vogue, and manage to evade them, and after very careful consideration I came to the conclusion that this class of offense could be best dealt with by the detective staff of the police, and arrangements were made for a number of that body to be placed upon tramway duty. For the first few months they applied themselves wholly to the tramway staff, with the result that a considerable number of arrests were made, and convictions secured, and it was found that the fear of the unseen hand was the strongest possible deterrent, and pilfering by conductors, as far as any evidence could be obtained, was wholly stamped out, and the attention of the detective staff was devoted to a small but active section of the public, which was known to be evading its liabilities by very many ingenious methods, with the result that during last year over 400 persons were summoned or arrested, over half that number being for avoiding payment of fares.

"The effect has been exceedingly good, and has appreciably increased the revenue; the system is not only highly effective, but is very economical, as only four men are employed on the work, who are changed frequently to avoid any disclosure of identity, the total annual charge amounting to £400, which in Liverpool amounts to about £1 per car per annum.

"Passenger checking is an important part of tramway management. It is earnestly hoped that a free and general discussion will follow upon the problems raised."

POWER WORKING STATION

BY A. L. C. FELL,

General Manager of the Sheffield Corporation Tramways

"In the majority of tramway undertakings the tendency is to start by putting down a power station too small to cope with the expansion of the scheme which invariably takes place immediately after the routes are opened for traffic. As corporation rate-payers and company shareholders are very loth to put down their money for what they invariably call an experiment, it is necessary for the engineer to formulate in his own mind a complete scheme, and then see what is the least he can do with for a start. In all cases the original power station buildings should be so designed that they will form the nucleus for the extended buildings, the ends being built up in a temporary manner, so that they can be moved forward at a very small cost as extra plant is installed.

"In the writer's opinion it is a mistake to instal very large generating sets for a start. The size of the units should be gradually increased as the installation is extended, and they should be so arranged that two-thirds of the plant installed will do the maximum load. By this means much greater efficiency can be obtained, as large units have not got to be run when the load is very light, and the supply can at all times be regulated to meet the demand under more efficient conditions.

"It is important to see in what way manual labor in the power station can be replaced or reduced. In a small station this is not a very important matter, but in a large station great saving can be effected. Automatic coal and ash-conveying plants, stokers, and oiling arrangements are the most important items under this heading.

"The next point to consider is that of uniformity. This is very important, as it is on this that the question of spare parts depends. Wherever possible the wearing parts liable to require frequent renewal should be made interchangeable, and as far as possible uniformity of arrangement should be observed. All pipes, valves and connections to each set should be arranged as far as possible on the same plan. Also all switchboards and connections should be arranged in this manner, so that the attendants in the power station may be trained to work like machines, it will then be found that in a case of emergency requiring prompt attenton the attendants have not got to think, they simply act.

"Staff.—It is necessary to have a fully qualified electrical engineer in charge of the whole power station, and under him shift engineers, to actually run the plant. Until fairly recently the question of obtaining properly trained electrical engineers for the latter positions with a sufficient knowledge of mechanical engineering to take charge of the shifts was a difficult one. A low rate of salary being offered, only very inexperienced men applied, and these, although they might have had a very fair technical training, had no actual combined electrical and mechanical experience, so that in the majority of power stations it has been necessary to have an additional foreman to look after the more purely mechanical part of the plant. Happily, however, a new type of station engineer has arisen, viz.: the marine engineer who has given up seafaring, and has devoted a sufficient amount of time to electrical engineering to be able to deal with any ordinary problem that may arise.

"The wages question is getting a vexed one in power stations, but up-to-date machinery will gradually relieve the situation. At the present time trades union representatives do not appear to realize the fact that automatic machinery is doing away, to a great extent, with the necessity for skilled labor. For instance, taking the question of automatic stokers, if these are in operation, it should only be necessary, in a large power station, to have one leading fireman on each shift, and a few ordinary laborers to do any odd work that may be necessary. Before adopting automatic stokers it is necessary to consider whether the interest on the capital outlay and the cost of up-keep and operating the stokers will be balanced by the reduced cost of labor and the decrease in the cost of coal. The first item is not, but the second may be a large item, as automatic stokers require careful attention and fair treatment to make them efficient. In stations where boilers have been originally hand-fired there is naturally a very strong prejudice against automatic stokers, and they are not, sometimes, used to their best advantage. To get the full advantage of automatic stokers it is, of course, necessary to have automatic coal-handling plant, as the labor of placing the coal in the stoker hoppers costs nearly 60 per cent of the item for hand-firing, in addition to the time for looking after the stokers and driving gear. Cheaper and smaller coal can be used in automatic stokers, but it is found that where either forced or induced draught is in operation that a large proportion of the smaller coal is carried into the flues only partially consumed. Again, small coal invariably contains a greater percentage of non-combustible material, so that what is saved in first cost is spent in carriage and handling this matter both before and after it has passed through the fires. It is a question as to whether it is advisable to use washed coal, as unless the coal has an exceptionally high calorific value, the effective heating capacity is greatly reduced by having to evaporate so much water out of the coal. The writer would strongly recommend the use of washed coal if coal merchants would only charge for the quantity of coal weighed out to the boilers after it has been stored in the coal bunkers in the boiler house for at least forty-eight hours.

"Oil Separators.—Extracting the oil from the exhaust steam from the engines, so that the water from the condensers may be again fed into the boilers, is of vital importance, as a small proportion of oil will often cause very serious trouble in the boilers. The oil forms a deposit, and it is quite possible that this may cause a collapse in the crown of the boiler, as a non-conducting film is formed on the plates, and they may become red-hot. There are numerous chemical-methods of dealing with this matter, but they are all somewhat complicated, and require very careful attention. Filters for taking the oil out of the feed water are practically useless, as a large proportion of the oil forms an emulsion with the water, and passes through the filtering medium, and it does not separate until it comes into contact with the heating surface of the boiler. One of the simplest and best methods of dealing with this question is by using a separator, consisting of a large tank placed in series with the main exhaust pipe. This tank should be of sufficient capacity to sufficiently reduce the velocity of the steam, so that all solid particles of oil and water will separate out and drop into the bottom of the tank. To assist the separation, baffle plates, formed of angle iron, should be placed in the tank. The oil and water in the bottom of the tank is drawn off by means of a pump, and only the dry steam is allowed to pass away to the condenser. The only difficulty in connection with this matter is that if the steam is exhausted at a very high temperature it is necessary to use a fine cold water spray in the tank to reduce the temperature, otherwise a fairly large proportion of oil would pass away into the condenser in a state of vapor.

The following table gives a few figures showing the growth of

the Sheffield Power Station, giving the number of units generated, and the cost per unit for each half-year during which the electric tramway system has been in operation. It will be noted that the cost of power per passenger carried has been fairly uniform. The increase during the period from Dec. 25, 1899, to March 25, 1900, was due to the difficulties experienced with snow on the tracks. It will be seen throughout that the cost of power per passenger is slightly more in the winter than in the summer:

DATE	No. of Units Generated	Cost per Unit	No. of Passengers Carried	Cost of Power per Passenger Carried
1899. September 4th to December 25th	313,850	671d.	4,646,487	.06d.
1900. December 25th to March 25th	321,534	777d.	3,281,120	.07d.
March 25th to September 29th	1,002,064	758d.	16,550,287	.04d.
1901. September 29th to March 25th	1,498,546	672d.	17,635,418	.05d.
March 25th to September 29th	2,281,850	498d	25,627,849	.04d.
Sept. 29th, 1901, to March 25th, 1902	2,808,065	433d.	23,177,816	.05d.

BRAKES FOR TRAMCARS.

BY C. J. SPENCER,

General Manager of the Bradford Corporation Tramways

"The brake question is, perhaps, one of the most important problems with which tramway managers and engineers have to deal, and I respectfully ask you to pardon this plea for venturing to trespass on the valuable time and good nature of this assembly with a subject that may be considered somewhat hackneyed.

"A standard brake equipment for all conditions and circumstances cannot, I venture to say, be at the present time admitted as possible or desirable, though I certainly think that something could be done in the way of settling the vexed question of what

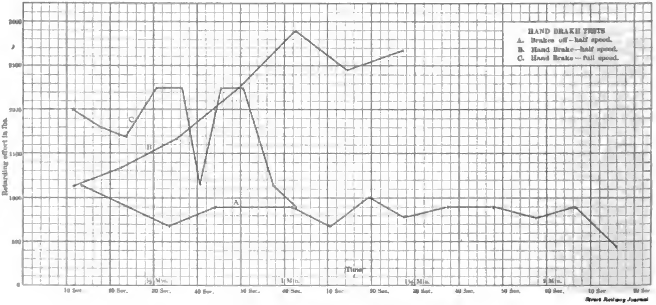


CHART NO. 1—DIAGRAM OF HAND BRAKE TESTS

type or design of brake is applicable and advisable for given conditions.

"Local conditions may be broadly divided into two classes. Towns with heavy grades, and towns without grades greater than one in twenty. Brakes may also be roughly divided similarly:

(1) "Brakes which retard by applying friction between the car in motion and the stationary roadway, using the car wheels, and possibly the axles and gearing as intermediate links.

(2) "Brakes which are direct acting, in the sense that they are designed to create friction between the moving car and the permanent way or roadway, without intermediate connection or links of any description. The great disadvantage of all brakes of the former class, which, in future, I will call 'wheel brakes,' is that their maximum retarding effort is attained when the skidding point has been reached. Leaving sand out of the question for the moment, the skidding point of car wheels under certain conditions is comparatively low, with the result that a wheel brake on very greasy and slippery metals (by no means an uncommon occurrence on most lines) becomes next door to useless in retarding the speed of a car.

"Sanding the track from the car (thus increasing the tractive effort) is looked upon as a remedy, and so far as it goes is certainly effectual. Given a perfect driver (a very rare commodity) it may be considered satisfactory. Unfortunately the average tramcar driver is very much like his fellow man, by no means a perfect individual, and the less he is counted upon the better. An empty sand-box or a choked sand-pipe accounts for many street car accidents.

"The failure of a brake to act when applied does not always have the same result. It may be over-running a stopping place on a level track, or disaster on a steep grade. If, therefore, it is possible to operate brakes without danger of skidding the wheels, then I submit that it is desirable, that is, of course, providing that a corresponding disadvantage of equal magnitude is not introduced. The slipper or track brake is essentially designed to overcome this trouble of skidding wheels by applying the brake-shoe direct to the track instead of to the periphery of the car wheel. At first sight it would appear that no possible advantage could be gained by so doing.

"A skidding wheel and a sliding shoe are certainly one and the same thing, and no matter what sort of levers are designed to push down the shoe onto the track, the effective pressure on the shoe is limited to the weight of the car.

"The question therefore arises, is it new weight that is brought to bear on the slipper shoe, or is it simply transferred from the weight already in the car wheels? The answer is simple, for whatever downward pressure there is on the shoe it must have been taken off the wheels.

"However, whilst it is not practicable to change the material from which car wheels are made, and to employ some substance with a higher coefficient of friction, it is possible to construct the slipper brake-shoe from some such material, thus obtaining a greater retarding effort for the same weight.

"For the purpose of finding out exactly what does actually take place, I have made certain tests and trials with the brake equipments on an ordinary single truck, fifty-two passenger car, at Bradford.

"The hand brake was the standard Peckham form, the electric rheostatic brake of the ordinary type, and slipper brake of mechanical construction applied by a hand wheel on the car platform, driving through bevel gear a horizontal thread into a nut fixed to the pull rod of the slipper brake gear on the truck. The tests were conducted on a level track with a wet rail. The car was drawn by two ordinary cars through a dynamometer draw bar. A second dynamometer was connected to the pull rod of the slipper brake, from which readings the downward thrust of the

wooden slipper block against the tramway rail was calculated. The downward thrust, and, consequently, the retarding effort of the slipper, will probably be considered low, compared with the hand brake. After considerable experience, however, I find in Bradford that the retarding effort is quite sufficient to control and stop cars on gradients, used in conjunction with the hand brake, varying from one in twenty to one in ten, under all conditions, without the use of sand. I further find that in practice the wet rail is the worst rail for the wood-block slipper brake, whereas, as is well known, car wheels bite almost as well on a wet rail as on a perfectly dry rail. The curves are almost self-explanatory, and will, I hope, provide useful data, and throw new light on the brake question in this special phase.

"Examining Chart No. 1, it will be noted that 'A'—namely, the frictional pull, plus gravity—averages about 850 lbs. at half-speed (I found it impossible to get reliable readings at full speed

A maximum retarding effort was obtained with a slipper and a hand brake combination, when, with a downward pressure on the rails of 3150 lbs., and with the hand brake applied to obtain a maximum braking effort, a total friction of 3300 lbs., less 850 lbs., equal to 2450 lbs. actual, was obtained, thus showing an advantage of 400 lbs. over the hand brake alone.

"Were it not for the fact that the slipper brake takes a certain amount of weight off the car wheels, the combined effect of the brakes would actually have been 2050, plus 650, equal to 2700 lbs.

"From the above figures the true value of the slipper as a factor in the retarding effect of the brake equipment may be deduced under the worst conditions (for the slipper), namely, a wet rail.

"Unfortunately, time did not permit me to make further tests with a dry and with a greasy rail, respectively.

"I find, however, from experience, that a greasy rail cannot exist on steep grades where the slipper is in constant use, as the

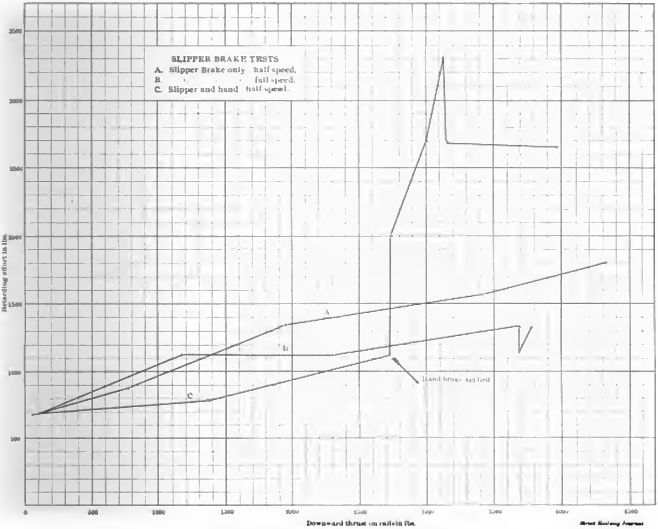


CHART NO. 2—DIAGRAM OF SLIPPER BRAKE TESTS

on the draw-bar dynamometer due to jolting), so that 850 lbs. must be taken from the retarding effort reading in the brake tests to obtain the true friction value of each brake and combination of brakes.

"Half and full speed are, I am afraid, vague terms, and may mean anything or nothing; but as they are to be used only in their relative sense, they will serve their purpose. The uneven nature of 'A' is due to the jolting between the two cars.

"In curves 'B' and 'C' the readings are steadier, due to higher tension on the draw bar couplings. At half-speed the hand brake was applied gradually, until a maximum was reached of 2900 lbs., less 850 lbs., equal to an actual maximum effort of 2050 lbs. on a wet rail. A little more tension was applied to the periphery of the wheels, locking them and causing them to skid, thus dropping the friction from 2050 lbs. to 2450 lbs., minus 850 lbs., equal to 1600 lbs. actual.

"'C' shows the reduced friction at higher speeds, and the effect of locking the wheels.

"Chart No. 2 shows an interesting relationship between downward thrust of slipper shoes and retarding effort on a wet rail.

rail is kept free from slime and dirt by the constant cleaning action of the wooden slipper blocks.

"The mechanical lever slipper brake is, in my opinion, useful only as an auxiliary brake in descending grades, and not as a separate working or emergency brake.

"My actual experience with slipper brakes is limited to mechanical designs, and I cannot, therefore, speak with certainty about power slipper brakes.

"I believe that compressed-air slippers are in successful operation in some towns, and I should be very glad to compare notes with tramway engineers operating power slippers.

"With large, heavy cars power brakes, both wheel and slipper, are necessary, but it appears to me very desirable that they should each be fitted with hand gear, in case of failure of the power at critical times. For example, a driver may have descended a certain heavy grade 999 times safely with a power slipper brake, and on the 1000th time something may happen to prevent the efficient working of the compressing plant.

"If it were possible to hold the brakes on by mechanical means, all danger would be averted.

"It seems to me, therefore, that it would be a good thing to work ordinary mechanical geared brakes with power, leaving the hand gear on the car platform, as at present, for use in cases of power failure.

"The electromagnetic slipper brake seems to overcome many disadvantages inherent in the ordinary slipper brake.

"The downward thrust on the slipper blocks can be carried to a dangerous point—namely, until sufficient weight is not left on the car wheels to keep their flanges in the grooves of the rail.

"With the electromagnetic brake, this is not altered, as the brake is applied. In towns where the grades are sufficiently easy to allow the wheel brake to control the car under any conditions, I should consider the electromagnetic brake admirable as a non-wheel skidding quick-service stop brake.

"Where, however, the grades are heavy and dangerous, and a failure of the slipper brake would mean a runaway car, I think I would prefer to pin my faith to a simple mechanical slipper, worked ordinarily by power, if desired, and not to a brake liable to derangement by a shorted armature or a faulty cable.

"I am afraid that my matter is somewhat crude and decidedly unorthodox, but I hope that the data may be of use to some members of the tramway industry."

NOTES REGARDING PRACTICE ON SOME AMERICAN TRAMWAY SYSTEMS

BY J. B. HAMILTON,

General Manager, Leeds Corporation Tramways

"Our worthy and most energetic secretary has insisted on my giving these disjointed remarks a title. Well, there is no use in our having a secretary if we do not obey him, and, consequently, I have dignified my observations of a private holiday trip across the Atlantic with a title, taking care, however, that it was sufficiently comprehensive as to enable me to range over all the subjects which call for so much of our time and attention on this side of the ledger. In drawing our attention to this group of headings, of which most are sufficiently important to have required your sole consideration, I do so more with the intention of giving point to general interchange of opinions than in the hope of being able to offer you any new views. Indeed, the inception of the paper was primarily intended more for the purpose of giving you a brief epitome of some of the salient features which a hurried tour over the principal tramway undertakings in the Eastern half of the United States enabled me to make during the month of April last. At that time I found myself in the, to me, unusual position of being able to snatch four or five weeks' holiday, and having during the preceding two and a half years had some experience of the costs and difficulties which are met by everyone in the operation of electric traction, I felt that pleasure and information could be combined in a visit to those cities which had so many years' longer experience of this form of traction than the majority of us have had on this side. Through the kind offices of friends in New York I was enabled to present introductions to the managers of all the principal systems in the cities which I visited, and was received with a frank kindness and courtesy which seems characteristic of our brethren on the other side. Everywhere the utmost attention and opportunity for gaining information was afforded, and I desire to record my heartfelt appreciation of the hospitality and desire to show everything and answer any query which was shown to me by everyone. The time at my disposal, about twenty days, enabled me to visit and learn something of the systems in the following towns: New York, Brooklyn, Boston, Buffalo, Toronto, Detroit, Cleveland, Pittsburgh, Washington, Baltimore, Philadelphia and New Jersey. Whilst the principal object of my visit was generally looking over the organization and methods of management to obtain information on (1) track maintenance (2), care of equipment (3), interchange of traffic and (4) power station labor, I did not confine myself to these subjects, but was prepared, when time permitted, to examine transportation arrangements and the various items under general expenses, from the salary of vice-president, or general manager, downwards. In fact, if I may put it colloquially, I had a general look round.

TRACK MAINTENANCE

"The difference in the surface appearance of track in this country and the United States will be familiar to you all. Whilst in many cities the track seems to be kept in admirable order, there are still a large number in which the track in many parts is in a very bad state of repair, loose joints and worn rails being quite common. This is, I think, largely owing to the fact that only recently consolidations have taken place, by which a number of companies have been grouped into one. Probably foreseeing this has been likely to take place, the former owners have not maintained the track in first-class condition. In this connection I may state that the paving, where that is done, is frequently in a state which no public authority in this country would tolerate. The most economical and efficient methods of repairing track is a question which is necessarily being seriously considered at the present time by every street railway manager upon whom I called. Owing to my visit having taken place early in April, which is immediately after the winter is over, I had not an opportunity of seeing any joint repairing in process. Briefly, there are four methods of performing this work, which were referred to.

CAST-WELDED JOINTS

"In one city I had the opportunity of seeing some track which had been done on this system, and, after two years' wear, it seems on the surface to be fairly good. There is no doubt that some weldings which had been performed when the method was first experimented with had not proved quite satisfactory, but improved methods are now being adopted, which, it is hoped, will result in more perfect joints being formed. These facts, no doubt, account for the varying opinions expressed to me by responsible managers.

ELECTRIC WELDING

"This form of welding joints has been adopted in several cities, and in Buffalo I had an opportunity of seeing a very considerable quantity, as they have over 30,000 joints distributed over 100 miles of track. In a recent communication from Mr. T. E. Mitten, the general manager, he says this method of welding has been very satisfactory indeed. The number of broken joints since the contractors removed their welding plant has been about 1 per cent. The welding heat is so concentrated in the web of the rail that the steel in the head is not affected. The electrical engineer states that the electrical return has been very much increased. There can be no question but that, barring broken joints, the efficiency of the joint as to conductivity is all that can be required. The disadvantages of the joints are, the increased time that tracks in process of reconstruction or welding are out of service; an electric welding plant occupies the track, or a considerable portion of it, night and day, until the welding is completed. If the tramway company has not an electric-welding plant of its own, the cutting in of broken joints is an expensive matter. Broken joints can be rewelded at a small cost, but if cut out, and a short piece of rail inserted, it becomes expensive. The feeling has been with this company, after three years experience, that any new girder rail constructed should have the joints electrically welded. Arrangements had just been completed for laying a considerable portion of new track during the present summer, and this was all to be electrically welded. Certain precautions are required in preparing the rails for welding, and when these are observed they are quite satisfied that this low percentage of breakages will be reduced. It is estimated that the cost per joint will be about £1. Speaking generally, those who have had experience of electric welding were very favorable to this method, and it was considered that when the improvements in the methods of preparing the rails are observed in operation, that electrically-welded joints on tracks of not less than one in sixteen grade would become largely used. One experienced manager was of opinion that when the grade was less than this the weight would tend to lessen the advantages of the welding.

CONTINUOUS RAIL JOINTS

"In Detroit this method of repairing joints is being largely used, and I saw a considerable portion of track in fair order which had been well worn before being repaired in this fashion. This form of continuous joint is supplied by the Continuous Rail Joint Company, of Newark, N. J., and I must refer you to them for particulars. In cases where joints have become worn down and afterward repaired by continuous joint, it was necessary to grind down the rail so as to taper off the worn portion. This was done by an electric grinder, and when the joint is stiffened up, lessens the jolt, and tends to prevent it coming loose again. In Philadelphia I had an opportunity, by the courtesy of Mr. Twining, the chief engineer, of seeing a form of joint repairing which he is presently experimenting with. As a full account of it is given in the STREET RAILWAY JOURNAL of this year, I need not describe it beyond saying that those responsible for it are highly satisfied with the result of their experiments so far, and are, indeed, quite satisfied that they will be able by this means to repair a large portion of the track as well as probably adopt it when laying new track. Whilst speaking on this subject, I may state that in Leeds an experiment has been made of welding two joints in a new piece of track, which is just about to be run over, by means of a chemical preparation which fuses the metal. I had not an opportunity of being present when the process was being gone through, but I have since inspected the joint, and on the surface it appears to be perfectly solid. Should it prove satisfactory it seems to me to be a very handy method of repairing old or welding new joints. Of the importance of this class of work I do not need to speak to the practical gentlemen I see present. In my opinion it will within

the next few years form a matter for serious consideration in many cities in which, up to the present, owing to the track being newly laid, it has not been necessary to go into the question.

CARE OF CAR EQUIPMENT

"This was a subject to which in every place I gave a considerable amount of attention, as it is one which I felt it likely that much valuable information as the result of long experience might be obtained. In many points the practice of the different rolling stock superintendents was very much opposed. In some cities they were of the opinion that equipments should be examined every three or four days, and overhauled certainly not more than every two months, whilst in other cities they were quite prepared to merely inspect them once a week, and overhaul them only when the armature bearings required renewal. Speaking generally, about one man to every seven cars is the custom. Nearly everywhere the cars are brought from the different depots to a central point for everything but the most elementary repairs. There is no doubt that the very most is got out of the plant they possess, and in some of the very largest systems practically no spare cars are allowed, so that in the rush hours every car may be on the route, except those undergoing a large repair. Very close and accurate account is kept of repair works done by each man, and thus bad work is easily traced to the repairer. Everywhere in the car repair shops the utmost attention is given to the use of labor-saving appliances, alike in wood and iron-working machinery. The comfort and convenience of those employed are exceedingly well cared for by the provision of light, airy mess-rooms and lockers for keeping clothes. The varieties of equipments in use vary from the very earliest to the most modern, and the ingenuity and patience of the car works' managers are taxed to the uttermost to keep the plant (much of which is now practically obsolete) in working order. The result is that a very considerable staff for electrical repairs has to be maintained. In the majority of cities this work is done by the piece, and very satisfactorily. In Brooklyn all the overhauling work on trucks is likewise carried out on stated terms. The jobs are divided into seven: 1, Overhead truck frame; 2, Overhauling and taking out and replacing wheels, so much for each pair, single truck; 3, Taking out and replacing pony wheels of double truck; 4, Overhauling motor and replacing armature and fields; 5, Replacing brake beam; 6, Replacing shoe-brake; 7, Replacing journal box. The prices paid are. For overhauling truck, about $2; for overhauling motors, $1; replacing wheels, 50 cents; replacing pony wheels, 30 cents; replacing brake beams, 40 cents; replacing brake-shoes, 60 cents. Of course closer inspection as to the quality of the work is required than if the work was done on time, but, on the whole, I am satisfied that it is the most economical method. In many of the larger cities the trolley wheels and all overhead material, except trolley wire and spans, is made by the operating company from their old material, and everywhere the very closest attention is paid to the avoidance of leakage on scrap, and to getting the contracted amount of wear from wheels and other purchased parts. I must confess I was much disappointed with the outside finish of the average street car. The inside is quite up to practice here, but the outside is neither so highly painted and varnished, nor are they kept so clean as we keep them. In fact, it is only customary in most places to wash them, and that with water, once a week. The insides, however, are kept very clean, being swept out every night and disinfected. In this connection I may say that everywhere there is the most scrupulous observance by passengers of the spitting prohibition. How much this restraint may be due to the boldy-printed notice of a fine of $500, which is put up in every car, I cannot, of course, say. Generally speaking, the arrangement for repair and maintenance of overhead lines are the same as here; but in Detroit I had an opportunity of seeing their organization, which seemed very perfect. By arrangement, whenever a fire alarm in any part of the city is rung, it signals, in addition to the fire station, the emergency depot of the tramways, the offices of the various newspapers and the police department. Whenever the call is within a half-mile circle of the center of the city, the wagon goes out at once. When the call is beyond that they await the summons of the division superintendent. Each wagon, in addition to ordinary jacks, etc., carries two cross-overs, which can be laid in three minutes each.

POWER STATIONS

"As much of the station apparatus for producing direct current has been in operation for a period of from eight to ten years, during which practice has varied considerably, it was extremely difficult to get anything like standard practice with regard to the number of attendants who were required for the work. Generally speaking, however, the intention seems to be to adopt the three-phase system at a more or less early date, and in doing so it will be necessary for the various companies to very considerably modify their present power station practice, and to scrap large quantities of their generating plant. In most of these cities the early practice of carrying the feeders upon poles is still maintained, but in Baltimore they are presently transferring these to conduits, and in Philadelphia this has already been completed. At the present time I may, therefore, say that the power station practice is in a state of transition, and that a visitor, two years hence, will probably find alternating current being generated in most of the large cities. In New York, as I have said, this system of generation and distribution has already been adopted, with the happiest results. Eleven engines are at present in operation, and a more compact, economically-operated station it is impossible to find.

TRANSPORTATION

"I think there is only one other point to which I wish to refer, and that comes under the heading of 'Transportation.' It is the method which obtains in many cities of arranging the duties of the motorman and conductor. In almost every case the route is arranged to touch at some point, preferably the terminus, the car depot or an office where the cash for the run is paid in. Sufficient running time to perform the journey is allowed, but no lying time; they simply turn the car round and proceed with the journey. When, however, they reach the point at which the money is paid in, if the journey is sufficiently long (say two hours), they step off the car, and a motorman and conductor, who are in waiting, immediately proceed with it for another journey. If the round journey is shorter than indicated, they may do two round trips. Those men leaving the car are allowed about five minutes, or as the service may be arranged, and take up the car which is then due. This goes on until the time for which the meal hour is arranged, when they stop off for, say, an hour, and then take up the car due at that time. By this means the maximum amount of service is obtained from the running plant, and employees are allowed sufficient time to get off, and it is possible to arrange for the meal hours at the best times. The men are usually paid by the hour, and in conjunction with this system it is easily possible to divert traffic in any direction, and to supply a sudden demand, without upsetting a rigid system of relief, whilst keeping, by means of trip sheets or way bills, a perfect record of the work done. It is exceedingly difficult in the time at my disposal to fully explain this matter, but I shall be glad to go more completely into the question, should anyone present wish me to do so. With regard to speeds, I am of opinion that the maximum speeds between the stops in cities is not greater in most American cities than it is here, but a higher average speed is obtained by the acceleration from a stop being quicker performed. Indeed, this is a marked feature in street work—no sooner is the first notch applied, and due speed attained, than the other notches are piled up quickly, so that, where the distance between the stops is 200 yards, the controller will be on top notch of speed (with a clear good track) before the car has covered the first 25 yards. The average speed granted in central parts—and they do not speak of anything else but average speeds—in cities is 8 miles per hour, and I am of opinion they make more stops in the very busy cities, such as New York, Boston, Pittsburgh and Philadelphia, than we do in the average city here. They fully maintain the average speed of 8 miles. Outside the cities, of course, much higher speeds are permitted and maintained. In the foregoing remarks I feel I have not been able to place before you anything of a very substantial or controversial character; but as the subjects themselves are very important, bearing, as they do, so closely on our everyday work, I trust that in the course of the discussion many interesting points may be raised. In that, I feel, will largely lie my justification for detaining you with my remarks."

The members on the evening of July 3 enjoyed a dinner at Agricultural Hall, by invitation of the promoters of the exhibition, and on the evening of July 4, after a visit to the Shepherd's Bush station of the Central London Undergronnd Railway and to the Chiswick power station of the London United Tramways Company, dined together at the Star and Garter, Richmond.

Convention of the Incorporated Municipal Electrical Association

The seventh annual convention of the Incorporated Municipal Electrical Association was held in London, July 2-5, some of the meetings being held at the Institution of Mechancial Engineers and others at Berner's Hall.

At the first session, on July 2, Sir John McDougall, chairman of the London County Council, welcomed the members to London. He pointed out that the convention was of great importance in finding out the very best means of locomotion for London and the other large towns, of which there was great need.

John H. Rider, electrical engineer of the London County Council Tramways, in his presidential address stated that the association was now representative of nearly 150 municipalities. In 1895, when it was founded, there were but five electrical street tramways in Great Britain, all, except Blackpool, owned by private companies. At present there were thirty-six owned by municipalities, and sixteen in course of construction. With three exceptions the whole of those were worked by the trolley system. Overhead construction cost about £5000 per mile of single track, including rails and paving, while surface contact construction cost £10,500, and conduit construction £13,500. Owing to æsthetic considerations, Washington, Paris, Berlin and other places adopted the conduit system in the center of the town, with the overhead system outside, and several corporations, including Bournemouth, had done the same thing; but it was really not worth while. It was true that the examples of overhead construction to be seen in several towns in the United Kingdom were anything but pretty, but that was the fault of the designer, and not of the system. It was perfectly easy and practicable to erect an overhead line which would look well in any locality. Neat, and even artistic, work cost very little more than rough and unsightly work. With reference to guard wires, the Board of Trade had recently issued a new set of regulations based practically upon those adopted by the post office In order to hear the views of the various tramway authorities upon these regulations a conference was held on June 20 last at the offices of the Board of Trade. On the advice of the officials of the post office and of the National Telephone Company, the Board refused to allow the principles of guard wire protection to be discussed. Guard wires might be a protection in a few cases, but in the large majority they were the means of causing the very accidents they were intended to avoid. They were a constant trouble to maintain, and were very liable to break when heavy telegraph or telephone wires fell upon them. The root of the matter was to prohibit entirely uninsulated wires of any kind to cross the trolley wires. If telegraph and telephone wires must be erected overhead, they should only be allowed to cross the streets at right angles, the spans should be kept exceedingly short, and the wires carried as high up as possible, in order that a broken wire might not reach the street. They should be insulated at such crossings, and if guards were insisted upon in addition they should be provided by a netting under the telephone wires, and not over the trolley wires. The recent accidents which had happened in Liverpool and other towns had been caused just as much by the telephone wires as by the trolley wires, but in the mind of the public they were called trolley wire accidents, and nothing else. If local authorities would insist that all telephone wires should be placed underground there would be no necessity for guard wires or such unsatisfactory half-measures.

Papers were then read on "Double-Current Generators and Their Application," by Mr. E. T. Ruthven-Murray, electrical engineer to the Willesden District Council, and on "High-Tension Continuous-Current Systems," by Mr. A. S. Barnard, of Hull.

Mr. E. T. Ruthven-Murray referred to four power stations in England in which double-current generators are being installed; the largest being that of the Mersey Railway, which will contain three double-current generators of 1200 kw each. These machines will have thirty-two poles, will run at 94 r. p. m., and will have on the a. c. side a frequency of 25 per second, and on the d. c. side a voltage of 650. He then described two 300-kw double-current generators being installed by himself. They can be separately or shunt excited, will have twelve poles and will run at 250 r. p. m. He considered that there was an excellent future for double-current machines.

In the afternoon visits were paid to the generating station of the Central London Railway at Shepherd's Bush, to the generating station of the Metropolitan Electric Supply Company, Willesden, and to the works of the Incandescent Electric Lamp Company at Wood Green. The start was made in brakes from the Westminster Palace Hotel, the headquarters of the association while in London.

On July 3 a visit of inspection was made to the tramways exhibit at Agricultural Hall, after which the association was entertained at lunch by the exhibition committee.

After lunch an adjournment was made to Berner's Hall, in Agricultural Hall, when the following papers were read and discussed: "Steam Turbines," by S. E. Fedden, city electrical engineer of Sheffield, and "The Correct Type of Engine for Large Generating Stations," by A. A. Day, borough electrical engineer of Bolton.

Mr. Fedden, who is now installing at the Sheffield power station some 1500-kw turbo-alternators, said that he considers the following main factors to be considered in laying down a steam turbine plant:

First.—Good vacuum in the condenser. This, he says, is even more necessary than with an ordinary engine, as the makers claim that the turbo expands the steam right down to the vacuum of the condenser. The following table of actual tests, taken on a 500-kw set, is quoted to show how important it is to obtain a high vacuum:

CONSUMPTION OF 500-KW TURBO ALTERNATORS, RUNNING AT 2500 REVOLUTIONS, WITH 140 LBS. STEAM PRESSURE AT THE STOP VALVE AND NO SUPERHEAT.

Vacuum Constant from Full Load to No Load	Consumption per kw-hour			
Inches of Mercury	Full Load	Half Load	Quarter Load	No Load
29	....	....	....	1,500
28	22.2	25.6	32.4	1,700
27	23.1	26.9	34.5	1,900
26	24.0	28.2	36.6	2,100
25	25.1	29.7	39.0	2,300
24	26.2	31.2	41.2	2,500
23	27.5	32.9	44.8	2,700
22	28.9	34.7	46.3	2,900

Second.—Arrangements for high superheat, as tests show that with 50 degs. F. of superheat, there is 8 per cent, and with 100 degs. F, 12 per cent economy in steam consumption. From the tests taken on the 1250-kw steam turbine sets, which are now working satisfactorily at Elberfeld, in parallel with Sultzer engines, where the speed ratio is something like 16 to 1, it was shown that there was a gain of 12 per cent with 55 degs. C. superheat, and that every inch of vacuum improves the steam consumption by 4 per cent. It was also shown that the steam consumption in the turbines, other things being equal, decreased constantly with increasing loads, whereas the Sultzer engines showed a less economy over three-quarter load.

The steam consumption in a turbine closely follows the right line law, or is proportional to the load added to a constant quantity which represents the consumption of steam at no-load.

In discussing the correct type of engine for large generating stations A. A. Day stated that the type which he considered most desirable was the horizontal slow-speed, compound or triple-expansion engine. Such engines, in mill work in Bolton, are giving an ihp-hour for less than 0.1*d*., with coal at 7*s*. per ton, and this on a load having a variation of 10 per cent. Two other papers were also read on subjects connected with electric lighting.

On Friday, July 4, a general meeting was held at 10 a. m. at the Institution of Mechanical Engineers, Storey's Gate. The following papers were read: "Some Notes re Earthing," by H. Faraday Proctor, city electrical engineer, Bristol; "Two vs. Three-Wire Distribution," by J. F. C. Snell, borough electrical engineer, Sunderland, and "High-Tension Continuous Current Systems," by A. S. Barnard, city electrical engineer of Hull.

Mr. Barnard made a plea for the use of high-tension direct current for power transmission systems, especially for railway work, where alternating current would have to be converted to direct. The direct-current step-down transformers have both high and low tension windings on the same armature, and are started as motors on the high-tension side from one central switchboard, and are switched into circuit on the low-tension network by means of electrically controlled switches, also operated from the central switchboard. Transmission systems of this kind or modifications of it are in operation in Oxford, Wolverhampton, Moore Camp, Barrow-in-Furness, Manchester, Hull and elsewhere. At Hull the main generators are of the four-pole type, and have an output of 510 kw each at 2250 volts. Recent tenders for a 480-kw enclosed engine and three-phase generator, running at 375 r. p. m., were on a basis of £9 1*s* 6*d* per kw, while for the high-tension direct-current generator and engine of 510 kw and 270 r. p. m. were on the basis of £8 6*s* per kw. He also quoted recent prices on a high-tension direct-current transformer, and a three-phase to direct-current motor generator, indicating a saving of nearly 25 per cent for a 90-100-kw unit.

During the afternoon visits were made (alternatively) to the generating station of the City of London Electric Lighting Company, Ltd., at Bankside, or the conduit tramway construction on the Tooting lines of the London County Council, by invitation of the contractors, Messrs. J. G. White & Co., Ltd. The former station supplies both alternating and continuous currents for public and private lighting in the city of London, and is one of the largest of the kind in Great Britain.

In the evening a very popular and successful smoking concert was held at St. James' Hall Restaurant, Regent Street. The artists included Thos. H. Harrison, Dr. Byrd Page, T. E. Gatehouse and others, and was largely attended. The business meeting of the association, which was held on July 5, concluded the sessions for the year.

Visit of the Transportation Committee of the Chicago Board of Aldermen to New York City

As readers of this paper are aware, the broad subject of a complete reorganization and improvement of the local transportation facilities of Chicago has been under consideration for some time by the authorities of that city. The history of this movement, which it is expected will be of incalculable benefit to Chicago, is so recent that it is hardly necessary to review it here. It might be said, however, that an extended report of the committee on local transportation, of the Chicago aldermen, which went very thoroughly into the relations of the city with the railway companies and which outlined the steps to be taken in the opinion of the committee, was presented to the mayor last December. Briefly, the report recommended a unification of the downtown terminals, so that an interchange of traffic between the principal surface lines could be affected, and the introduction of a subway by which the congestion on some of the downtown streets could be reduced by the removal of the railway lines to below the surface. This plan was approved by Mayor Harrison last January in his message to the City Council, in which he also made further recommendations which, if carried out, will demand a complete reorganization of the transportation systems of the city. Realizing, however, that before taking any radical action in the direction of one plan or another, it was advisable to investigate the transportation situation in other cities, the city authorities decided to send a delegation, consisting of its committee on local transportation, to make a study of what was being done in the East. The cities selected included New York, Boston and Washington, and the purpose of the committee was to interview the gentlemen who have been prominent in the development of the transportation lines in those cities, and to decide upon a policy which would be suitable to the needs of a city the size of that of Chicago, and which would combine the best experience in subway and other construction which had been secured in the cities to be visited.

The committee on local transportation includes some of the leading and most successful business men in Chicago, and consists of Frank I. Bennett, chairman; and Messrs. M. I. Foreman, Charles Werne, E. F. Herrmann, H. W. Butler and H. F. Eidmann, lawyers; Wm. Mavor and Thomas Carey, prominent contractors; W. J. Raymer, John Minwegen and W. T. Maypole, manufacturers, and W. S. Jackson, of the Chicago Board of Trade.

These gentlemen reached New York on Thursday, July 24, directly from Chicago. On Friday, July 25, they examined the Manhattan Railway system. In the afternoon, at the invitation of President Greatsinger, of the Brooklyn Rapid Transit Company, they took a trip in a special car over the lines of that company, visiting the power station and other points of interest. On Saturday a visit and tour of inspection was made of the construction work of the Metropolitan Street Railway Company. On Monday, July 28, the committee called on William Barclay Parsons, chief engineer of the Rapid Transit Subway, and later made an inspection of the City Hall terminal of that road, now under construction, and visited other parts of the work. On Monday evening they were entertained by James H. McGraw, president of the STREET RAILWAY JOURNAL, at a dinner at Sherry's, at which President H. H. Vreeland and Assistant General Manager Root, of the Metropolitan Street Railway Company; Contractor John B. McDonald and Chief Engineer Deyo, of the Rapid Transit Subway, as well as others, were present. On Tuesday morning the committee left New York for Boston.

The committee is being accompanied, in its trip, by Bion J. Arnold, who, as recently stated in these columns, has been appointed the consulting electrical engineer and transportation expert of that city. Mr. Arnold's reputation as an electrical engineer is well known, and he was recently engaged by the New York Central Railroad Company to draw up a system of recommendations for the electrical equipment of the Park Avenue line of that company by electricity. Mr. Arnold has associated with him in the work on which he is now engaged for the city of Chicago a number of the leading experts on transportation matters in the country, including Oren Root, Jr., assistant general manager of the Metropolitan Street Railway Company of this city; Charles V. Weston and George C. Sykes, of Chicago, and others.

Apart from some discourteous articles which appeared in several of the New York papers in regard to the purpose and standing of the committee, the visit to New York was very successful, and the delegates expressed themselves as deeply gratified with the treatment accorded them by the local transportation managers and engineers, and as satisfied with the information secured by them during their visit.

Annual Meeting of the Union Traction Company of Chicago

The annual meeting of the stockholders of the Chicago Union Traction Company was held on Wednesday, July 23. Four changes were made in the board of directors, and the old officers were reelected. The meeting was slimly attended in numbers, but 188,186 shares of stock being voted. William Dickinson, C. K. G. Billings, P. A. B. Widener and Charles L. Hutchinson retired from the board of directors, and William F. Harrity, of Philadelphia, and John Lambert, Henry G. Foreman, and Joseph Downey, of Chicago, were elected in their places. The board of directors, as now constituted, consists of Jesse Spalding, chairman; Walter H. Wilson, James H. Eckels, John V. Clarke, John M. Roach, John Lambert, Henry G. Foreman, Joseph Downey, R. A. C. Smith, H. B. Hollins, and W. F. Harrity. At the directors' meeting, following the stockholders' meeting, the retiring officers were re-elected as follows: John M. Roach, president and general manager; R. A. C. Smith and Walter H. Wilson, vice-presidents; James H. Eckels, treasurer; Markham B. Orde, secretary and assistant treasurer; W. W. Gurley, general counsel; John A. Rose, general attorney; F. E. Smith, auditor.

The financial statement showed a deficit for the year of $247,528. The gross revenue from operation and the income from other resources showed an increase of $549,750 over last year, but there was an increase of operating expenses, amounting to $628,525. The general expenses increased $347,131. The report shows an immense increase of taxes, amounting to $294,120. The complete statement of operations for the fiscal year ending June 30, compared with the previous year, follows:

	1902	1901
Gross earnings	$7,825,119	$7,289,139
Operating expenses	4,570,719	3,942,194
Net earnings	$3,254,400	$3,346,945
Other income	117,349	869,670
Total income	$3,371,749	$4,216,615
Fixed charges	3,619,277	4,058,040
Deficit	$247,528	†$158,575
Preferred dividend	......	150,000
Deficit	$247,528	‡$8,575

† Balance. ‡ Surplus.

President Roach, in presenting the report, said:

"The business done by the company during the fiscal year closed June 30, 1902, so far as increased earnings are concerned, was all that the management could reasonably expect under the adverse conditions with which we had to contend. Briefly, however, the financial statement will show that prospective profits have been taxed into a deficit.

"That this is not an overstatement will sufficiently appear by reference to the enormous amounts paid out for taxes during the past year, viz.:

Personal property taxes	$112,492
Real estate taxes	60,429
Capital stock tax	311,567
Car licenses and amounts paid to city as per requirements of different ordinances	64,893
Amount paid account taxes reassessed for 1900, as directed by United States court	134,350
Total	$683,731

"This is equal to about 8½ per cent of the total gross receipts of the company for the year, and to about 21 per cent of the net receipts for the same period, counting as net receipts the gross receipts less only operating expenses, and not inelnding in operating expenses either the interest on bonded indebtedness or rentals paid underlying companies. The company has some reason to hope that for the current year it may have its property, including capital stock, assessed upon the basis of its earning capacity, the only just method. If this hope shall be realized, the capital-stock tax ought to be, and doubtless will be, greatly reduced. The item of $134,350 additional tax for 1900, of course, will not occur this year, and upon the basis of earning capacity the item of $311,567 capital-stock tax for 1901 would be reduced by at least $100,000, and should be reduced by $125,000.

"Large sums were expended in permanent improvements in right of way, rolling stock, and power plants. Several miles of new track have been laid, thousands of rail joints have been cast-welded, and upon streets where city improvements have been made we have

resurfaced our tracks, substituting granite, asphalt, or brick pavement in place of cedar block or cobblestone. The improvements, when completed, will lessen the cost of operation and improve the service to the public, but at present they eat heavily into the receipts, with no immediate financial return. Our rolling stock has been maintained at a high standard and increased by a large number of new cars. Power houses are now more efficient than heretofore, and contemplated improvements will place the operating department in a position to better care for the traveling public.

"In view of our heavy expenses for improvements, the early settlement of the river bridge problem and the general prosperity of the community, the management confidently expect (barring unforeseen contingencies) that the ensuing fiscal year will show results more satisfactory to the stockholders of this company."

The additions made to property during the year were as follows:

Construction		
Track and roadway	$5,815	
Electric line	2,474	
		$8,289
Real Estate		
Buildings		4,507
Equipment		
Power plant equipment	4,098	
Shop tools and machinery	2,077	
New cars	65,108	
Electric equipment of cars	31,443	
Mail cars	294	
Total	103,020	
Less credit from sale of wagons and coal motor	2,653	
		100,368
Other Property		
Furniture for law department		395
Reconstruction		159,987
Total		$273,649

Throughout the year every effort was made to reduce the liabilities of the company through the sale of unused real estate, and the proceeds of the sales made, amounting to $74,000, have been used so that an annual saving in fixed charges of $8,641 has been effected.

New Cars for the Old Orchard Beach Road

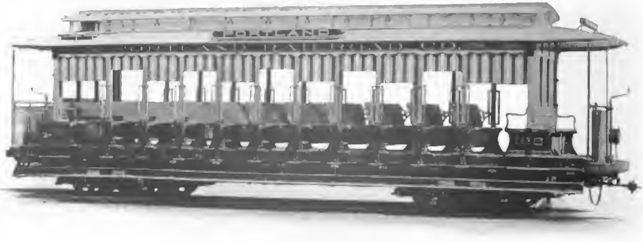
The Portland (Maine) Railroad Company has recently received ten 14-bench open cars from the J. G. Brill Company, of Philadelphia, for use on the Old Orchard Beach Division. The cars are of the Brill patented "Narragansett" type described in the STREET RAILWAY JOURNAL of last October. The first lot of this type were built for the Narragansett Pier Road—from which they took their name—and were so successful that it is not surprising to learn that a number of large roads are equipped with them this summer.

It will be remembered that the car was invented by John A. Brill, vice-president of the J. G. Brill Company, with the view of providing a double-step open car of no greater width than the standard single-step car and still have space for the radiation of high-speed trucks. His invention accomplishes this, and in addition is a form of construction unequalled for giving strength and rigidity to a long car body, namely, a main sill of deep angle iron having another angle iron bolted thereto, forming together a Z-bar. The extra strong manner in which the posts are secured is plainly shown in the illustrations. The "round-corner seat-end" panels—another of Mr. Brill's inventions—have an important part in the general comfort and convenience to the passenger. Attention should be called to the fact that the length of the seats is not curtailed.

SEATS AND STEP CONSTRUCTION FEATURES OF OLD ORCHARD BEACH CARS

The Portland cars are 37 ft. 10⅜ ins. long over the crown pieces; 7 ft. 10½ ins. wide over the sills, and 8 ft. over the posts. The width over all, with steps lowered, is 9 ft. 2 ins., and with steps raised, 8 ft. 3 ins. The distance from the rail-head to the top of the lower step is 16 ins. The bulkheads are fitted with drop-sash, and the roller curtains can be drawn to the floor, making a tight car in stormy weather. The inside finish is of natural ash and cherry, with decorated oak veneer ceilings.

Brill patented angle-iron bumpers, radial draw-bars, ratchet brake-handles and "Dedenda" gongs are included in the equipment. The trucks are Brill No. 27-G.



OPEN CARS FOR OLD ORCHARD BEACH

Jack for Electric Railway Service

Street railway repair gangs, as well as the construction department and contractors, find frequent use for a jack that can be readily handled. The Railway & Electric Supply Company, of New York, as manufacturer's agent, is introducing a device of this character, which is made by the Bray Manufacturing Company of Newark, N. J. This jack, like the others made by this company, is of the best iron and steel, has ball-bearings and interchangeable parts. These devices are strong, light and quickly adjusted. The cut shows a jack with two steps attached, and is designed especially for electric and street railway service. It may be used in track construction, also as a car jack in cases of emergency, such as derailments or accidents where cars have to be lifted quickly and lowered gradually. The rack with steps can be easily detached, thus presenting a complete lifting jack, adjusting from 14¼ ins. to 23 ins., with a capacity of 12,000 lbs. to 14,000 lbs. The combined weight is 35 lbs.

RAILWAY LIFTING JACK

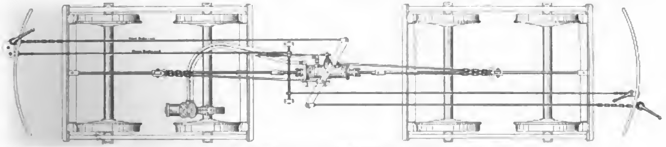
The Neal Duplex Brake

The United States Steel Company, of Everett, Mass., has closed a contract for supplying 170 brake equipments to the North Jersey Street Railway Company, and the Jersey City, Hoboken & Paterson Street Railway Company. The brakes are of the improved Neal duplex type, made by the United States Steel Company. The closing of the 170-equipment order was the result of a several months' test, made under the severest conditions on the Jersey roads.

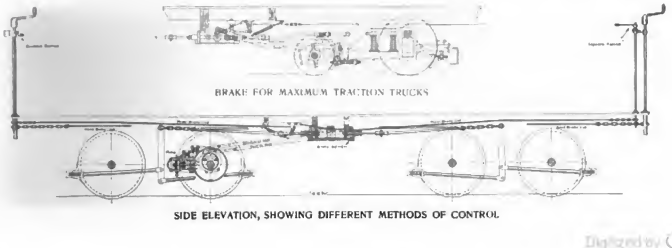
This brake is designed for city and suburban electric cars, and is applicable to any form of truck, and was invented by J. H. Neal, whose long connection with the Boston Elevated Railway Co. familiarized him with the requirements of the service. The Neal duplex brake, the mechanism of which is very simple, is composed of two essential parts, namely, an axle driven pump of ordinary construction, operated by an eccentric, with absolutely no air friction, consequently no heat; and a cylinder holding about three gallons of a non-freezable oil, which is fastened to the sills of the car. This cylinder contains two pistons which are connected directly with the regular brake levers. The oil, when the brake is not in use, is forced by the pump through one piece of a flexible hose, and returns to the pump, through another. The valve by which the oil leaves the cylinder can be closed by the motorman with one-quarter of a revolution of the ordinary hand brake, after which the brake remains on, and hand brake may be wound up as far as desired. Release of the brake is instantaneous.

When the valve is closed, the oil is forced through ports in each end of the brake cylinder, thereby operating the brake. The pressure is identical at each end of the cylinder, and, therefore, should one truck or pull rod become crippled, it is still possible to brake one end of the car or one truck; but should one end of the brake adjustment be up close and the other slack, it would be impossible to brake the close end until the pressure on both ends was equalized. The present hand brake rig is not disturbed. The brake cylinder valve is provided with graduated ports, thereby enabling the motorman to make either an emergency or a service stop, as occasion may require.

The first cost of the brake is moderate; the weight is less than 500 lbs., and the cost of maintenance is slight. The power for this brake is provided from the axle of the car. The use of the hydraulic principle, instead of the air compression or friction clutch, secures smoothness, uniformity, and directness of action. It is unaffected by weather or dust conditions. When the car is in motion the brake is ready for application and the pressure is always at hand. It is also free from electrical troubles, and it is absolutely noiseless. It contains no complicated air valves, and as it runs in oil is self-lubricating. The skidding of wheels is automatically checked, inasmuch as the pressure on the brake cylinder piston heads instantly decreases with the stopping of the pump on axle. It is also a combination power and hand brake operated at the same time and upon the same staff, so that the motorman at all times has at hand the full efficiency of the ordinary chain brake by simply continuing to revolve the one brake handle. Another point claimed in favor of this brake is that it can also be operated independent of the hand brake, and that it will stop a car quicker and more smoothly than any other brake. It can also be operated by vertical or horizontal wheels, levers, or brake handles and be adjusted to any truck that allows six or more inches of axle space. One-half revolution of a 33-inch wheel makes an emergency application of the brake. One important point to be taken into consideration is the fact that it is impossible for a motorman to allow the brake shoe to ride the wheel, thereby creeping close to the car in front and increasing liability of an accident.



PLAN VIEW OF DOUBLE TRUCK EQUIPMENT, NEAL DUPLEX BRAKE



BRAKE FOR MAXIMUM TRACTION TRUCKS

SIDE ELEVATION, SHOWING DIFFERENT METHODS OF CONTROL

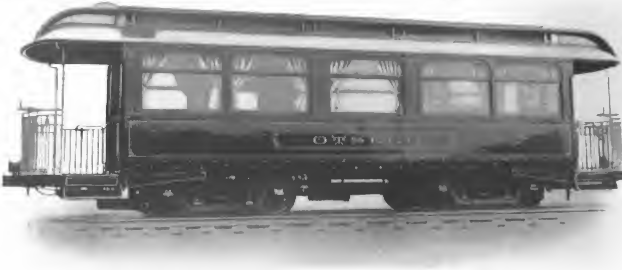
A Handsome Parlor Car

The Oneonta, Cooperstown & Richfield Springs Railway Company has recently secured from the St. Louis Car Company the parlor car shown herewith. It has a 28-ft. car body, 38 ft. over bumpers and is mounted on St. Louis Car Company's No. 23 truck. The interior finish of the car is African figured mahogany with marquetry work decorations.

The car has a toilet room provided with wash-stand, etc.; a cabinet for books, ice box and locker for china and tableware, water cooler, etc., so that the occupants can pass the time comfortably, even on a much longer journey than the service for which the car is intended.

The smoking compartment is particularly attractive. The car is also equipped with chairs upholstered with blue plush to match the carpets and draperies. The name of this car is "Otsego."

The car is also equipped with Christensen air brakes, St. Louis arc head lights, interior arc lights, G. E.-57 motors, and has proved very popular with the public in Oneonta.



A NEW PARLOR CAR

Car Sheds at Wallasey, England

The accompanying cut illustrates the front of a tram car shed of the Wallasey Urban District Council Tramway, Wallasey, England, the front of the shed being equipped with "Kinnear" steel rolling car house doors, manufactured by the Kinnear Manufacturing Company, Columbus, Ohio, U. S. A.

In addition to their extensive use in America, the "Kinnear" car house doors are being largely used by many of the European tramways. The merits of these doors may be said to consist largely in their compact construction, durability, ease and speed of operation and fireproof qualities. A further important claim is made for the minimum cost for maintenance, and repairs in case of damage.

In connection with the car house doors, the Kinnear Company constructs a special trolley wire connection, which permits of an uninterrupted current with the doors at any position, and when open automatically provides for an unobstructed trolley surface. These doors are built in large sizes, and they are constantly gaining favor with managers of the larger roads.

CAR HOUSE AT WALLASEY WITH STEEL ROLLING DOORS

Shaw's Non-Arcing Lightning Arrester

The accompanying cut illustrates the Shaw non-arcing lightning arrester for railway plants, manufactured by the Universal Electric Company of New York. It meets the requirements of the National Board of Fire Underwriters, and, in practice, has proved a very efficient means of protection. It is composed of alternate layers of non-arcing composition and mica assembled upon a fibre rod which is supported upon brasses containing serrated teeth projecting toward the composite body, and fastened to a porcelain base by studs, washers, and burrs which serve also as a means for making line connection. It is placed in an iron box thoroughly insulated. The lid may be easily removed by a few turns of a thumb screw. In this form of construction, the serrated teeth break up the discharge as delivered to the first layer of non-arcing composition, and it is again broken into minute discharges as it passes over the mica disc to the next layer of composition and successively until passed to the earth. The minute discharges are completely disseminated, and are not strong enough to carry the dynamic current along with them. It is claimed that 25,000 volts have been unable to break through this device, while infinite static discharges are broken and disseminated without any perceptible interference or leakage of the generated current.

LIGHTNING ARRESTER FOR RAILWAYS

An Automatic Oil Circuit Breaker

The Hartman automatic oil circuit breaker type "D. R.," has been especially designed for street car service, and is intended to afford the same degree of protection to the car equipment from the effects of overload or short circuit as is now given to the station apparatus by the modern switchboard instruments.

The special feature of this instrument, which is illustrated herewith, is the operation of the switch mechanism in oil. The break in the circuit takes place in a non-conducting fluid, which prevents the formation of an injurious arc under the most severe conditions of overload or short circuit. The danger of fire, which is always imminent in the vicinity of woodwork, is entirely eliminated, it is claimed, by enclosing the switch mechanism, together with all of the operating parts of the instrument, in a tight metal case. This feature also gives absolute immunity to the circuit breaker from the effects of exposure to the weather and the severe conditions and general rough usage to which an instrument intended for street car use is liable to be subjected. The circuit breaker cannot be

HARTMAN OIL CIRCUIT BREAKER

closed during the continuance of an overload or short circuit. Each side of the switch operates independently of the other. Closing the first switch does not close the circuit. As soon as it is attempted to close the second switch, if a short circuit exists, the first switch, being free to act, will immediately fly open. The motorman is thus notified that the current continues at an abnormal strength.

No auxiliary switch need be used in connection with this instrument. A tripping device is provided which is operated by pushing a rubber knob projecting from the upper part of the case. By a pressure no greater than that required to operate the ordinary push-button the motorman can at all times break the circuit without danger of arcing.

Owing to the fact that the operating mechanism is entirely enclosed the instrument is not affected by exposure to damp and unfavorable locations, and it will operate as reliably under such conditions as though it were on the switchboard.

An Improved Car Wheel Grinder

A wheel grinder is a tool almost as necessary in these days of electric traction as a wheel press, as it is just as important an item of economy to keep the wheels in good order as the cars themselves. Everyone having experience of modern railway practice is aware that in spite of all possible precautions "flats" are, at times, formed through wheels sliding.

A flat may occur early in the life of a wheel, and unless the means are at hand to true it up, much good material will be wasted.

AN IMPROVED WHEEL GRINDER

With an efficient grinder the average mileage of chilled wheels can be increased by 30 per cent, and it is, therefore, clear that the initial cost of the machine is soon counterbalanced by the saving effected in maintenance of rolling stock.

A particular feature of grinder illustrated herewith, which is manufactured by Miller & Co., of Edinburgh, is that the car axles revolve on their journals, and the wheels mounted thereon can, therefore, be ground exactly true to the axle. When the wheels are hung in centres only, the pressure of grinding wheel at work and the weight of wheels and axle tend to disturb the true position. Four of the principal tramway corporations in Great Britain have already been supplied with this machine, and the results are very satisfactory.

The machine has been carefully designed, and it is sold at a moderate price, as Miller & Co.'s main object is to furnish a tool within the reach of all, so that the average life of their chilled wheels may be increased.

Reference Book for Exporters

A book devoted to export trade has just been issued by Lewis, Scribner & Co., of 125 East Twenty-third Street, New York, entitled "Foreign Trade Requirements," and it is designed especially to meet the needs of American firms interested in extending their business in foreign markets. It has seemed advisable to include within the limits of this volume only the description of conditions that are likely to remain fairly stable throughout the year, leaving to a series of special reports the task of supplying information as to prices, discounts and competition, custom duties, names of dealers and other specific information regarding the particular line of goods handled by any individual manufacturer or dealer. The information presented has been carefully classified, condensed and arranged in the following sections: Trade Conditions of the World; Traveling Salesmen; Agencies and Advertising; Credit Customs of the World; Commercial Laws of the World; Trade-Mark and Patent Laws of the World; Transportation Facilities of the World; Encyclopedia of all Principal Commercial Cities (giving location, population, industries, banks, etc.); Coins and Currencies of the World; Postal Regulations; Cable Rates; and Weights and Measures of the World (with United States equivalents). No other work ever prepared in any language has attempted to cover the same range of subjects or to occupy the same field.

NEWS OF THE WEEK

Everett-Moore Affairs

Several important transactions affecting properties of the Everett-Moore Syndicate have recently been made. At a meeting of officials of the Detroit United Railway, held in Cleveland, the last instalment of the purchase price of the Rapid Railway System, or Detroit & Port Huron Shore Line, was effected. At the time the deal was made for the control of this road, it was agreed to pay $800,000 for the property, the Detroit United assuming the debt. The embarrassment of the Everett-Moore Syndicate prevented the closing of the transaction and the securities continued in the hands of the Cleveland Trust Company as trustee. The road will continue to be operated under its present corporate organization, since only 75 per cent of the stock was included in the sale. The Detroit United Railway Company has also taken a 60-day option on the property of the Detroit & Toledo Shore Line; the option being subject to an option by W. B. Strang, who has gone to Europe to interest capitalists who own the Grand Trunk and Canadian Pacific roads. If his efforts are unsuccessful, the property will be taken over by the Detroit Company. The Detroit United is also making overtures to purchase the Toledo & Monroe Railway, and in event of its purchase it would be connected with the Detroit & Toledo Shore line. It is announced that the syndicate has completed arrangements for financing the Lake Shore Electric Railway. Bonds on the property to the amount of $6,000,000 will be issued. Two-thirds of this will cover the floating indebtedness, underlying bonds and receivers' certificates; $1,000,000 will be used in placing the road in first-class condition for fast traffic, and $1,000,000 will be retained in the treasury for future extensions. The capital stock is $6,000,000, divided into $1,500,000 preferred, and $4,500,000 common stock. Mr. Moore, who has had charge of the negotiations, declines to name the parties who will take the bonds, but it is generally understood that a Cleveland syndicate, headed by Horace E. Andrews, will do the underwriting of a large portion of the securities. The Everett-Moore bankers' committee held a meeting a few days ago, and it was decided to pay the interest due all security holders of the syndicate up to July 1. It is announced that as soon as the Lake Shore Electric deal is consummated, the bankers' committee will relinquish the partial control which it has exercised over the affairs and actions of the syndicate. On July 22 it was announced that the syndicate had sold all its interest in the Scioto Valley Electric Traction Company to a party of Cincinnati and Columbus financiers, headed by Cyrus Huling, of Columbus. The syndicate owned about 60 per cent of the stock in the line, which is only partially completed. The road will run from Columbus to Circleville and Chillicothe. The syndicate has given an option on one-half of its holdings in the London (Ontario) Street Railway to Claude Ashbrook, of Cincinnati, at a price of $61 per share. The opportunity is given to all stockholders to sell their holdings at this figure. The Everett-Moore Syndicate will be left in control of the property, and agrees not to sell any of the remaining stock until Jan. 15, 1903, at less than $70 per share. The total stock issue is $400,000, of which the Cleveland people control the larger portion.

Massachusetts Companies Win

The full bench of the Massachusetts Supreme Court has handed down, in the cases of the city of Springfield vs. the Springfield Street Railway Company, and the city of Worcester vs. the Worcester Consolidated Street Railway Company, a decision which says that the general street railway statute of 1898, imposing a tax upon all street railways and relieving them from the obligation to keep streets in repair, except where the obligation is a condition of an original grant of location, is constitutional. In both cases the plaintiffs sought to have the companies make certain repairs in certain streets, but the court held that the effect of the legislation of 1898 was to free the street railway companies from all obligations thereafter to keep any portion of the surface material of the streets, roads and bridges in repair unless the obligation so to do had been imposed in a grant of an original location, which the act defines to mean the first location granted to the company in the city or town as to whose streets, roads or bridges there might be a question. It was contended by the cities that the statute was unconstitutional, because it impaired the conditions imposed upon the companies to keep portions of streets in repair. This contention was based on the theory that the condition constituted a contract, but the court held that it did not constitute a contract, as the location granted by a city or town is in the nature of a license. In the cases decided the court held that none of the locations were original, and the companies were relieved by the statute of all the obligations which the cities sought to enforce.

Indiana Traction Companies Combine

The final step in the absorption of the Indianapolis Northern Traction Company's lines, rights of way and franchises, as well as all tangible property, by the Union Traction Company, of Anderson, has been effected. The former corporation has filed records in all the counties of the State in which it has any property rights of a lease of its assets to the Union Traction Company. The lease conveys its property for a term of fifty years. The leasehold was written to go into effect July 1 last, and was made subject to a mortgage executed by the Indianapolis Northern Traction Company to the Colonial Trust Company, of New York, to secure bonds issued, the proceeds of the sale of which are to be devoted to the completion of the Northern Traction Company's lines already prospected, and the purchase of new rights of way, and the securing of franchises. The Union Traction Company is to build all the lines of the Indianapolis Northern Traction Company not yet completed, operate the same and pay all taxes and other liabilities and to guarantee the payment of all interest on bonds.

Unique Position of an Electric Railway

The close relations that have been established between the Providence & Danielson Railway, running into Providence, R. I., and the People's Tramway Company, of Putnam, Conn., have produced a situation in regard to the former road which is rather unique. The Providence & Danielson Railway has made arrangements at the Connecticut end of the line with the People's Tramway Company, which is controlled by the New York, New Haven & Hartford Railroad Company, and with the Union Railroad Company at Providence, controlled by the Rhode Island Company, and the Providence & Danielson Railway, running through the western part of Rhode Island and eastern part of Connecticut, is the connecting link between the two great rivals of the railroad field of Rhode Island. The Providence & Danielson Railway has a ninety-nine-year agreement with the Union Railroad Company, and a fifty-year agreement with the People's Tramway Company, otherwise the Consolidated road, and while not participating in the rivalries of the two companies, it enjoys the privileges of sending its passengers over the roadbeds of both. The plans of the New York, New Haven & Hartford Railroad in Connecticut to parallel its lines by establishing electric railways, thus cutting off competition from rival companies, are made manifest through its acquiring the People's Tramway Company, and the plans it has for the extension of that line down to Moosup and beyond, while it has already combined with five other electric railways and established a parallel system between Danielson and Worcester. The Providence & Danielson Railway has constructed its road as far as the Connecticut State line. By the agreement that was concluded with the People's Tramway Company on June 23, of this year, the Providence & Danielson Railway is to lease the right of the People's Tramway Company to construct a road from the State line to Chestnut Hill. This strip is two miles in length and is to be constructed by the Providence & Danielson Railway, while the remaining 3½ miles toward Danielson not yet built, is to be built and controlled by the People's Company. But the Providence & Danielson Company will enter into an arrangement at the other end with that company similar to the arrangement that it has with the Union Railroad Company at the Providence end for the running of its cars from the city line to the terminus at Market Square. Each of the rival companies is thus being kept apart for the time by the Providence & Danielson Railway holding them at arm's length, but as the arrangements provide for a carrying of the cars of either the People's Tramway Company or the Union Railroad Company over the lines of the Providence & Danielson Railway there is no knowing when an interesting situation may arise from the overlapping process.

Another Southern Road Sold

Another street railway is to be added to the long list of Southern properties that have recently changed hands. The Dominion Railway is the property that has been sold, but just who the purchaser is has not been made public. It is reported by some that the property has been acquired by the Gould interests, while others report that the Williams interests, of Richmond, are the purchasers. The Dominion Railway is a consolidation of the Portsmouth Street Railway, the River Front Railway, the Norfolk County Railway, and the Virginia Equipment Company, and its system covers Portsmouth thoroughly, and reaches to Port Norfolk, Parkview, Prentis' Place and Gilmerton. While only a small property, the system is typical of those in the South, and serves in excellent manner the territory traversed by its lines.

A College Town Invaded by the Trolley

The Princeton Street Railway, known as the Witherspoon Street branch of the Trenton, Lawrenceville & Princeton Railroad, was opened to the public on July 17. The road was built for the purpose of securing an entrance to Princeton for the Trenton, Lawrenceville & Princeton Railroad, and the opening of the line marks an epoch in the history of Princeton, as it shows a marked change from the situation there as seen for eight years past. The college and town authorities have always fought the entrance of an electric railway into the town, and in the present case it was only with the greatest reluctance that the Trenton Street Railway was finally given permission some time ago to cross Alexander Street, in the lower part of the borough, in order that it might reach a terminal near the center of the town. Had this road not been already in operation to the lower end of Alexander Street, from which point it came on private right of way nearly to the crossing, the Borough Council would never have granted it permission to cross a street. When the Trenton, Lawrenceville & Princeton Railroad was started toward Princeton there was a general outcry that one electric railway was quite enough to combat with, from the moral standpoint, and that another would probably finish the ruin which it was confidently predicted the first would engender. In the fall of 1901 the Trenton, Lawrenceville & Princeton Railroad reached the northern line of the borough of Princeton and permission was sought to go up Witherspoon Street. While this was being argued cars were put on the line, a passenger waiting-room and freight depot were erected at the temporary terminus, and business went ahead with a rush. After bitter opposition from some of the University faculty a franchise was granted, in which it was specified that the new company should pave the street with Belgian block or paving of equal worth, from curb to curb, and furnish lights for the street. This was locally considered as good as a victory for the anti-trolleyites, but when the ordinance was brought before the Council, the Lehigh Valley Traction Company, at Allentown, Pa. (which controls the Princeton line through the New Jersey & Pennsylvania Traction Company), declined the franchise. Work was only begun upon the extension a few weeks ago, and the company directly supervised all the work done. The ties, which are of chestnut wood, are 7 ins. x 8 ins. and 8½ ft. long, and are laid upon a 10-in. concrete base, or ballast. Between the ties more concrete is used and this is brought up high enough to form a foundation for the vitrified bricks, which are used for paving between the rails, and which will be used upon the street itself. Trilby rails are used, and the gage of the track is 4 ft. 8½ ins. Double span wire and fancy iron poles have been used, and the trolley wire is 0000 phono-electric. A locomotive car hauls freight to the foot of the Witherspoon Street extension, and in an emergency the locomotive also hauls a trolley car, but will not be able to take them further than the old terminus. Cut rates in freight have been the result, and the opposition between the Trenton, Lawrenceville & Princeton and Pennsylvania Railroads, at Princeton, has been quite marked. With the exception of the Witherspoon Stret extension, the road is built entirely upon private right of way, 50 ft. wide, and the 70-lb. rails are laid upon gravel ballast.

After the Rowdies

The local papers in one of the largest cities in Western New York tell of the crusade being made by the railway company in that city against the rowdies who make themselves so objectionable to the passengers on the company's cars to the pleasure resorts in and about the city. Every car will be policed until it reaches the city line, and the local police officials will be asked to station patrolmen at convenient call as soon as the cars enter the city. Men in civilian dress will be placed on cars not manned by constables, and every possible effort will be made to put an end to the disgraceful scenes which have recently marked the operation of cars on Saturday and Sunday. Now, in this question of keeping the rowdy in his place, every street railway company is interested. From all parts of the country there come every summer reports of the outrageous doings of these disturbers of the peace. Traveling in such numbers as to intimidate even him who, in behalf of his fellow passengers, would be tempted to object to their outrageous doings, they carry their rowdyism to a point where the average passenger is deterred from riding on a car. The passenger should be protected, and the company and the police, working together, by making an example of several offenders, ought to be able to check the objectionable actions of these offenders. In a number of instances where the conductor and the motorman of a car have attempted to protect the passengers, the operators of the cars themselves have received rough treatment at the hands of these uncouth offenders.

Atlanta's Good Showing

As an instance of the results that may be expected to accrue through such consolidation as have recently been effected between lighting and power interests in a number of Southern cities, the Georgia Railway & Electric Company, controlling the entire lighting and railway interests of Atlanta, is an excellent example. The company was organized Jan. 1, 1902, as a consolidation of the Atlanta Railway & Electric Company, the Atlanta Rapid Transit Company, the Atlanta Steam Company, and the Georgia Electric Light Company, and while the properties were in excellent physical condition before the consolidation, the economies that have resulted through joint operation has greatly exceeded even the most enthusiastic. The statement of the earnings of the company for the month of May, which is at hand, shows an increase of about 7 per cent over the preceding month, and for the five months ending May 30, 1902, an increase of 20 per cent over the same period for 1901 is shown. The May earnings are: Gross, $107,387.19, as compared with $90,283 for May, 1901, an increase of $17,103.65; net, $56,333, showing an increase of $14,355.80 over 1901. The proportion for interest and taxes is, $38,598, leaving $17,730. Of this $7,500 is necessary for preferred stock, leaving a surplus of $10,230 for common stock.

PERSONAL MENTION

MR. W. H. BACON, of Messrs. Ford, Bacon & Davis, of New York, has been appointed consulting engineer for the Metropolitan Street Railway Company, of Kansas City, Mo. Mr. Bacon's first special duty will be the supervision of the erection of the new power house of the Metropolitan Company.

MR. HARRY JOHNSON has resigned as superintendent of the Norfolk & Bristol Street Railway, of Norfolk, Mass., and is succeeded by Mr. Thomas Gammon, of East Braintree, Mass. Mr. Johnson was presented a handsome gold watch and chain by the employees of the company, as a token of their esteem.

MR. S. N. JAMES, formerly superintendent of the Eighteenth Street Division of the Metropolitan Street Railway Company, of Kansas City, Mo., has been made second assistant general superintendent of the company. Mr. James Griffin, formerly assistant to Mr. James, has been advanced to the position vacated by Mr. James.

MR. ALEXANDER MACKENZIE, a member of the legal firm of Blake, Lash & Cassells, of Toronto, Ont., has been appointed the chief representative of the Sao Paulo Electric Company, of Sao Paulo, Brazil, and severs his connection with Blake, Lash & Cassells to assume his new duties. Mr. Mackenzie returned from Sao Paulo recently, where he had been for three years in the interest of the company.

MR. E. C. HATHAWAY has resigned as general manager of the Lexington Railway Company, of Lexington, Ky., and Mr. R. E. Hunt, assistant general manager of the company, has been elected as his successor. The position of assistant general manager has been abolished Mr. Hathaway, it will be recalled, is president of the Consolidated Street Railway, Electric Light & Gas Companies, of Norfolk, Portsmouth and Newport News.

MR. CHARLES M. MILLS, assistant engineer of the bureau of surveys, of Philadelphia, in charge of bridges, has resigned to accept the position of assistant engineer in charge of subway and

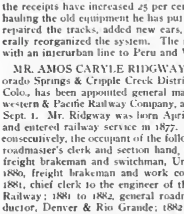
elevated road work for the Philadelphia Rapid Transit Company. Mr. Mills has been eight years in the service of the city, and among important work done by him was the superintending of the construction of Gray's Ferry bridge. Prior to going into the city service, Mr. Mills was in the employ of the Phœnix Bridge Company. Mr. Mills is a member of the American Society of Civil Engineers.

MR. JOSEPH H. JACKSON, chairman of the Massachusetts Railroad Commission, returned to Boston, July 25, after an extended trip to Europe in the interest of railroad problems, which he has studied in England, France and Germany, giving special attention to the problem of cheap suburban morning and evening traffic, including the interurban means of transportation in European cities. Mr. Jackson made a close study of the London subways, as well as the electrical equipment of some of the Continental railroads, and will embody his observations in a report to the Massachusetts Legislature.

MR. E. C. FOLSOM, general manager of the street railway system of Logansport, Ind., has for the last three months been making extensive improvements on his road, and his efforts are being greatly appreciated by the local public. Under Mr. Folsom's management the road is giving better and faster service and the receipts have increased 25 per cent. Besides thoroughly overhauling the old equipment he has put in much new overhead work, repaired the tracks, added new cars, motors and trucks and generally reorganized the system. The road is soon to be connected with an interurban line to Peru and Wabash.

MR. AMOS CARYLE RIDGWAY, general manager of the Colorado Springs & Cripple Creek District Railway, of Cripple Creek, Colo., has been appointed general manager of the Denver, Northwestern & Pacific Railway Company, and will assume his new duties Sept. 1. Mr. Ridgway was born April 16, 1860, at Water Gap, Pa., and entered railway service in 1877. Since that time he has been, consecutively, the occupant of the following positions: 1877 to 1878, roadmaster's clerk and section hand, Kansas Pacific; 1878 to 1879, freight brakeman and switchman, Union Pacific Railway; 1879 to 1880, freight brakeman and work conductor, same road; 1880 to 1881, chief clerk to the engineer of the Missouri, Kansas & Texas Railway; 1881 to 1882, general roadmaster's clerk and work conductor, Denver & Rio Grande; 1882 to Sept. 1, 1889, chief clerk, second and third divisions of the Denver & Rio Grande; Sept. 1, 1896, assistant superintendent second and third divisions same road; May 1, 1896, to July 1, 1899, superintendent of the same road. Dec. 1, 1899, Mr. Ridgway was appointed general manager of the Colorado Springs & Cripple Creek District Railway.

MR. DOW S. SMITH, the new general superintendent of the Brooklyn Rapid Transit Company, has already made his personality felt on the rank and file of the operating departments of the system. He comes from one of the best-managed street railways in the country, the Twin City Rapid Transit Company, where for eight years he was superintendent of the St. Paul Division, and was largely instrumental in bringing up to the high standard which it has attained, the operation of that road. Mr. Smith is well equipped with expert knowledge of the requirements of his position, added to his undisputed familiarity with every detail of electric railway management. He has an untiring energy and rapid manner of carrying into effect the improvements which he contemplates making. Mr. Smith is a graduate of the University of Minnesota, in the class of 1888, and immediately upon graduation he was made superintendent of construction of the West Superior Iron and Steel Company, West Superior, Wis. He remained in this position for five years, when he resigned to become superintendent in Minneapolis for the Twin City Rapid Transit Company. Remaining here for one year he was transferred to the St. Paul Division, where for eight years he has ably managed that property. The position of general superintendent in the Brooklyn Rapid Transit Company combines entire control of the traffic and repair departments of both the elevated and surface lines, an office which was created during the recent reorganization of the relations between the various departments. Mr. Smith has taken hold of the elevated problem with the same energy which has marked his former connection with the running of surface roads, and promises to make as successful progress in this, to him, new line of work as he has proved himself capable of in his more familiar duties in the West. The combination of the elevated and surface roads is a new departure of the company's, although it has been advocated by many of the officials for some time, and its practicability depends largely upon the efficiency of the man at its head. Mr. Smith's management as general superintendent will, therefore, be watched with considerable interest.



D. S. SMITH

MR. ROBERT I. TODD, second vice-president of the Cincinnati Traction Company, Cincinnati, Ohio, has tendered his resignation to accept a position with the United Gas Improvement Company in Philadelphia. The work which he will have in charge will be in connection with the company's traction interests. Mr. Todd is a native of New Jersey, having been born near Lakewood, Nov. 29, 1869. He graduated from the Johns Hopkins University in the class of 1893. His first connection with street railway work was as assistant superintendent of the Eckington & Soldiers' Home & Belt Railway Companies, Washington, D. C. Later, when these lines and others were merged into the City & Suburban Railway Company, Mr. Todd was made general superintendent and electrical engineer, resigning from this position in the spring of 1889, to take charge of the experimental work of the Compressed Air Company in New York city. Mr. Todd resigned this position in July, 1900, to accept the position of mechanical engineer of the Consolidated Traction Company, of Pittsburgh, which position he held until February, 1901. He resigned at this date to become general manager of the Cincinnati Traction Company, when that property was acquired by the Elkins-Widener-Dolan-Morgan Syndicate. In January, 1902, he was promoted to the position of second vice-president of the company. Mr. Todd's work in these many cities has given him experience with all the various methods of street car propulsion, horse, storage battery, air, underground electric and single and double trolley, and his wide experience in the traction field has peculiarly well fitted him for the work which he now assumes.

CONSTRUCTION NOTES

SANTA CRUZ, CAL.—F. W. Swanton, of Santa Cruz, is reported to have said that a deal has been completed that insures the building of an electric railway to connect the towns and settlements of Pacific Grove, New Monterey, Monterey and Oak Grove with Del Monte. Mr. Swanton is also reported to have said that a deal will be concluded shortly whereby the present horse car line, from Santa Cruz to Seabright, will be converted into an electric road and extended to Capitola.

SUISUN, CAL.—The Board of Supervisors has granted a franchise to J. E. Woolley for the construction and operation in Solano County of an electric railway to connect Suisun, Vacaville, Winters, Elmira and Cement City. There were three bids—J. E. Woolley, who secured the grant; J. W. Hartzell, representing the Vallejo, Benica & Napa Valley, and Lewis A. Hilborn, of Suisun, representing an Eastern syndicate. The line will be about 40 miles long, including branches. The road is to handle both freight and passenger traffic, and it is said that it will be operated by electricity from the Bay Counties Electric Power Company's lines, which touch both Suisun and Vacaville.

HARTFORD, CONN.—It is stated that the electric railway which the Connecticut Railway & Lighting Company is building between Cheshire and Mount Carmel, where connections will be made with the Fair Haven & Westville system, thus forming a continuous line between New Haven and Cheshire, will be ready for operation about Aug. 1. For the present, power for the new line will be supplied by the Fair Haven & Westville line. After the completion of the road to Cheshire the Railway & Lighting Company will proceed to extend the line to Milldale to connect with the lines of the New Britain district. Completion of this stretch will make a continuous line of trolley between Stamford and Boston by way of Hartford and Springfield.

. . .

FERNANDINA, FLA.—The Amelia Beach Company has been organized to build a street railway from Fernandina to Amelia Beach. John G. McGiffin is president of the company; L. G. Hirth, vice-president; E. W. Bailey, secretary, and John W. Simmons, treasurer.

BLOOMINGTON, ILL.—Charles P. Griffin, G. G. Metzger and W. T. King, and others, have organized a company to build the Bloomington, Peoria & Pekin Railway. Right of way has been secured between Bloomington and Pekin, Ill., and work will start as soon as the balance has been secured, which will be in the near future.

NEW ALBANY, IND.—A new electric railway from New Albany to White Sulphur Springs by way of Leavenworth, Ind., is being planned. Capt. W. W. Hite, of Louisville, Ky., president of the Louisville and Evansville Packet Company, is reported to be interested in the project.

DONALDSONVILLE, LA.—The Town Council has granted M. D. Bringier the privilege to operate a railway through the streets, the grantee to pave the streets through which the road runs. The grantee is given nine months to begin work.

ROCKLAND, MAINE.—The extension of the Rockland, Thomaston & Camden Street Railway to Warren has been placed in operation.

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The Situation at Catlettsburg

Judging from the newspaper accounts of the strike of the Camden Interstate Street Railway Company's employees, the "victory" of the union resulted from intimidation and violence on the part of the strikers and their sympathizers. Rioting and bloodshed were reported at Huntington, Ironton, Catlettsburg and Ashland, but these disturbances failed to awaken the authorities to a realization of their duties. The press dispatches, during this lawlessness, said: "The city officials are making little or no effort to keep order. Sheriff Walton was appealed to for assistance, but said that city authorities should first make an effort to keep the peace." All of this trouble grew out of the refusal of the company to recognize the union, and the conduct of the men during the strike shows that there are very good reasons why the union should not be recognized aside from any question of company policy. It is a sad commentary upon any community that such an organization is not only tolerated but encouraged.

The Trackless Trolley Car.

Our readers are familiar, through several articles which have appeared in this paper, with the device known as the "trackless trolley," and which is employed in Europe to some extent where the amount of traffic is not sufficient to justify the expense of laying the ordinary track construction. Up to this time there have been no systems of the trackless trolley kind installed in this country, but it is just reported that F. G. Tilton and G. F. Stiles, two Lowell capitalists, will build a line of this kind between Franklin and Franklin Falls, N. H. A 20-hp omnibus has been ordered, capable of carrying thirty-two passengers and freight, and this car will be run by overhead wires on a macadam road. It is nowhere claimed that this system is as cheap to operate as the ordinary trolley system, or is in any respect more desirable than the latter, except that by it the expense of laying a track is avoided. The records of power consumption on the roads installed abroad indicate that about twice as much power is required on a good road to operate an omnibus of this kind as would be needed to propel a trolley car of about the same size. It is needless to say, however, that one chief essential for success is that the highway be a good one, and sufficiently broad to accommodate the traffic.

* * *

The average electric railway manager very often finds himself confronted with a situation where a certain amount of traffic could be secured by the construction of a short spur to his main track, but where there is considerable doubt whether enough passengers can be secured, certainly at first, to put the line on a paying basis. We ourselves can call to mind a number of instances of this kind, in some of which the local manager has actually taken into serious contemplation the operation of an automobile car, either steam or electric. Again, there may be places where the right to lay tracks either cannot be obtained or else will only be given under such burdensome restrictions that it will not be profitable. To both of these cases the trackless trolley seems particularly adapted. If the future should show that the traffic is not sufficient to justify the road, the expense of installation has been very slight, while, on the other hand, if the traffic should grow, the ordinary track can be laid and used with the same overhead wires, while the trolley omnibus can be relegated to another branch, where it can develop another traffic territory. Still another instance where this system, if it is practical, can be used is in a small town where there is no trolley system and where current to operate the line can be purchased from a local lighting company.

* * *

Two systems of this kind are employed abroad. In one the trolley is of ordinary under-running type and the two poles carried on the bus are similar to those on a car, except that they are longer and are swiveled both at the base and at the harp, so that a certain amount of variation in running is possible. In the other system the trolley runs on top of the wire, as in the old early Van de Poele system, and is connected to the omnibus by two flexible

wires The advantage of the latter method is, of course, that of a greater range in movement for the bus, depending on the length of the connecting cable. The former plan, on the other hand, permits an overhead construction exactly similar to that of the ordinary trolley car, except that two wires are used. For this reason the line can be converted very easily, so far as the overhead equipment is concerned, from a trackless to that of the ordinary track sort. The announcements published of the Franklin line do not indicate which system is to be employed in that city, but we hope when the line is in operation to present some details of it.

* * *

We have already referred to the absolute necessity of having a good road to run over, if the trackless trolley is to be even a fair success. We do not know the condition of the particular highway upon which it is stated the trial is to be made, but we could wish for better roads than the experimenters are likely to find in that part of the country. A combination of sand, stones and bad construction faithfully describes the ordinary New England highway, and on top of this everybody insists on using narrow tires, so as to insure the maximum tractive effort Even the roads that exist are narrow, as well as bad, and a line of ordinary automobile trucks would encounter many difficulties. We can imagine a trackless trolley car performing fairly well on Continental or American roads of the better class, but the average American road is quite another story. Putting out of consideration the annoyance of the double trolley, under even the most favorable conditions, the power required on ordinary roadbeds and grades is considerable, and the mere difficulty of dodging other vehicles, simple enough with a common automobile, is formidable when the trolley connections are taken into account.

* * *

The average denizen of the rural districts has little enough love for automobiles at their best, and when trying to pass a trackless trolley car with a heavily loaded hayrack we fear his language would be more picturesque than polite. However, let the experimenters try it on—they have our best wishes for success—and if they can din the gospel of good roads into the unbelieving ears of the rural heathen we will pass around the missionary box for them. Even on city streets the automobile truck has thus far had a strenuous time of it, and while it doubtless has a great future, its present is full of griefs. The advent of a thoroughly successful kerosene burner or kerosene explosive engine, would clear up the difficulties wonderfully, and when the storage battery has really arrived perhaps the horse will shake his harness for good and all. A French breeder has been experimenting of late years on the development of horses of stature suitable for household pets. He has, we are informed, already brought the full-grown equine to the modest dimensions of a setter dog, and if both he and the automobile fulfil their hoped-for destinies, we may see the elect lounging back in their touring cars with their horses in their laps. But for the present we will pin our faith to the trolley car when we wish to get there on time.

The Street Railway in American Cities

It has been the usual custom for American cities, in the matter of railroad franchises, to wait until somebody wanted to do something, and then the city has been content to say yes or no It has long been my contention that a city ought to be able to say what it wanted to have done and then to ascertain what somebody would do it for; in other words, that the city should be able to take the initiative.—From Mayor Low's Weekly Talk

This statement shows a lack of appreciation of conditions that obtain in American cities, and it is hard to accept it as the expression of a student of municipal organization. Had the policy here advocated been followed, the present development of city transportation facilities and the consequent improvement of living conditions resulting therefrom, which are now universally enjoyed in this country, would be unknown. It is only necessary to bear in mind the financial condition of the average American city, the numerous demands that are made upon its resources, and the present status of public works entrusted to its care, to realize the wisdom and good fortune of the cities that have adopted the policy of entrusting the street railway business to private corporations

We should not lose sight of the fact that the street railway companies have done a great public service in developing transportation facilities, not the least important feature of which has been the opening up of residential districts outside of the crowded business centres, thus relieving the congestion of these quarters and enabling all classes to secure homes in localities where better living conditions could be obtained.

The street railway companies have not waited for the demands of traffic; they have opened up new territory and led the way for the settlement of new districts It is no exaggeration to say that they have been pioneers of civilization in the highest sense of the term. They have given the people the means of getting away from the crowded thoroughfares, and in many instances have been compelled to operate their roads, for long terms, at considerable loss relying entirely upon the future for a fair compensation for this outlay. The investment represented in these roads has been very great, much more than any city could devote to similar work under even more favorable conditions. To-day there are comparatively few cities in this country that are in position to engage in enterprises of this kind, and it is doubtful if there are any that have funds at their disposal that could be spared for the period that must, of necessity, expire before the investment could become profitable

This distinctive American policy has resulted in a higher development of electric railways in this country than in any other part of the world, which, of itself, is sufficient justification, even if there were not many other good reasons for it.

The Sky-Scraping Coal Bill

At the present rate of increase in the price of even soft coal, the time is soon coming when the motor power department of the electric road must take counsel with itself wherewith it shall stoke the boilers. Coal has been on the up-grade for some years, but the last two seasons are ominous. It really seems as if the coal monopoly, for such it practically is, proposed to "educate" the dear public to pay for its coal by the pound. It is hard enough on large electric railway systems that have terminal facilities of their own, and order coal by the ship load. But the burden falls with double severity on the small road that has, of necessity, a poor load factor and probably a rather uneconomical station to boot. In such cases, the cost of fuel, even at the former reasonable prices, was a serious item in the year's expenditures, and now the case is much worse; the more so as the outlook for improvement is not promising. It, therefore, behooves all hands to look out for means of relief.

Anything that will improve station efficiency means lower coal bills, and, consequently, it is desirable to overhaul the station equipment with a critical eye. Perhaps it did not pay to condense three or four years ago, but the balance turns the other way now, and the sooner that new compound engine is ordered the better. Then, too, how about that water-tube boiler that you have talked about since summer before last? Would it not be good policy to order it about to-morrow morning? And, while you are about it, you had better consult with the makers and see that the furnace is planned especially for the use of cheap fuel. Then, too, you have been musing about and considering storage batteries for a year or two—hadn't you better quit thinking it over and do something? Your load factor is bad enough to demand it, surely, and every month the coal bill gives you a bad quarter of an hour. Batteries cost good money, too, but they do not pull on your bank account quite so hard as the coal pile does, and once in, they will save a handsome percentage on the investment. If worst comes to worst, the time may soon come when it will pay to investigate the merits of producer gas and gas engines. It is a hard state of things when one has to turn away from the steam engine, but unless the back of the coal monopoly is broken, and that promptly, something must be done to improve the utilization of the fuel one is able to buy. It

is now quite certain that by the skilful use of producer gas one can get the horsepower-hour on the equivalent of little more than a pound of coal, and it is high time that the question were seriously considered. Electric power transmission should see a boom coming, too, and every water power that is available should be turned to immediate account. The comic paragrapher has pictured the magnate of the next generation wearing a sizeable chunk of anthracite in his shirt-front, but the joke is getting, even now, altogether too grim for enjoyment. The coal supply is far from exhausted, but the patience of the consumer is, and it is time to take the matter in hand and to push it to a final settlement.

The Convention of the International Tramway Association.

Electric railway progress in the United States has been so rapid, and we have been accustomed to such a great extent to look upon American railway practice as standard throughout the world, that American railway managers have, as a rule, taken comparatively little interest in the meetings of the foreign tramway associations. Another reason for this fact has undoubtedly been that it is the general impression that operating conditions are so different abroad that little practical value can be secured by a study of foreign electric railway conditions. In some respects both of these statements are true, although, when we consider them carefully, the arguments neutralize each other, because if American apparatus is used extensively abroad the experience of others with it will often be of as much value as if the apparatus were being employed in this country. As a matter of fact, Europe possesses a number of very active street railway associations at which topics are often discussed which are of interest to Americans, and while local conditions have caused a difference in certain operating methods there is nowhere near the diversity of practice between tramways abroad and in America as exist between the steam railroads in the two continents. The fact that electric railway development has occurred at a time when the interchange of ideas by the technical press and in other ways has been so general, together with the extensive development of electric railways in this country, have had the effect that the principles of American electric railway practice are pretty well understood, and to a large extent followed abroad. The result is that any new improvement which is made here in any important feature of electric railroading is known in Europe almost as soon as it has received publication in this country, and is considered on its merits even if it is not adopted.

Nor can Americans claim that they have nothing to learn in electric railway engineering from the companies across the water. From the opening of the early Siemens & Halske railway at Gross-Lichterfelde, in 1881, there has been an interchange of ideas between the two continents in which America has profited in many ways. Among the examples which we may cite of this truth is the underground slot conduit which was developed in Budapest before it was applied in this country, although American conditions required a considerable modification of the Hungarian model. The carbon brush and the storage battery for power stations, one now considered an essential and the other as an important adjunct in many cases to railway operation, were employed abroad before they were in this country, while the rotary converter was originated abroad though developed and perfected in this country, so that its general use is now distinctively American. Even at the present time we have an instance of the same thing in underground tube railways, and the use of three-phase motors for railway work. While the three-phase roads abroad may yet be considered in the experimental stage, the fact remains that lines of this kind are in regular operation, and have been for some time, while there are no instances of the direct application of three-phase motors to railway work in this country.

The largest and most important foreign street railway association is the International Tramway Union, which was established some fifteen years ago, and which now holds biennial meetings in the different capitals of Europe. The meeting this year, held in London, was the first ever conducted in an English-speaking country, and in this issue we publish a report of the first part of the meeting. The second part will appear in an early issue.

The membership of the International Street Railway Association is made up largely of Continental managers, and three languages, English, French and German, were used in the meetings in London, a digest of the remarks of each speaker being translated into the other two languages for the benefit of those who did not understand the language which the speaker used. We will not attempt here to make any analysis of the different papers or discussions, as the report is complete in itself. It is interesting to note, however, that many of the topics are the same as those which often come up for debate on this side of the Atlantic, a fact which indicates the community of interest in tramway matters in all parts of the world.

The New York State Street Railway Convention.

The convention of the New York State Street Railway Association is always looked upon as one of the most important events of street railway interest of the year, and the meeting which will take place next month promises to be one of the most interesting in the history of the association.

The date fixed for the meeting is Sept. 9-10, and the convention will be held at Fort William Henry Hotel, Lake George. The place selected for the meeting is a most attractive one during September, and the management of the association hopes that there will be a large attendance. There is another reason why the convention this year should possess unusual interest. The entire district in New York State north of Albany and bounded, in fact, by Utica on the west, the State line on the east, and Lake George on the north, has during the last two or three years undergone an enormous development of its electric railway facilities. The roads built have been of the high-speed type, and have been carried through this rich farming and popular summer resort region in many directions, so that as an interurban center this portion of the State almost, if it does not quite, rival the older and better known interurban electric railway districts of the Middle Western States. Recent consolidations have brought this system largely under one management, and it is now possible to travel from Albany to Lake George and beyond, entirely by electric road. The method of operating this vast system of electric railways will naturally be of extreme interest to a visiting railway manager, and we have no doubt but that facilities for an inspection of some of the most interesting features of this line will be afforded those who attend the convention next month.

The New York State Association certainly deserves a great deal of credit and congratulation for its successful history and the important work in advancing the interests of street railways which it has accomplished since its foundation. We have on several occasions in the past expressed our high opinion of the work of the association and the ability which has been displayed in directing the work and aims of this body by its able president, G. Tracy Rogers, and the executive committees who have co-operated with him in carrying out the work of the association. The papers presented at the annual meetings have always been of the highest class, and the association has been fortunate in securing the active and hearty co-operation of the leading railway managers in the State, whose presence and discussions on the topics presented have been of the greatest value. It is with no idea of depreciating the street railway associations of other States to call attention in this way to the work accomplished by the New York State Association and to point to it as an example of what can be accomplished by united action and the expenditure of a little time for the common good. We know that many companies, who always make a point of sending representatives to the convention of the American Street Railway Association, neglect the meetings of the association of their own State, presumably on the theory that being small, it is not worth the time and consideration which would have to be given it. The State associations, however, have their peculiar province, and some things which they can do cannot be accomplished or even undertaken by a national body.

Rochester's Parks and Pleasure Resorts

The development of the park system in Rochester and the establishment of the summer resorts along the lake and bay in that vicinity may be said to date from the introduction of the electric railway system, and to be due, in large part, to the extension of the trolley lines, not only within the city, but to all points of interest along the lake within a convenient distance. Fifteen years ago the people of Rochester were dependent upon two small plots of ground in the heart of the city for recreation purposes; namely, Jones Square and Brown Square, with an occasional outing at Falls Field or Maple Grove. Now, however, they have one of the finest systems of parks in the country—probably the most complete of any city of its size in the world—comprising, in addition to eleven small squares or interior parks of ten acres and less, about 630 acres in three plots, all of which are easily and quickly reached over the lines of the Rochester Railway Company. The original cost of the land for these pleasure grounds aggregated about $300,000, and during the last ten years, while the park plan has been developing, about half a million dollars has been expended for maintenance and improvement. The three principal parks in the city are Seneca Park, which lies on both sides of the Genesee River in the northern part of the town; Genesee Valley Park, similarly situated along the upper river and on the southern border of the city, and Highland Park, which contains the reservoir of the city's water system.

GENESEE CANYON, BELOW LOWER FALLS, SENECA PARK, SHOWING ANCIENT SILURIAN (NIAGARA) STRATA

ON THE RIVER, GENESEE VALLEY PARK

LAKE IN SENECA PARK

The waterside resorts which are reached by the Rochester Railway Company and its connecting lines include Ontario Beach, Summerville and Windsor Beach, Manitou Beach, Sea Breeze, Glen Haven and Sodus Bay. All of the waterside resorts lie to the north of the city; Manitou, which is several miles up the lake, be-

ing the farthest western point, and Sodus, forty miles east of Rochester, marking the other extreme. The other points dot the lake front between these outposts. They are all reached directly by trolley lines from Rochester which connect with the local system and enter the city over the Rochester Railway lines.

The system of the Rochester Railway Company covers all parts of the city very thoroughly, and comprises 105 miles of track over which 185 motor cars and forty trail cars are operated. The lines are laid out so that all routes lead to the business center of the city, from which the cars for the pleasure resorts and parks start, thus enabling patrons in all parts of the town to make direct connections with any of these points. The company has arranged trips taking in several points of interest, and combining not only trolley rides through interesting parts of the city and attractive rural scenes, but also lake trips or a ride on Irondequoit Bay, which is a very picturesque spot and a favorite resort for fishermen and canoeists. A forty-mile trolley ride through a beautiful country to Sodus Bay is offered those who enjoy rural scenes and long trolley rides.

While the lake resorts are available only a comparatively short time every year, the parks are visited at all seasons, especially in the fall and spring, when they are particularly beautiful and attractive to all lovers of nature.

CHILDREN'S PAVILION, HIGHLAND PARK

Seneca Park comprises 212 acres, 141 acres of which are on the east side of the river and 71 acres on the west side, and it contains a long section of the cañon of the Genesee, which rises over 200 ft. from the water level and is densely covered with the native forest growth. One of the most attractive features of this park is a charmingly picturesque lake of five acres, fed by natural springs, and encircled by promenades and driveways. This park also contains a large dancing pavilion and buildings for the zoological collection. Among the natural beauties of this site is a series of terraces and plateaus and a very complete collection of shrubs, trees and flowering plants.

Genesee Valley Park, on the other hand, comprises a broad expanse of meadow, cool and shady woodlands, and placid stretches of river, which are very tempting to those who desire to indulge in outdoor sports or in recreative pursuits. This park comprises 340 acres. The land is practically a level tract, and possesses many elements of beauty, furnishing a rare example of the possibilities of landscape gardening in a location possessing many natural advantages. This park, too, is divided by the Genesee River, whose placid waters wind gracefully between the shady banks, affording an ideal place for boating and canoeing. There are golf links, base ball and athletic grounds, and a fine bicycle track. In summer, concerts are frequently given by popular bands.

FOUNTAIN IN MT. HOPE RESERVOIR, HIGHLAND PARK

Highland Park is the smallest of the three principal resorts, and comprises only 60 acres, but it is one of the most attractive spots, as it contains the waterworks reservoir, in which is a fountain projecting water to the height of 100 ft., and there is also an elaborate floral display. From the eminence in this park an unobstructed view to the south reveals a landscape of extraordinary beauty, and on all sides are beds of flowers and clumps of blooming foliage. To the north, the city stretches out, and beyond can be seen, on a clear day, the waters of Lake On-

tario. The plan to use the reservoir site for park purposes was proposed by Ellwanger & Barry who were at one time interested in the old street railway company which operated the horse car lines in Rochester for many years. They offered to donate twenty

SCENE IN GENESEE VALLEY PARK

acres to help out the project. This generous offer was accepted, and now the park includes part of a moraine extending from the river to a point several miles east, the south slope of which has been developed to make of the park an arboretum. Here are over 1100 species and varieties of the 1800 sorts indigenous to this latitude. Such a sight as this slope during the flowering season cannot be found elsewhere in this country, and the troops of bright, laughing children frolicking on the banks—for this is a "children's park"—lend additional grace and beauty to the scene. However, the children are not the only admirers of this collection, for it attracts horticulturists from all parts of the world. The north slope is devoted to evergreens, of which there are numerous varieties, beneath whose spreading branches are arranged long rows of picnic tables and settees. In 1890 Messrs Ellwanger & Barry constructed a beautiful pavilion for the children, circular in form, three stories in height, 62 ft. in diameter and 46 ft. to the apex. This has proved a great attraction.

There are many additional points of interest in the city that are not included in the official park system, although some of them lie along the park route, and are much admired and visited by residents and strangers. Most important of all are the Falls of the Genesee. The upper falls are situated in the heart of the city; to the south of Platt Street bridge, which spans the gorge at the height of 200 ft. From here a splendid view may be had. The falls are 85 ft. high, and it was over this precipice that the famous Sam Patch made his last and fatal leap in 1829, before

PRIVATE CAR OF THE ROCHESTER RAILWAY COMPANY

thousands of spectators. The middle falls are 26 ft. high. The lower falls may be viewed to advantage from the Driving Park Avenue bridge. They are 96 ft. high and present a most imposing spectacle. To the north is the cañon of the Genesee. Driving Park Avenue bridge spans the Genesee cañon at a height of 212 ft. The bridge is 900 ft. long, and is the third longest single span bridge in the world. All of these points of interest, like the city parks, are located on the lines of the street railway company.

The city is particularly fortunate in its location, which enables it to enjoy many attractive summer resorts on Lake Ontario. Irondequoit Bay and Sodus Bay; all reached by trolley cars operated in conjunction with the local service.

The ride to Ontario Beach by trolley occupies about three-quarters of an hour. The first part of the journey is through

TROLLEY PARTY VISITING LAKE RESORTS

State Street, one of the city's chief business thoroughfares. At Lyell Avenue an oblique turn is made into Lake Avenue, and from this point to the Ridge Road is a succession of handsome residences and well-kept lawns. Beyond the city limits the route continues over the Charlotte Boulevard through a picturesque section. On the left is Kodak Park. Farther along on the boulevard the car passes St. Bernard's Seminary and Holy Sepulchre Cemetery. About two minutes' ride beyond this is Riverside Station, opposite which is Riverside Cemetery. After this comes Charlotte Village and then Ontario Beach. The entire route is lined with magnificent shade trees, which help to make the ride cool and refreshing on the hot summer days. The ride is also free from dust and dirt, as the streets and boulevards over which the cars run are constantly sprinkled.

Ontario Beach, on the shores of Lake Ontario, about 7½ miles north of Rochester, is the most popular lake resort in the State. It offers attractions usually found at the great seacoast resorts. During the season concerts are given afternoon and evening by bands of national reputation, and free vaudeville shows are continually going on in the pavilions, as well as spectacular outdoor attractions for entertainment.

From Ontario Beach to the west runs a trolley line along the shore to Manitou, which is a favorite resort for picnickers, fishermen and family outings. This is owned by the Rochester, Charlotte & Manitou Railroad Company, and is a very popular route. It works in conjunction with the Rochester Railway Company.

Summerville, on the opposite side of the river from Charlotte, is a popular resort, and offers as attractions a splendid electric fountain, the Paul Boyton chutes, and a bathing beach. Adjoining Summerville are Windsor Beach and the White City, comprising a community of summer campers, whose long rows of tents present a very pretty spectacle. The ride to Windsor Beach and Summerville from the city is through a beautiful section of country, and follows the course of the river along the east side. Many visitors take the Windsor Beach car from Rochester, cross the river by ferry, and return over the Charlotte line, or reverse the order, and thus get a trip on each side of the city.

THE WHITE CITY AT WINDSOR BEACH, LAKE ONTARIO

Sea Breeze is the suggestive name of a popular resort at the point where Irondequoit Bay connects with the lake. It has been laid out in very attractive manner by landscape gardeners, and as it possesses many natural advantages, it draws many pleasure seekers. The Rochester & Irondequoit Railway Company, which is leased by the Rochester Railway Company, operates a direct line to this point, from which steamers can be taken on Irondequoit Bay to Newport, Glen Haven and other points, or on Lake Ontario to Ontario Beach.

OLD PATHWAY IN SENECA PARK

LIGHTHOUSE, SODUS POINT

Glen Haven, one of the latest resorts in the neighborhood of Rochester, is situated in a charming glen at the head of Irondequoit Bay, on the line of the Rochester & Sodus Bay Railway.

It possesses many attractions, and has splendid accommodations for excursions and picnics, being surrounded by delightful groves on all sides. It has the advantage of being nearer to Rochester

SUMMERVILLE, AT THE MOUTH OF THE GENESEE RIVER

than any other of the summer resorts, the trip taking only thirty minutes' ride from the center of the city.

Sodus Bay, which, of all the resorts reached by trolley lines from Rochester, is the farthest, is likewise one of the most attractive, as it affords many advantages which cannot be found elsewhere. It is acknowledged to be the finest harbor on Lake Ontario, and is protected by a splendid breakwater, built by the Government. The shores and islands abound with attractions and beautiful scenery, and accommodation for picnics and excursions are offered on every hand. A ride to Sodus Bay on a "Royal Blue Line" car of the Rochester & Sodus Bay Railway Company, which is now controlled by the Rochester Railway Company, is one of the most enjoyable "trolley trips" possible to find anywhere. The line passes through a fine residential section as far as the Glen Haven depot, and then makes a turn to the left, and passes through the outskirts of the city. Just beyond the city the line runs through a most picturesque glen, and emerging from this enters Glen Haven. Here a turn to the right brings the car through the bluffs. Irondequoit Bay presents itself to view for over a mile. Leaving the bay and the main power station of the company, the route leads through the Dugway, winding in and out among the hills. This part of the ride contains some of the finest landscape scenes to be found on the line. The track has been built for a considerable distance along the Webster Road and the Ridge Road, which was at one time the shore of Lake Ontario. The first point of importance is the village of West Webster, then three miles beyond is Webster, a prosperous and thriving village of about 1200 people. Through a beautiful farming section the line runs to Union Hill, a few miles beyond which is Fruitland, and then Ontario Center and Ontario. The landscape is ever changing; the road is lined with splendid orchards, and in springtime, when the trees are in blossom, the sight is most inspiring. The next town is Williamson, two miles beyond is East Williamson, and five miles further Sodus—the most important town on the line, with a population of 1800 persons. After leaving Sodus the line parallels the Rome, Watertown & Ogdensburg Railway as far as Wallington, where it passes under that road and turns to the north. About three miles beyond Wallington is Margaretta Grove, a favorite resort for picnickers. After this a few minutes' ride lands the traveler at his destination in the historic village of Sodus Point. It is expected that this road will eventually become one of the most important parts of the system of the Rochester Railway Company, as the freight and express service during the winter and the pleasure traffic in the summer months have been rapidly developing since the opening of the line. Sodus has proved a very attractive resort for Rochesterians.

At all points reached by the trolley lines along the lake the railway company has contributed generously toward furnishing attractions and entertainments, and this liberality has resulted in largely increasing the patronage of these resorts and the revenue of the street railway company.

MANITOU BEACH, ON LAKE ONTARIO

Buenos Ayres Horse Road to be Converted

The Buenos Ayres Grand National Tramways Company, Ltd., a British concern which operates about 50 miles of horse tramways, employing nearly 300 cars, in the city of Buenos Ayres, Argentine Republic, is about to be equipped with electricity, according to private advices just received from South America. J. Hamden Wall, the general manager of the company, is now on his way to London for the purpose of conferring with his directors on the subject. The consulting engineers of the company are Sir George Bruce & White, of London. The company's head offices are at 6 Eastcheap, London, E. C.

Plotting Speed-Time Curves—III

BY C. O. MAILLOUX

Modified Curves.—Fig. 11 is reproduced for the purpose of illustrating the modifications produced in the acceleration curve and the distance-curve by various changes in service conditions. The lower "*A*" curve is the same as the solid line curve in Fig 7. The lower "*B*" curve shows the change in the form of the acceleration curve produced by the addition of a trailer-car to the motor car. It bears a relation to the curve *A* similar to that of a curve for a down grade of relatively high percentage, this relation being obvious from the analytical principles previously set forth. The lower curve, *C*, shows the acceleration which would be obtained if the motors remained connected in series throughout the acceleration cycle. The curves *Fa*, *Fb*, *Fc*, etc., are the corresponding distance curves. In the case of both acceleration and distance curves the upper line of each pair is that which corresponds to the next higher gearing ratio. It should be noted that while the maximum speed attainable is higher with an increased gearing ratio, yet the initial acceleration is smaller. The two acceleration curves and the two distance curves cross in the figure at a point near the bend or "knee" in the curve. This characteristic of the two curves is the reason why the higher gearing ratio would be selected when the lengths of run are relatively great, whereas the lower gearing ratio would be selected when the lengths of run and the time allowable for acceleration are relatively short.

Run Curves.—The process of plotting a "run" curve consists in selecting and in bringing together properly certain determinate portions of acceleration curves, drifting curves and braking curves, constituting its component parts.

The operation of selecting and plotting the portions of component curves aforesaid naturally involves a more or less comprehensive study of all the basic data, the peculiar features and the specific conditions of the case, as well as the determination of their influence and effects by reference to the principles of analysis and synthesis previously considered; and it also requires the practical application of methods of plotting such as hereinbefore described. The operation of bringing together and of combining the component curves involves the utilization of the distance-time curve as a gage of the distance and time intervals corresponding to each distinct portion of curve; and it requires some knowledge of drafting room methods.

In a conventional run curve of the simplest form, such as shown in Fig. 4, there are only three component parts (*A*, *B*, *C*), which are easily combined together in the manner already explained in Sec. I. Such a run curve, however, only applies when the track actually is, or is assumed to be, straight and level. When it is desired to make proper allowance for track curves and grades, the process of producing the run curve is no longer as simple.

Fig. 12 shows a "service" run curve in which the speed line is modified by grades only. It represents express service run No. 7, running north, on the New York & Port Chester Railroad.

Fig. 13 shows a "service" run curve in which the speed line is modified both by grades and track curves. It represents express service run No. 11, running south, on the same line.

The latter curve has been specially selected as an interesting practical example of speed-time curve plotting, embodying substantially all the features and complications which are usually met with in the plotting of such curves.

These two service-run curves form part of a large series of such curves prepared for the aforesaid company during the last year, under the joint direction of Mr. W. C. Gotshall, president of the company, and the writer, to serve as the basis and also as the corroboration of technical evidence regarding the engineering features and merits of the project of the company, as presented in the hearing before the New York State Railroad Commission; and they are here reproduced, together with some of the corresponding subsidiary curves, by permission of Mr. Gotshall. The writer further takes this occasion to acknowledge many valuable ideas and suggestions kindly given by Mr. Gotshall, and gladly utilized in the preparation of this paper.

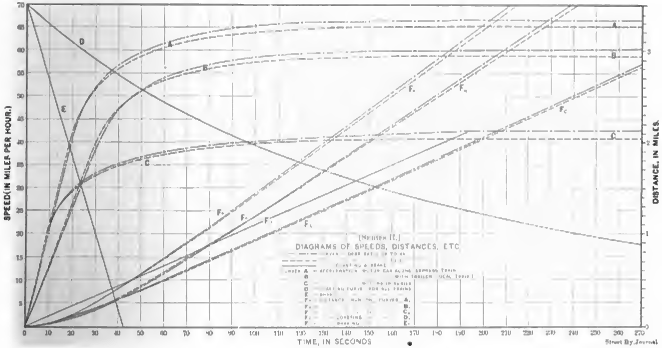


FIG. 11

Tables I and II give the line data which are the basic data by reference to which these two run curves were prepared. These data were taken or calculated from the profile maps, location maps and field notes of the preliminary surveys made of the entire line. The first column gives the reference letters by means of which the corresponding portion of the run curve in the figure may be identified. Column II gives the lengths of the corresponding portions of the total run in fractions of a mile. Columns III and IV give the percentages of up-grade and down-grade, respectively. Column V gives the track curvature, stated in track "degrees," the word "tangent" being synonymous with "zero degrees" (0°), and being used to designate *straight* portions of track, all in accordance with the established practice in civil engineering. Column VI gives the track curvature expressed in equivalent percentage of grade. In Column VII the "net equivalent grade" values are given, these values being the same as the grade values given in Column III, for all portions on which there are no track curves, and being equal to the algebraical sum of the values given in Columns III and VI for all portions of the run on which track curves occur.

It will be noted that in the tables the total length of run is subdivided into as many portions as there are changes in track gradient or in track curvature, each portion being tabulated separately in a distinct line. Each of the lines in the tables corresponds to at least one "component" portion of the run curve.

Note.—The first instalment of this paper appeared in the Street Railway Journal July 5, and the second part July 26, and contained Figs. 1 to 10, inclusive.

TABLE I.—LINE DATA FOR EXPRESS SERVICE RUN NO. 7 (NORTH) NEW YORK & PORT CHESTER RAILROAD CO.

I. Portion No. (Fig. 12)	II. Length Miles	Per Cent of Grade III. Up	Per Cent of Grade IV. Down	Track Curvature V. Degrees	Track Curvature VI. Equival't Grade*	VII Net Equivalent Grade
O to A	.107	....	0.900	4°	+0.180	−0.720%
A to B	.347	....	"	Tangent	......	−0.900%
B to C	.521	0.364	....	"	......	+0.364%
C to E	.567	....	0.483	"	......	−0.483%
E to G	.183	0.122	....	"	......	+0.122%
G to H	.065	"	....	2°	+0.090	+0.212%
H to I	.063	"	..	Tangent	......	+0.122%
	1.853	....	....	....	......	......

TABLE II.—LINE DATA FOR EXPRESS SERVICE RUN NO. 11 (SOUTH) NEW YORK & PORT CHESTER RAILROAD CO.

I. Portion No. (Fig. 13)	II. Length (Miles)	Per Cent of Grade III. Up	Per Cent of Grade IV. Down	Track Curvature V.	Track Curvature VI. Equival't Grade*	VII. Net Equivalent Grade
O to A	.306	0.284	....	Tangent	......	+0.284%
A to B	.113	"	....	1° 30'	+ .068	+0.351%
B to E	.374	"	....	Tangent	......	+0.284%
E to H	.208	"	....	7° 10'	+0.322	+0.606%
H to I	.135	"	....	Tangent	......	+0.284%
I to J	.180	Level	....	"	......	
J to M	.169	1.300	....	"	......	+1.300%
M to N	.111	Level	....	"	......	......
	1,695	...	....	....	..	......

*By equation (XIII), taking b = 11.9

Some of them may correspond, as will be seen later, to two or more such component portions. Thus, while the total distance for run No. 7, amounting to 1.853 miles, in Table I, is sub-divided into seven distinct portions, each tabulated in a distinct line, it will be found that the corresponding run curve (Fig 12) is made up of nine "component" portions of run. In like manner the eight distinct portions of the run (No. 11) tabulated in Table II, correspond to fourteen "component" portions of run in Fig. 13.

The manner in which the aforesaid line "characteristics" influence the form of the speed-time curve has already been fully considered. In plotting a run curve we need, it is obvious, to consider, in addition to these line data, the other forces concerned in acceleration. If we use the "chart" method, previously described, we will need a "Chart of Coefficients,' on which will be drawn the proper curves analagous to M and N, giving, respectively, the gross and net motor accelerations as functions of the speed, and also the curve R, giving the equivalent acceleration due to train resistance. The "corrected" speed curve and the tractive-effort curve marked "C", in Fig. 5, constitute the motor characteristics, by reference to which the curve of gross acceleration coefficients (M), shown in Fig. 9, was prepared. This curve (M) is substantially the same as was used in plotting the set of acceleration curves corresponding to various gradients shown in Fig. 7 and the service-run curves shown in Figs. 12 and 13.

It is proper to state that the straight portion of this curve M is based upon the assumption that the mean value of the current during the early stages of acceleration will be exactly 400 amps. per motor, corresponding to a maximum initial tractive effort of 2044 lbs. per motor, as indicated by the corrected curve of tractive efforts (C) in Fig. 5.

The track curves occurring during a given run are the first features requiring attention. If the track curves occur at the beginning or at the end of the run they usually impose no limitations on the speed. When they occur at midway points on the run they will impose limitations unless they are of relatively small degree. Run No. 11 furnishes an instance of this kind, as will be seen later.

Service Run No. 7—(Fig. 12), begins with a portion, 0.107 mile in length, having a track curve of 4 degs. and a down-grade of 0.90 per cent. The data in Column VI giving the "equivalent grade," and in Column VII giving the "net grade," show that the advantage of the down-grade is partly offset by the increase in the train resistance due to the track curve, the resultant effect being the same as if the track were straight and had a down-grade of only 0.72 per cent. instead of 0.90 per cent. The first portion (O-A) of the service-run curve in Fig. 12 will, therefore, be the same as the first portion of an acceleration curve, such as would be obtained on a straight track having a down-grade of 0.72 per cent. The net acceleration coefficients for this portion of the curve may, it is obvious, be readily obtained from the "Chart of Coefficients" (Fig. 9), and the corresponding time values can then be obtained by reference to the "Chart of Reciprocals" (Fig. 10) in the manner already fully explained.

The process of determining the co-ordinate points for the portion of curve to be plotted has already been described fully in the previous pages, and, therefore, need not be detailed further. The co-ordinates of the curve having been determined and the curve itself having been plotted and drawn, the next step is to ascertain the exact point at which the first portion (O-A) terminates. This is done by means of the distance curve, in the manner already fully explained, and also illustrated by reference to Fig. 4 in the foregoing reference to the "distance-time curve." The time point at which the ordinate of the distance-curve, when measured by the scale of distance, indicates a distance of 0.107 mile, represents the time point at which the first portion of the run-curve (O-A) should terminate. A vertical ordinate line is usually drawn from the terminal point A after it has been thus determined. The end of the first portion of the run (A) corresponds to a speed of 41.8 m. p. h., and a time interval of 19 seconds from the time of starting.

The second portion of the run has, according to Table I, a length of 0.347 mile, with the same down-grade (— 0.90 per cent), but without any curve. It begins at the speed point A (= 41.8 m. p. h.) and ends at the point B (= 59.6 m. p. h.). The co-ordinates for this portion of the curve are to be determined in substantially the same way as for the first portion of the curve, with the exception that the time values for all speed points higher than 41.8 m. p. h. are the only ones which need to be determined. After the curve has been plotted and drawn to a certain length

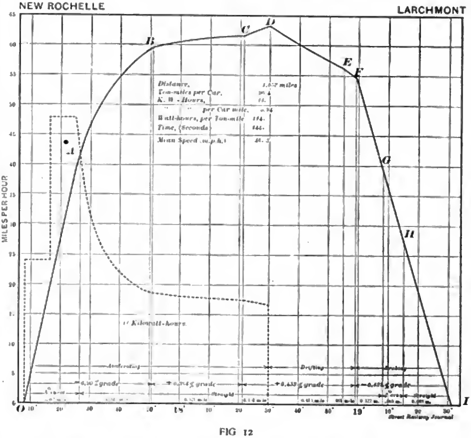


FIG 12

the point B, at which it should be cut off, is determined by reference to the corresponding distance-curve. The third portion of the curve, as shown in Table I, is 0.521 mile in length, straight, and on an up-grade of 0.364 per cent. The co-ordinates for this portion of the curve are determined and plotted, and the terminal point (C = 61.7 m. p. h.) is determined in the same manner as

before. The relative flatness of this portion of the curve is both the result and the indication of the effect of the up-grade, the relative gain in speed being, as should be expected, much less on an up-grade than on a down-grade.

As the three portions of run-curve thus far considered cover a little over one-half of the total distance, it becomes necessary, in proceeding to plot the next portion, to anticipate and to determine two things: First, the point at which the electric power is to be shut off and at which the train will begin to coast; and, second, the point at which the brakes will be applied. Both points are determined somewhat arbitrarily, and vary greatly in different cases. It may be said that both are related to, and depend upon, the time allowed for making the run, or, in other words, the schedule speed required. The sooner the electric power is shut off, the smaller, it is obvious, will be the amount of electric energy consumed during the run. The effect of cutting off the electric power early is to increase the length of time during which the train must drift or coast, and also to lower the speed at which the brakes must be applied, in order to cover the same given total length of run. When economy is an important consideration it is obviously desirable that the amount of coasting should be greatly increased, and that the braking should begin at as low a speed as possible, for, the greater the amount of speed reduction obtained by drifting or coasting, and the lower the speed at which the brakes are applied, the smaller the momentum of the car at the time of braking, and, consequently, the smaller the amount of energy dissipated by friction during the operation of braking. When time is an important consideration, however, as in the case of a rapid transit or express line, it becomes necessary to sacrifice economy in order to gain time. In such cases we must shorten considerably the period of time during which the train will coast, and we must begin the operation of braking at a much higher speed. It may be desirable in fact to reduce the period of braking until it is virtually eliminated, the brakes being practically put on at the same instant that the power is shut off. A run-curve made under those conditions will be the curve corresponding to the *minimum time of run* for that particular case, although it will not be the curve of *minimum energy consumption*. It is desirable, even when the quickest time is to be made, to still make allowance for a certain period of coasting between the time that the power is shut off and the time that the brakes are applied. This gives the motorman a certain margin, for, if running behind, he can keep the current on a little longer and reduce, or eliminate, the period of coasting, while if running ahead, he can cut off the power earlier, and increase the period of coasting. In the service run under consideration (Fig. 12) the acceleration is continued on entering the fourth portion of the run (*C* to *E*) until the point *D*, distant 0.152 mile from the point *C*, has been attained. At the point *D* (= 63.3 m. p. h.) the current is shut off and the train begins to drift. In this particular case it was decided to let the coasting continue until the speed became reduced to 55 m. p. h., at which point (*E*) the operation of braking is to begin. The fixing of the braking point has the effect of also fixing the point *D*, at which the current is to be cut off. This is due to the fixed relation between the form of a speed-time curve and the area enclosed by it, and also to the fact that this area, as pointed out in Appendix A, is equal to and serves to measure the distance covered by the train in the corresponding time interval.

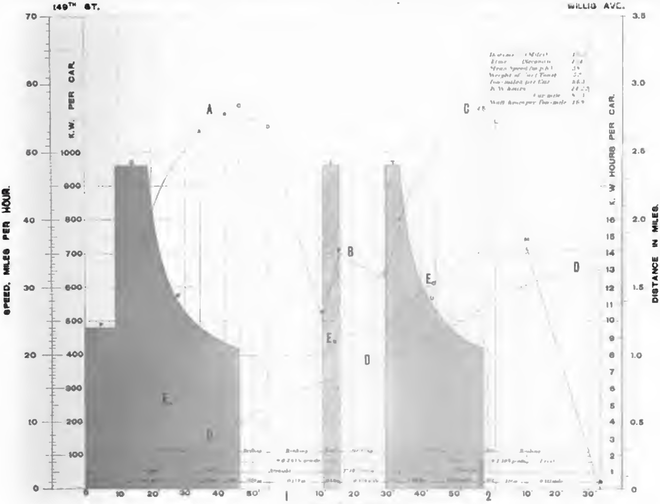


FIG. 13

The fourth portion (*C* to *E*) of the run tabulated in Table I will, therefore, correspond to two "component" curves, one being an acceleration curve (*C-D*) and the other a drifting curve (*D-E*). The acceleration curve is to be determined and to be plotted in the manner indicated for the preceding portions. As the point *D* is not known and has to be determined, it will be necessary to plot the curve to some arbitrary length, such as may be deemed sufficient for the purpose. If too long the excess can be erased; if too short, it will have to be lengthened.

The point *D*, at which the drifting begins, cannot be determined until we ascertain how much distance will be covered by the train while braking from the speed of 55 m. p. h., which, as already stated, was fixed as the point at which the operation of braking is to begin. It will be necessary, therefore, to determine and even to plot out the braking curve before plotting the drifting curve itself.

In plotting the braking curve we have to work backwards, so to speak, for we must, of necessity, begin with the last portion. According to Table I the last portion of the run is straight, on a + 0.122 per cent grade, and is .063 mile in length. We need to determine, first, the speed at which the train would be running at the time of entering this portion; second, the time consumed in running through this portion. This case corresponds exactly with the first brake-curve problem discussed in Appendix D. The equations (*e*) and (*f*) therein obtained for the speed and time values will exactly apply in this case. The speed will be:

$$y = \sqrt{7200\ k\ s} \qquad (e)$$

and the time will be:

$$x = \frac{y}{k} = \sqrt{\frac{7200\ k\ s}{k}} \qquad (f)$$

in which

y = the initial braking speed for that portion of the run.
x = the time interval for that portion of the run.
k = the net or resultant retardation coefficient.
s = the length of the corresponding portion in miles.
= .063 mile, in this case.

The value of the retardation coefficient, k, when calculated by the formula given in equation (X), will be found in this case to be:

$$k = 1.647 + (0.01098 \times 0.122 \times 20) = 1.674$$

Substituting the proper values in equation (*e*) we have:

$$y = \sqrt{7200 \times 1.674 \times .063} = 27.6 \text{ m. p. h.}$$

(which is the speed at the point H); and the time, by equation (*f*), will be:

$$x = \frac{27.6}{1.674} = 16.5 \text{ seconds.}$$

We next proceed to determine the co-ordinates for the portion of run ($G\ H$) immediately preceding the last portion.

The case corresponds exactly with Problem 2 in Appendix D. The initial speed (at the point G) will be:

$$Y = \sqrt{7200\ K\ s + a^2} \qquad (1)$$

where

Y = the entering or initial speed,
a = the leaving or final speed,
s = the distance,
k = the net coefficient of retardation.

The final speed (a) will obviously be the same as the initial speed y (= 27.6 m. p. h.) for the last portion of the run.

The distance from Table I is

$$s = .065 \text{ mile.}$$

The net retardation coefficient for the "equivalent" grade given in Table I, Column VII, will, by equation (X), be

$$k = 1.647 + (.212 \times .20 \times 0.01098)$$
$$= 1.694$$

Substituting these values in equation (1) we will have:

$$Y = \sqrt{7200 \times 1.694 \times .065 + 759.3}$$
$$= \sqrt{792.7 + 759.3} = 39.4 \text{ m. p. h.}$$

(which is the speed at the point G).

The time interval corresponding to this portion of the run will be:

$$x = \frac{Y - a}{k} \qquad (i)$$

$$= \frac{39.4 - 27.6}{1.694} = 6.97 \text{ seconds,}$$

or, practically, 7 seconds.

The speed at the point G being only 39.4 m. p. h., as already seen, it follows that the braking must have begun before the train enters upon the portion $G\ H$. The next step, therefore, is to determine how much of the portion ($E\ G$) preceding the portion $G\ H$ will be covered by a train when braking a long enough time to reduce the speed from 55 m. p. h. to 39.4 m. p. h. This case corresponds exactly with problem 3 in Appendix D. The formula for the distance traveled is

$$s = \frac{Y^2 - a^2}{7200\ k} \qquad (m)$$

where

Y = the initial braking speed.
a = the final braking speed.
k = the net retardation coefficient.
s = the distance traveled while braking from speed "Y" to speed "a."

The net equivalent grade (Column VII) being the same for this portion as for the last portion ($H\ I$), the net retardation coefficient will also be the same, or $k = 1.674$.

Substituting values in equation (m) we have:

$$s = \frac{55^2 - 39.4^2}{7200 \times 1.674} = .122 \text{ mile}$$

which is the length of that part of the portion of run $E\ G$.

This, as we find from Table I, is not the whole of the portion of run $E\ G$, which is 0.183 mile long. The difference, which is

$$0.183 - 0.122 = 0.061 \text{ mile,}$$

represents distance covered by the train *before* the braking begins, or, in other words, while the train is still drifting. Hence the portion of run $E\ G$ must be represented in the run curve by two "component" curves, one ($E\ F$) being a drifting curve and the other ($F\ G$) being a braking curve. The time interval corresponding to the portion $F\ G$ is calculated in the same manner as for the portion $G\ H$ by means of formula (*i*). Its value is

$$x = \frac{55 - 39.4}{1.674} = 9.3 \text{ seconds}$$

The next step is to plot a portion of drifting curve from which the portion $E\ F$ may be cut off. This can be done by the chart method, using the curve Q on the chart of coefficients. We may begin plotting from a slightly higher speed, say 57 m.p.h. or 58 m.p.h., and plot the curve downward with positively increasing time values, in the usual way, until the speed line comes down to 55 m.p.h.—where the drifting ceases.

We may, however, plot the drifting curve in the opposite direction or "backwards," as it were, starting from the lower speed limit (55 m.p.h.), and continuing upward and backward until the length of the portion plotted is sufficient to represent a little more than the distance required to be covered. With a little practice, it is as easy, by the chart method to plot a curve "backward," as it is to plot it "forward." This is one of the incidental features and advantages of the method. The *modus operandi*, when plotting barckward, is, in reality, exactly the same, but the *order* is reversed. In plotting a drifting curve "forward," the retardation coefficient values would be taken from the chart of coefficients in the order of descending speed values, or from right to left, and the summated values would be reckoned and plotted in the right-hand direction, like positive abscissae. In plotting "backward," we merely reverse this order; the retardation coefficients are taken from the chart of coefficients in the order of ascending speed values, and the summated time values are to be reckoned and plotted in the left-hand direction, as if they were negative abscissae.

The curve having been plotted (on a separate sheet), the next step is to determine the "entering" point (E), at which it should be cut off. This is to be done, as in the case of the three portions of acceleration curve (O to C), by reference to the distance curve corresponding to this drifting curve. The initial or entering speed (at the point E) is found to be 56.4 m.p.h.

We now come to the final and somewhat difficult operation of making the "joint" or connection between what might be termed the "acceleration end" and the "retardation end" of the run curve. This joint occurs, as already seen, at a point D, on the portion $C\ E$, which point is, itself, to be located. It is necessary in this case to operate from both ends of the portion of run $C\ E$. For this purpose we need an acceleration curve suitable for the beginning of this portion, and a drifting curve suitable for the end thereof. Suppose we plot, in accordance with the data given in Table I, for the portion $C\ E$, on separate sheets of tracing paper or of tracing cloth, two distinct speed-time curves—one being an *acceleration* curve whose "beginning" or lowest speed point is the same as the speed at the point C (= 59.6 m.p.h.)—the other being a *drifting* curve, whose "end" or lowest speed point is the same as the speed at the point E, (= 56.4 m.p.h.); and suppose the distance curve for each speed-time curve to be also drawn on the same sheet therewith. If the two sheets be placed in correct ordinate relation with a straight line serving as the axis of x for both curves, the acceleration curve being placed at the left and the drifting curve at the right, and if they be then moved toward each other until they become partially superposed, the upper ends of the two curves will eventually come in contact; and if the sheets continue to move toward each other, the point of intersection between the two speed-time curves will gradually become lower until it corresponds exactly with the right speed point D, at which point the motion should stop. When the two curves are in this relation, they will precisely represent the portion of the run $C\ D\ E$ shown in Fig. 12, and it will be found by reference to the distance curves, that the aggregate distance corresponding to the two component curves $C\ D$ and $D\ E$ will be exactly 0.567 mile, as given in Table I. It is evident that if the curves were made to intersect at a point higher than the point D, the aggregate area, and, consequently, the aggregate distance covered by the two curves, would be greater, whereas, if the curves were moved closer together, thereby bringing the point of intersection below the point D, the area enclosed, and, consequently, the

distance covered, would be smaller. The point D, is, therefore, the only one which meets the condition. It will be found that the acceleration portion, C D, ends when a speed of 63.3 m.p.h. has been attained, and a distance of 0.152 mile has been covered, the rest of the distance (0.415 mile), being covered while drifting from this speed to the entering speed at the point E, (56.4 m.p.h).

The component curves C D and D E having been determined, they can now be plotted on the same sheet as the preceding portions of the run curve. The portion E F, plotted on a separate sheet, may now be transferred to the same sheet. The portions of braking curve, F G, G H and H I, being straight lines, can be readily plotted by reference to the data calculated in the manner previously indicated. Thus, the point G corresponds to a speed of 39.4 m.p.h. and a distance of 9.3 seconds from the ordinate of the point F. In like manner, the point H corresponds to a speed of 27.6 F. In like manner, the point H corresponds to a speed of 27.6 m.p.h., and a distance of 7 seconds from the ordinate of the point G. The terminal point I occurs at a time distance of 16.5 seconds from the ordinate of the point H.

Service Run No. 11 (Fig. 13).—A glance at the curve shows that it has two "notches" and three "crests," A, B, C, indicating three distinctive acceleration cycles. The acceleration in the first cycle lasts from the time of starting until the speed point C (56.35 m. p. h.) is attained, after which the train drifts as far as the point D (53.2 m. p. h.), and then brakes as far as the point E (25 m. p. h.), where the second cycle begins. The acceleration in the second cycle continues until the speed has risen to the point F (35 m. p. h.), after which the train drifts to the speed point G (31.1 m. p. h.), where the third cycle begins, with acceleration continued to the speed point K (56.2 m. p. h.), followed by drifting to the point L (54 m. p. h.), at which point the final braking begins, being continued to the end of the run (N).

The striking difference in outline between this run curve and the run curve shown in Fig. 12, is due to the restriction imposed upon the speed by a track curve of relatively short radius (7° 10'), which occurs in the portion E H, about midway, in this particular run. It will be found by reference to the line data in Table II. that there are two track curves in this run. The first track curve (1° 30') occurring in the portion A B and tabulated in the second line in Table II, does not impose any limitations on the speed, such track curves being considered safe at any speeds below 60 m.p.h. In the case of the second track curve (7° 10'), however, it is necessary to restrict the speed considerably. It was decided in this particular case that the speed on entering this particular track curve ought not to exceed 25 m. p. h., and that the speed ought not to exceed 35 m.p.h. while running on the curve, excepting toward the end, where it would be allowable to allow the speed to rise as high as 40 m. p. h. while running out of the track curve. This restriction, it will be readily seen, accounts for the notch at the point E, as well as for the crests B C, in the run curve. This case is an interesting illustration of the important modifying effect produced on the service-run curve by a track curve of relatively small radius occurring at a midway point in the run. The track curve is, in this case, the primary cause for the two supplemental accelerations required in this particular service run, each of which involves an application of electrical energy to the train, and, consequently, occasions a material increase in the energy consumption required for the run, as will be found later on plotting the energy in-put curves.

When the service run has but a single cycle, as in Fig. 12, the plotting must of necessity begin with the very first portion. When it has several acceleration cycles, as in this case, if the speed value at the beginning of the second or third cycle is determined, or arbitrarily fixed, it is possible to begin the process of plotting at one of these cycles. Thus, in this particular case, the speed being restricted and set to 25 m. p. h. at the point E, corresponding to the point at which the train enters the sharp track curve, it would be possible to begin the process of plotting the run curve from the point E instead of from the point O. Advantage may be taken of this fact when it is desired to do work quickly, and to apportion it among as many persons as possible. In this case we shall follow the usual practice and assume that the curve is to be plotted by beginning at the very first portion (O A).

The operation of plotting the run curves is susceptible of being still further simplified, especially when the run curves are plotted and drawn on a relatively large scale, by a "method of interpolation," which the writer has used considerably, with success and satisfaction. The method is specially useful when the number of run curves to be made is large. For the purpose of giving an example illustrating the nature and practical use of the method, it will be assumed to be the method used in plotting the service-run curve shown in Fig. 13.

New York's Transportation Needs

Mayor Low's weekly letter, July 31, discussed the transportation facilities of New York and the improvements and extensions which, in his estimation, would be required to secure the unification of the several boroughs that will be necessary to carry out the spirit of the enactment which made possible the greater city. These requirements are considered under three general headings, namely: Inter-borough communication between Manhattan Island and Long Island, communication with Manhattan Island from the north, and the improvement of the city's commercial facilities in connection with the development of the water front of Manhattan Island. These features of the letter which relate particularly to intramural service are reprinted herewith:

When the Brooklyn Bridge was designed it was intended, from the railroad point of view, to be a bridge with shuttle trains passing to and fro upon it. In the process of time it has become a railroad thoroughfare—wholly so as to trolley cars, partly so as to the bridge railroad proper. One need not be a prophet to be able to foresee that its destiny is to become, from this point of view, wholly a thoroughfare. Two conclusions flow from this situation: First, that the suspended structure of the Brooklyn Bridge should be rebuilt as soon as possible to adapt it to the largest possible use as a railroad thoroughfare; second, that all the other East River bridges must be treated as railroad thoroughfares—that is to say, they must not only arrive, they must lead somewhere.

These conclusions may be briefly amplified. There are certainly very few, if any, railroad bridges in the country twenty years old that have not been rebuilt, at least once, in that interval, and, in some instances, twice, to adapt them to the demands of modern use. The towers of the Brooklyn Bridge and the cables and anchorages of it are equal to any demands that may be made upon them, but the suspended structure cannot do any more than it is doing now. Were this suspended structure to be rebuilt to comply with modern conditions, six car trains could be run instead of four car trains; in other words, the train capacity of the bridge would be increased 50 per cent. I believe this work can go forward without interfering with the use of the bridge. It ought to be planned for at once, and put under contract as early as possible. The estimated cost is $2,000,000. With this work completed we should have a modern railroad bridge instead of one twenty years old.

But, as I stated, a railroad thoroughfare not only ought to arrive; it ought to lead somewhere. Now, where in Manhattan should those East River bridges lead? The Brooklyn Bridge incontestably ought to lead south to the financial districts and across the city to the Hudson River ferries, and also north via Center Street and other streets to the Williamsburg Bridge. This would enable it to place Brooklyn in touch with a large district of Manhattan and with the New Jersey ferries. The southern connection can wait, but I think it will come. In the meanwhile the northern connection is immediately important, because it will not only increase the value of the Brooklyn Bridge, but it will also bring the Williamsburg Bridge (which ought to be open by Oct., 1903,) in touch with the City Hall, thus making that bridge, in its turn, a railroad thoroughfare. The same connection will, of course, unite the two bridges, and it seems to me possible, should it be thought desirable, that if the southern connection should one day be built for the Brooklyn Bridge trains from the Williamsburg Bridge could also make use of it.

The Manhattan Bridge runs from a point near the junction of Fulton Street and Flatbush Avenue, in Brooklyn, to the neighborhood of Canal Street and the Bowery. The railroad of this bridge ought to be carried across the city in such a way as to give contact with the West Side elevated roads, as well as with those upon the East Side.

The Blackwell's Island Bridge should be brought into immediate communication with the City Hall.

The connection between the Brooklyn Bridge and the Williamsburg Bridge, if the detailed studies show it to be practicable should be made underground, as proposed by Mr. Parsons in his recent report. The railroad outlet for the Manhattan Bridge must be either underground or by elevated road, as further study may dictate; for Canal Street is a broad thoroughfare, entirely given up to business. So far as the Blackwell's Island Bridge is concerned, this bridge terminates at Second Avenue, so that it could easily be connected with the Second Avenue railroad, and that road should be brought to the City Hall. It is clear that the natural agent for using the Blackwell's Island Bridge as a railroad thoroughfare is the Manhattan Railroad Company, and the natural agent for using as railroad thoroughfares the Brooklyn Bridge, the Williamsburg Bridge and the Manhattan Bridge, is the

Brooklyn Rapid Transit Company. So also is this latter company the natural agent for using the second Brooklyn tunnel, which ought to be located, as far as possible, to meet its views; provided, always, that these two companies will do their part in developing this thoroughfare traffic. They can hardly be expected to pay full interest on these costly bridges, for the bridges serve other purposes than that of railroad thoroughfares; but it ought not to be impossible to reach an equitable adjustment of the sum to be paid for the use of the bridges, and these companies ought to pay, as the subway company does, for the cost of the connecting links; that is to say, the travel that uses the bridges ought to pay its way, precisely as the travel does that uses the subways.

It may seem strange to some that I have said so much about the Brooklyn Bridge without alluding to the unseemly and dangerous crowding of the trolley cars. I am not indifferent to this crowding; but the fact is that it is an incident of conditions that cannot be removed by temporary treatment. Only such a comprehensive treatment of the subject as I have outlined will do away with the present crowding at the Manhattan end of the Brooklyn Bridge. I think it is true that a moving platform would carry double the number of people of the present bridge railroad; but it would be reverting to the old idea of the bridge as a thing complete in itself instead of as a railroad thoroughfare. Neither do I think it good judgment, if it can be avoided, to abandon, even temporarily, a single fare between the boroughs. I am quite confident that the moving platform should not be resorted to, except in cases of necessity or except in response to a popular demand. The part of wisdom, I am sure, is to go ahead with the plans for permanent relief as soon as possible. If I am asked what, then, is to happen next winter, when the dangerous and unseemly crowding again appears, I can only say that this must be overcome, as far as practicable, by suitable regulation, unless still further study should show that additional trolley loops can be installed without interfering with the bridge railroad platform. If no new loops can be made, the Rapid Transit Company must be called upon to remove some of the many lines that now use the bridge, so as to reduce the overcrowding. Thus far no practicable plan has been brought to my attention.

The key of this situation, so far as it is an unsolved problem, is the New York Central & Hudson River Railroad. It is a fortunate thing that no legislation affecting the Grand Central Station was had last winter, for legislation hurriedly prepared and passed under pressure of a feeling of panic can seldom be sufficiently matured to deal wisely with such a problem. When the Legislature was in session the New York Central Company was under the impression that it could not undertake to change the motive power of its through traffic from steam to electricity for many years to come. It advocated then plans for a change of power for its suburban traffic which called for a loop under Madison Avenue and various other streets.

Since the adjournment of the Legislature I have kept in close touch with this question, and I am now authorized by the president of the New York Central Railroad to say that his road is ready to enter into a stipulation with the city, if the city will approve the changes which they now wish to make at the Grand Central Station, to substitute electricity for steam, not only for their suburban, but also for their through traffic, and that they will sign a contract for the erection of power houses adequate for both of these purposes immediately after the approval by the city of their terminal plans. Nor is this all that has been gained by a more careful study of the problem.

In response to my suggestion that there ought to be some point or points in the Borough of the Bronx at which passengers could change from their suburban and through trains to the subway and to the various elevated roads running south, the company has given me its assurance that the city can command its most earnest and energetic co-operation in developing such a center, or centers, as may be deemed best, north of the Harlem River. This attitude on the part of the company seems to make it probable, though, perhaps, not entirely certain, that it will not be necessary to carry any loop under Madison Avenue; thus relieving the former of one of its most serious objections.

In other words, all that the railroad company asks of the city now is to be permitted to throw the western roadway of Park Avenue, below Fifty-Sixth Street, into the approach to its yard; and to close certain portions of the cross streets that will be wholly enclosed within its yard as the company proposes to enlarge it. The railroad company has bought substantially all of the property affected by these changes and proposes to give to the city a new roadway for Park Avenue, adjacent to its present one and of equal width, and to pay the city for all the streets that may be closed in connection with its yard. This matter will be brought before the proper boards for action in September.

The city has ample power, under the charter, to do a large part of what is asked. If more power is necessary to complete the work, that can be had next winter by enlarging the powers of the city, instead of the railroad. This will avoid the difficulty of passing a general law to deal with a very special situation. The railroad company must, of course, get legislative authority to change its motive power from steam to electricity, but there is no doubt that this authority can be had for the asking. A law should also be passed, which was overlooked last winter, compelling the New York, New Haven & Hartford Railroad to make the same change, so far as it continues to use the Grand Central Depot.

In this connection I have stipulated that an arrangement shall be made at the same time which shall provide definitely for the removal of every grade crossing now maintained by the New York Central Company within the limits of the city.

The matter of the Grand Central Depot being disposed of, every effort should be made to develop, north of the Harlem, one or more union stations to serve the needs of the traveling public. It is one of the greatest merits of Mr. Parsons' plan for carrying the railroad of the Brooklyn Bridge underground that it makes, near the City Hall, a union depot for bridge trains, for the subway and for the elevated roads of the East Side. If a similar common center were developed north of the Harlem I think it will be apparent how greatly the convenience of the traveling public would be subserved, only in the north I should hope that the conditions will make it possible to bring to one or another of these points not only the elevated roads of the East Side, but those of the West Side as well. It is not easy to accomplish this at the City Hall, where the conditions are so much more rigid, but north of the Harlem it ought to be entirely possible. I am confident that if the various railroad companies concerned will co-operate with the city this result can be brought about in the near future.

The East Side subway, already being planned for, should, of course, be carried to completion as early as possible; and neither should the Jerome Avenue extension, already approved by the Rapid Transit Commission, be forgotten.

It does not seem necessary to discuss at length the desirability of carrying the existing subway on Broadway from Forty-Second Street down to the Battery. That is a development that must come in the not distant future. I only wish to express one thought, at the present time, in connection with it; and that is that pipe galleries shall be provided for on such an ample scale that the surface of Broadway, after this work is completed, will never have to be disturbed again, in any future that can be foreseen to-day. This seems to me to be almost an essential condition for permitting this work to be done.

The improvements already made by the Dock Department and those that are about to be begun provide not only for a large number of modern piers, but also for an exterior street 250 ft. in width. This street is already completed, with unimportant breaks, from Cortland Street to Gansevoort Market, and it will soon be completed as far as Thirty-Eighth Street. This street is wide enough to permit of the erection, without disadvantage to anybody, of an elevated railroad having a spur, if desired, running down every pier. Such an elevated railroad might easily be carried from the lower part of the island up to a point where it reaches the right of way of the New York Central & Hudson River Railroad, at Thirtieth Street.

If the Pennsylvania tunnel franchise should be granted it would not be difficult to make a connection between the Pennsylvania system and this exterior road. The result would be a railroad directly connecting every pier upon the West Side of Manhattan Island with the New York Central and the Pennsylvania Railroad systems.

Settlement of Chicago Labor Troubles

When employees of the Chicago City Railway Company recently perfected their organization they submitted certain demands to the officers of the company, which the officials refused to grant. The local division of the Amalgamated Association of Street Railway Employees discussed the matter until an agreement was entered into whereby the points of difference were to be held in abeyance pending a consideration of the questions involved by three arbitrators. The motormen and conductors on the trolley lines demanded 28 cents an hour, in lieu of 21 cents, and pointed to the fact that the cable operators on the Cottage Grove Avenue line were receiving 30 cents an hour, and those on the State Street system 28 cents. A compromise was reached whereby the rate of wages was raised to 24 cents per hour, beginning 60 days from the period of instruction.

Meeting of the International Tramway Union

The International Tramway Union, the official title of which is the Union Internationale Permanente de Tramways, held its eleventh meeting at London June 30 to July 4. This association was organized some seventeen years ago, and since that time has held a series of eleven congresses in various European capitals, viz.: Berlin, 1886; Vienna, 1887; Brussels, 1888; Milan, 1889; Amsterdam, 1890; Hamburg, 1891; Buda-Pesth, 1893; Cologne, 1894; Stockholm, 1896; Geneva, 1898; and Paris, 1900. The recent meetings have been held every two years, instead of every year, as with the American Street Railway Association. The Union numbers among its members representatives from tramway companies and others interested in electric traction from practically every European country, but up to within recently its greatest membership has been from the Continental countries in Western Europe, viz.: France, Germany, Belgium, Holland, Switzerland, Austria and Italy. The congress held in London last month was the first ever conducted on English soil, and was upon the invitation of the Tramways & Light Railways Association of Great Britain. There was a large and representative attendance, the number of delegates from countries outside of England being more than 140. The meetings were very successful, both from the standpoint of attendance and results secured, and through the hospitality of the hosts, the Tramways & Light Railways Association, the social features of the convention were very enjoyable. The meetings were held at Berner's Hall, in Agricultural Hall, Islington, and in connection with them was a very large exhibit of electric railway apparatus of all kinds in which most of the prominent English manufacturing firms and many American companies participated. Several other tramway meetings were held in the same building during the continuation of the exhibit, such as that of the Association of Municipal Tramway Managers of Great Britain, and that of the Incorporated Municipal Electrical Association, composed of many municipal electrical engineers and superintendents resident in Great Britain, so that the sessions were well representative of all the tramway interests of Europe.

The congress of the International Tramways Union was, of course, the one in which the principal interest centered. The arrangements which had been made for entertaining the congress were most complete and reflected the highest credit upon Mr. R. H. Scotter, chairman of the Entertainment Committee; Mr. Ernest Benedict, the secretary of the Tramways & Light Railways Association; the Entertainment Committee as a whole, and all who contributed to the comfort and entertainment of the delegates during their stay in London. The coronation festivities which were to have occurred the week before the meeting of the association, and other incidents, including the unfortunate illness of the King, which could not have been foreseen when the date of the meeting was selected, threatened at one time to interfere with the success of the meeting, and added greatly to the labor of the hosts of the Union. The fact, however, that all the arrangements, as planned, were carried out most successfully is a most striking testimonial to the energy and ability of the gentlemen composing the local committee. Even the complications introduced by the use of three different languages by the speakers were successfully overcome. Hitherto, in the meetings of the Union, while the official language has been French, the proceedings have been conducted in both French and German. This year English was also introduced, and all of the papers presented to the congress were translated and printed in English, ready for distribution to the delegates before the opening of the convention. This fact, together with the careful translation into English of an abstract of the speeches made in German and French by the different delegates, added greatly to the ease with which the American and English members were able to follow the discussions.

In the issue of Aug. 2 an account was published of the meetings of the two English Associations. The space available this week will not permit the publication of an abstract of the entire proceedings of the International Union. A portion, therefore, is given this week, and the rest will be published in an early issue.

MONDAY, JUNE 30

The official opening of the congress and of the exhibition occurred at 12 o'clock on June 30, when the delegates to the meeting of the International Union were cordially welcomed to London by the Right Hon. Gerald Balfour, M. P., president of the Board of Trade. The chairman of the meeting was Sir Charles Rivers Wilson, president of the British Electric Traction Company, who, after a few words of welcome, introduced Mr. Balfour. Replies to the speech of the latter were made by Mr. Janssen, president of the International Union, and Mr. Scotter, chairman of the congress committee of the International Tramways & Light Railways Association, after which the delegates adjourned to a sumptuous lunch provided by the members of the tramways committee. After lunch the delegates entered brakes and visited the principal objects of interest in the city of London, including the Guildhall, Tower Bridge and Mansion House. In the evening a reception was tendered the Union at the Institution of Mechanical Engineers at Storey's Gate, St. James' Park. The guests were received by Sir C. Rivers and Lady Wilson, President Janssen and Mr. and Mrs. Scotter and were entertained by music from the Viennese band, and by a biograph exhibition. Among the views thrown on the screen during this part of the entertainment were several representing the opening of the road of the London United Tramways Company.

TUESDAY, JULY 1

The sessions at Berner's Hall were opened at 9.30 a. m. by President Janssen.

The president said that at the opening of the meeting of the congress in London he wished to thank the various governments who had been kind enough to honor them by sending representatives, and he cordially welcomed the various representatives who had accepted the invitation to be present. They were particularly honored to see among them so many men distinguished in the industry in which they were interested. Their presence was greatly appreciated, and he trusted that as the result of the deliberations of the congress, those who had gathered together would carry away a great mass of useful information and data. Proceeding, Mr. Janssen deplored the death of several of their prominent members who had passed away since they met in Paris, and he also referred to the honors which had been conferred on several of their members. Mr. Nonnenberg had given up the position of secretary-general of the union, which he had filled to the great appreciation of the committee, and Mr. Janssen paid a very high tribute to the talent and devotion the late secretary had shown in carrying out the duties of the office. Alluding to the organization and working of the union, he said their aim was to make the union of the greatest possible service to the members in many ways. There were branches in each country, and they were making arrangements for the collection of accurate and complete information from the various branches, which would be of the utmost use to those who were engaged in the tramway industry. He thought they were all agreed that this was a most desirable step to take, for there was no doubt that tramway work was developing at a great pace. Each one of them had something to learn from his neighbor, and they were fortunate enough to be engaged in an industry in which they could all furnish one another with useful information. In many industries and trades there were secrets which could not be divulged, but, fortunately, that was not the case with the tramway industry, and, as he had said, every one could probably be of assistance to some one else. To this end, therefore, they had established a general secretariat of the International Union, and from his office all members could obtain the information which was collated, technical or otherwise, which might be of use to them in the working of tramways and light railways. (Applause.) All such information would be gladly placed at the disposal of any member, but he would ask them to bear in mind that any service of this kind should be reciprocated, and they should all be ready on their part to furnish any information to the office which was required. It was also most important that all the data should be collated on a uniform basis, so that useful and accurate comparisons could be made. What this basis should be they would have to settle. Another important function of the international secretary would be to collect information as to the legislation in different countries affecting them, and that would be most valuable to the members. They would also collect together various legal decisions affecting the industry. In conclusion, Mr. Janssen made a strong appeal to those present to co-operate in giving all the assistance possible to the office, so that the undertaking might be made a great success.

Sir Charles Rivers Wilson, G. C. M. G., C. B., then took the chair. He said that it was with a good deal of shame that he had to acknowledge that although this was the twelfth congress it was the first held in this country. He felt that it was not the fault of the union, neither was it the fault of the British tramway industry. In his opinion the fault lay elsewhere. He felt that the British prided themselves on this being a land of liberty, but he thought that liberty might be abused, and in his opinion liberty in this direction had been abused, and had been used to oppose the advance of the industries in which those present were particularly interested in. To the foreign members present he wished to say how delighted he was to see them, and thought that the effect of the congress would be decidedly helpful with the government. The effect produced on Mr. Balfour, who honored them by opening the exhibition, would, he thought, be very helpful in helping on the interests which they all had at heart. In conclusion, he said he trusted that the kindly and friendly intercourse which had been going on between members of the congress since their arrival would

continue, and that firm friendships of different nationalities would be one of the outcomes of the congress. (Cheers.)

Mr. Lavalard, of Paris, then read a paper on "Transfers." An abstract of this paper follows:

TRANSFERS

In Paris, a considerable time before the creation of tramways, transfer tickets were used upon the omnibuses.

This regulation dated from 1834. It was devised by the old Entreprise Générale des Omnibus, under the management of MM. Moreau-Charlonet et Feuillant at the suggestion of a shareholder. At that time the public transportation service in Paris was conducted by thirteen companies, having different names, such as the Entreprise Générale des Omnibus, Constantines, Favorites, Hirondelles, Batignolaises, Gazelles, Béarnaises, etc. The first transfers were established between the lines of the boulevards and those of the Barrière du Trône (which is a continuation of the former, starting from the Bastille), by the Entreprise Générale des Omnibus.

The system, having given good results, was successively applied to the other lines of the same society, and to the lines of the other companies we have named, and, finally, it was adopted not only for the lines belonging to one company, but for those of different companies.

While, in the year 1861, out of 76,000,000 passengers, more than 12,000,000 were passengers with transfer tickets; in 1901, the Compagnie des Omnibus alone distributed 87,664,358 transfer tickets out of 266,935,912 passengers carried. This figure was made up of 85,699,234 tickets for inside places—that is to say, those issued without extra charge—of which only 38,543,200 were utilized, or 45 per cent, and of 1,945,124 outside tickets; that is to say, those for which a supplement of 15 centimes was paid, of which 1,810,490, or 93 per cent were utilized. Uniting the two classes, interior and outside, we have: Of 87,644,358 transfer tickets issued, 40,353,690 utilized, or 46 per cent. There is one remark to be made. It is that the passenger almost always utilized the transfer tickets for which he had paid, as is proved from the preceding figures. We must point out that, with the transfer tickets, passengers can, for 30 centimes, travel enormous distances from north to south and from east to west in Paris. Speaking generally, all the omnibus and tramway companies exchange transfers along their lines, with the lines of a considerable number of other companies. It cannot be denied that at certain hours of the day those traveling on transfer tickets are exposed to long delays while waiting their turn on the most frequented lines, but even on these lines the cars follow each other rapidly, and, in truth, the very lowness of the fare often gives patience to the passenger.

But when Paris extended, the transfer tickets issued without supplementary charge within the line of the fortifications, have remained unchanged, up to this day.

Fraud has often to be feared, certainly it has often been practiced, but by issuing different colored tickets, and, above all, by noting the hour of their issues, its extent has been much diminished.

It is not without interest to see how the American tramway managers have treated this question of transfer tickets.

We find, in the number for October, 1901, of the STREET RAILWAY JOURNAL, published in New York, a very complete article on the subject appears from the pen of Mr. Oren Root, Jr., assistant manager of the Metropolitan Street Railway Company of New York. In it he states that the transfer system, adopted and in use for ten years, has increased the receipts and the profits of the company, more than any other improvement, without excepting the use of electricity as a motive power.

We shall now examine the replies which we have received from eighteen companies on the question of transfers:

Sixteen use the transfer system and admit the result to be more or less favorable.

Two only do not make use of it, the first the Société d Entreprise de Travaux of Liege, which does not consider it useful; the second the Great Tramway Company of Berlin, which states that its tariff is too low, and that, moreover, its commutation tickets facilitate the transfer of regular patrons.

Of the sixteen companies using the transfer system, some consider it a necessary evil, while the others, on the contrary, recognize the fact that it has augmented the receipts, and is useful to the companies on that account, while it is very advantageous to the public.

Many companies allow two changes of cars, but many claim that this facilitates fraud, and permit only one change; with the exception of the tramway companies of Aix-la-Chapelle, of Strassburg, and of Barmen-Elberfeld which make one extra charge for several changes.

Thirteen companies issue transfer tickets without extra charge, and, in general, use the same tickets, so as to diminish the working expenses.

Two companies only, those of Hanover and Brussels, make a supplementary charge on issuing a different ticket which serves for the second car.

The charge of 15 pfennigs, instead of 10, the price of an ordinary ticket, in Hanover, is intended to check the over-loading which occurred in certain parts of the town, where the lines intersect, and to encourage the journeys by transfer over relatively long distances.

The object in Brussels is to allow passengers to take two short journeys over different sections for each of which the passenger would not pay anew the maximum fare, but for which he is willing to pay a slightly increased single fare. The same reasons are given by the Electric Tramways of Barmen-Elberfeld. This company has attached to its reply an extract from the report of M. de Pirch to the general meeting of the directors of German tramways and light railways, in 1899. At that meeting, forty-six companies which had established the transfer system acknowledged that the system is useful.

The sample tickets which were sent to us by the tramway companies, which have replied to the questions sent out, and those we have ourselves collected on our numerous voyages, are almost identical; that is to say, they indicate: First, the point of departure; second, the place where the passenger must exchange from one line to another; third, the date of the month, or the day of the week; and, finally, the hour of departure, which serves to regulate the duration of the validity of the transfer ticket.

In many companies the colors of the tickets vary, giving certain indications. With some exceptions, transfer tickets are only issued within certain boundaries in all the towns, and an additional charge is made for the suburban districts.

Summing up all the documents we have consulted, we find:

1st. The transfer system is to be recommended and has, in general, increased the traffic, and, almost always, the receipts, for it attracts passengers, above all when it is gratuitous.

2d. It is most advantageous for the passenger, since it enables him to make two fairly long trips; and it is this which justifies the imposition of a small extra charge.

It permits him also to travel over two small sections of lines which intersect.

3d. Free transfers need hardly be given, except on very short lines; they facilitate checking, as with it the same ticket can be used for the two cars. And, as we have already said, passengers should not object to a slight additional charge, for a long journey, on two lines which cross.

4th. Transfers should only be allowed onto a line not parallel with the original line. The issue of transfers for several changes is productive of fraud.

5th. As far as possible the transfers should only be allowed at junctions, or crossings.

6th. The marking of day, date and hour, is an excellent practice, above all, on the first ticket issued. Change in the color of the paper is also very important, above all when it indicates the direction of the journey.

7th. It is indispensable to limit the transfers, above all, the free transfers, to the interior of towns or to localities, very close to them unless under special conditions affecting several companies. For suburban districts there should always be an extra charge.

8th. If possible, suppress the transfer service on days of crowded traffic, such as Sundays and holidays.

9th. The transfer system increases the staff and the material to a certain degree. As far as regards the staff, its increase is not great when the transfers are gratuitous and on the first ticket issued. The checking of tickets at junctions and crossings necessitates a new staff, which we think could be dispensed with when the payment of an additional fare is made for an additional ticket giving access to the second car. In the first transfer systems the checking was effected at the offices of the crossing places. This is no longer done.

As regards the rolling stock, the transfer system increases in traffic, and this may be undesirable on a line with horse traction, owing to excessive over-loading. But with mechanical traction, which allows of trailer cars, every one admits that the transfer system is an advantage for the public which always finds room, and for the company, which, without extra expense, can increase both its traffic and its receipts.

10th. As regards transfers between neighboring and different companies I must refer you to the deliberations which took place at the meeting of this association in 1887, and with reference to the division of the receipts.

Mr. Grialou, of Lyons, in discussing the paper, said he agreed with the conclusions given by the author. Transfer tickets were usually imposed upon companies by law, and therefore it was no question as to whether a charge should be made for them or not, as they were generally made obligatory. The question was—How were they to be issued, and what was the best method of insuring a correct use of them. The system was open to two abuses—first, on the part of the public, and, secondly, by the employees of the company. A passenger would get into a car, ask for a transfer ticket, and then get out and do a little shopping on the way, instead of going directly to the car, as they should. By this means this ticket was converted into a "stop over", instead of a transfer ticket. The employees of the company were also tempted by the existence, of these transfer tickets to use them fraudulently, and he cited cases in Lyons where considerable trouble had arisen with them. He had found it an excellent precaution in Lyons to put a mechanical register on the car and every time a passenger got into a car he was registered. The company had found that this system had been very successful in stopping the abuse of transfers by conductors. The introduction of the mechanical register had increased the company's receipts between 5 per cent and 6 per cent. He particularly desired that the question should be again discussed at the next meeting.

Mr. Gustave Koehler, of Berlin, and Mr. Lavalard also discussed the question, after which Mr. Röhl, of Hamburg, said he would like to propose that a commission should be formed to consider this extremely important matter. Every country and every town was different, and a congress should not come to a hasty conclusion. Therefore, he proposed that a commission should be formed to report to the next congress.

The proposition was carried.

The next paper presented was on "A Proposed Basis for Estimating the Power of Motors," and was read by Dr. G. Rasch, professor of the Polytechnical School of Aix-la-Chapelle. Dr. Rasch's paper is published in abstract below:

MR. JOHANNES RÖHL
of Hamburg

MR. LEON JANSSEN
of Brussels
(President)

MR. H. GERON
of Cologne

MR. E. A. ZIFFER
of Vienna

MR. E. J. LAVALARD
of Paris

MR. JULES KESSELS
of Brussels

MR. F. NONNENBERG
of Brussels
(Treasurer)

MR. GEORGES BROCA
of Paris

MR. P. T'SERSTEVENS
of Brussels
(Secretary)

OFFICERS AND EXECUTIVE COMMITTEE OF THE INTERNATIONAL TRAMWAY UNION

THE RATING OF MOTORS AND GENERATORS

The regulations of the German Institute of Electrical Engineers define as the normal power of a traction motor that which in the

test room can be obtained for one hour without causing the temperature to rise above the admissible limits. During these tests the covers, lids, etc., usually closed in service must not be removed, opened or modified in any essential manner, nor is it permissible to replace artificially the current of air created by the displacement of the car. The writer is of the opinion, however, that even under these conditions a trial of one hour is insufficient, as a traction motor, even though loaded on an average below the normal, is in use for fourteen or sixteen hours a day. The length of the trial should take into consideration the special conditions of the car service for which the motor is destined. It is in this connection that M. Maximilian Muller has examined the question in the Electrotechnische Zeitschrift. This article develops very interesting considerations on the subject of the duration of trials which are to be advised for traction motors. We have attempted to condense the results of this study into the following formula:

$$x = \frac{t\,T_1}{t + 28\,(T - T_1)}$$

in which x stands for the required duration of the trial, T the time during which the car is out of the depot, and T_1 the time during which the motor is working; $T - T_1$ stands, consequently, for the time during which the motor is not subjected to the electric current, t stands for the heating of the motor, that is to say, the excess of its temperature over that of the atmosphere. The foregoing formula contemplates a cooling of 28 degs. C an hour, during its period of rest.

We shall apply this formula to an example; the motor works during 7.3 hours. With a permissible temperature increase to 70 degs. C we obtain:

$$x = \frac{70 \times 7.3}{70 + 28\,(14 - 7.3)} = 2$$

or a duration of two hours, during which it would be desirable to run the motor under full load.

But while retaining a trial of the duration of an hour, the German regulations preserve the advantage of defining precisely what is meant by the normal rating of a motor, without which no clear signification could be given to the word overload. Concerning overload trials the German regulations prescribe that the admissible limits of temperature cannot, equally, be exceeded; it follows then that overloads can only be carried during relatively short periods. Without taking traction motors into special consideration, the German regulations prescribe in a general way an overload of 25 per cent during half an hour for generators, motors, rotary converters and transformers.

Concerning the permissible rise in temperature the German regulations say:

As a general rule, and as the temperature of the atmosphere does not exceed 35 degs. C., the admissible limits for the rise in temperature will be as follows:

For cotton insulations, 50 degs. C.

For paper insulations, 60 degs. C.

For insulations in mica, amiante or other similar preparations, 80 degs. C.

For stationary coils—as for example the magnet coils—the admissible limits of temperature may be allowed an increase of 10 degs. C.

The regulations add that for traction motors the foregoing limits may be 20 degs. C higher if the trial is made in a test room. This greater latitude in favour of traction motors has without doubt been made to allow for the better ventilation in ordinary working on a car than in the test room.

It seems at first irrational to allow of a greater limit of heating for stationary windings than for rotary windings, the more so as the ventilation of the latter is superior to that of the former. This raising of the limit is nevertheless only apparent for, according to the German regulations, the rise of temperature for stationary windings is to be determined by the increase of the electrical resistance, while for the movable parts of the machine, it is to be obtained directly by the thermometer.

It is a singular thing that in none of the communications which have been received in reply to the question is mention made of that difference in the methods of trial which we have indicated; we may then consider that the different companies agree on this point with the German regulations.

A body submitted to the action of a current, as, for example, an induction coil, is not heated in a uniform manner, and, consequently, does not possess a uniform temperature; the temperature on the outside is less than in the interior. The lowest of these temperatures, that on the outside, can be determined by the thermometer. On the other hand, an average temperature can be obtained by calculation from the increase in electrical resistance. These two methods of measuring are liable to give results differing as much as 60 degs. C.

The limit of heating of 60 degs. which would be applicable according to what has been said, to fixed windings with cotton insulation, for example, has probably been determined according to the investigations made by M. Dettmar and published in the Elektrotechnische Zeitschrift for the year 1900, pp. 727 et seq. This author arrived at the following results for conductors covered with cotton: A temperature of 95 degs. C may be considered as perfectly admissible for stationary windings; on the contrary, for the rotating coils this temperature of 95 degs. C should be regarded as an extreme one, and is not to be allowed in a well-adjusted machine. Besides, as an atmospheric temperature of 35 degs. C. is in no way extraordinary, it results in the case of a cotton insulation that a limit of 60 degs. C. overheating is permissible.

Among the replies which were made to the question of 1900, the opinion is found that motors should be able to support with safety temperatures of from 75 degs. to 80 degs. C.; it would seem unreasonable from this to fix the temperature limit, that is, the excess of the temperature of the motor over the temperature of the atmosphere, to 50 degs. or 55 degs. C.

In addition to the power of the motor, the purchaser has equal interest in being informed as to its torque and speed. We are of the opinion that it would be convenient to characterize a motor by the two following factors:

M = torque in kilogrammes, and N = turns per minute of the axle of the motor.

These two factors are related in the following manner to the power, w, of the motor given in watts:

$$w = \frac{2\pi\ 9.81}{60}\,M\ N = 1.028\ M.\ N.$$

or, assuming an efficiency of 95 per cent, W, the input of the motor, could be indicated as follows:

$$W = \frac{w}{0.95} = 1.08\ M.\ N.$$

This formula is within 5 per cent, which is sufficiently accurate.

If then, a motor was thus designated, say by two numbers, for example, 20/550, it would be understood to be a motor which under a normal load produces a torque of 20 kilogrammeters and attains a speed of 550 r. p. m.

The energy received by the motor would be then, $1.08 \times 20 \times 550 =$ 11,900 watts, which at a pressure of 600 volts, will represent a current of 20 amps.

It is further to be remarked that in the preceding formula the torque represents not the useful torque, but rather a torque somewhat higher than that. The torque indicated above would be sufficient, nevertheless, to rate the motor, and if guarantees can be asked from the contractor, nothing prevents these referring to efficiency.

In conclusion I make the following suggestion: The determination of the rating of a motor shall remain as fixed by the rules of the German Institute of Electrical Engineers. These define without ambiguity what should be understood by half load, and by 50 per cent overload. The manufacturer would have to fill in the following table:

	Half Load	Normal Load	Overload of 50 Per Cent
Power of the current in amp.	....	....	....
Torque in kilogrammeters	....	....	....
Number of revolutions per minute	....	....	....
Efficiency	....	....	....

It hardly appears necessary to us to specify the special basis to adopt for the rating of generators. We strongly recommend for adoption the principles laid down by the German Institute of Electrical Engineers.

Mr. Mackloskie, of Brussels, in discussing this paper, said he thought the union ought to accept the report of Dr. Rasch, who proposed that they should take up the method of rating recommended by the German Institute of Electrical Engineers. In fact, he believed they were the only standard which had been formulated up to the present time, and he thought the union could not do anything better than accept them.

Mr. Pedriali, of Brussels, suggested that as the German society had already adopted a standard method of rating, the meeting should adopt this standard, and that the engineers of the railway companies in the union should use them in their specifications.

Dr. Rasch observed that the German specifications, as they now stand, are not sufficiently detailed for tramway work, and he therefore proposed that the association should take the question up further, and add to the clauses in reference to tramway work.

Mr. Max Von Leber, government representative from Austria, remarked that the conditions were so different in the various systems of electric traction in various towns, and on account of the various laws and regulations, that it seemed impossible, in short,

to frame a separate rule by which that standardization might be carried out.

Mr. Scotter said he might point out that at the present time they had in England a standardization committee, sitting under Sir William Preece, who was a member of the reception committee of the congress, and the whole question was coming up sooner or later for discussion. They would be most happy—he only spoke unofficially, but he felt sure they would be most happy—to receive that discussion, and to attempt to help the members of the union, and he hoped the members of the union would help them in England to arrive at something like what one might call a universal standard in these matters.

Mr. F. W. Egger said the Americans had a good deal more experience of tramway work than the Germans, and the German conditions did not come up to the conditions and particulars which the American makers supplied with their machines. He would like to propose that the American methods of testing, and so forth, be adopted in preference to the German, and also that the question of sparking and overload should receive more attention than it had done up to now.

Dr. Rasch said although in the short resume he had given of his paper he did not refer to sparking, yet it was dealt with in the paper. One of the difficulties concerning it was that they could not make accurate measurements of it.

Mr. d'Hoop impressed upon the congress the necessity of something being done very quickly in the matter. Work was going on in different countries, and different specifications were being issued, and the longer it went on the more difficult it would be to unify them in the end. He hoped, therefore, that every effort would be made to press the matter forward.

Mr. Scotter said that, on behalf of his association, if it met with the approval of the congress, he would see that the paper and the discussion thereon should be placed before Sir William Preece's committee at the earliest possible moment.

This course was agreed to.

Mr. Scotter then announced that the members would lunch by invitation of the Mayor of Islington, and would afterward visit the Islington municipal electrical works, as well as the works of the Great Northern and City Railway Station at Old Street. In the evening a conversazione would be given by the President and Mrs. Swinburne for the Council of the Institution of Electrical Engineers at the Natural History Museum.

The congress then adjourned.

The Islington power station, which is used exclusively for lighting purposes, is equipped with eight Lancashire boilers, and ten Babcock & Wilcox water tube boilers. There are ten Adamson compound engines, three of which are of 1000 hp, direct-coupled to 2000-volt Ferranti & Fowler dynamos, and one Scott engine and Crompton dynamo. The output during 1900 was 2,324,057 kw-hours.

The City & Great Northern Railway, which was described fully in a recent issue of the STREET RAILWAY JOURNAL, is designed to run from Moorgate Street, city, to Finsbury Park, a distance of about 3½ miles—the bulk of which is in tunnel. The tunnel will be 16 ft. in diameter. There will be five stations, including the two terminals. The cars will be 49 ft. 6 ins. x 9 ft. 4 ins., and will comply with the Great Northern Railway gage, so that ordinary railway carriage can be used if necessary. Both of these installations were visited by a large number of delegates.

The evening reception, or conversazione tendered to the union at the Natural History Museum by the Institution of Electrical Engineers was very largely attended, and the handsome building looked especially brilliant with its tasteful decorations. The attendants, who included most of the delegates to the international congress, as well as many of the most prominent electrical engineers in England, were received by President and Mrs. Swinburne, and were afterwards entertained by a handsome collation, as well as by music from two orchestras. At 11 o'clock "God Save the King" was played, and all those present heartily joined in singing the words of that well-known hymn. The courtesy of the institute in postponing its conversazione in order to hold it during the week of the congress, so that an invitation to attend could be extended to the members of the union, was heartily appreciated.

WEDNESDAY, JULY 2

The members of the union met at Berner's Hall at 9.30, when the chair was taken by Colonel Boughey, C. S. I., one of His Majesty's Commissioners of Light Railways.

Mr. Ch. Thonet, of Liege, read a paper on "Central Stations." This paper is published in abstract below:

POWER STATIONS

As a rule, the steam engines used are compound-tandem; above 1000 hp they are generally cross-compound, in order to bring the dynamo between both cylinders. In some stations, for very high power units, triple-expansion engines are used, notably in Berlin and Paris. Laval steam turbines are also operated in Paris, Holland and Germany, but we have no information concerning these.

The engines are usually worked condensing; the condensers being of the jet type allowing of a vacuum of 65 to 70 cm.

The speed ranges from 52 to 150 and even 235 r. p. m. with the Mackintosh, Willans, etc., engines. The steam pressure lies between 7.5 and 10 kg per sq. cm.

The daily cost of maintenance per car km for the steam engines, comprising the salaries of the operating staff, ranges from: Fr. 0.004 to fr. 0.008; that is, fr. 0.006 or ½ pfennig on an average.

The steam consumption per horsehour varies greatly. At the guarantee tests, the consumptions range between 5.8 and 8.2 kg per ihp and for compound condensing engines; while in ordinary working conditions it is from 6.5 to 8.8 kg.

When reckoned per effective hp, these figures are: 6.7 and 9.45 kg.

The consumption in coal attained in a guarantee test differs widely from that obtained in ordinary working conditions.

These are some data furnished by the principal companies operating condensing, with tandem-compound steam engines of 300 to 700 hp and when good ordinary coal was burned:

	At the Guarantee Tests				Under Ordinary Working Conditions		
	kgs	kgs	kgs	kgs	kgs	kgs	kgs
Per ihp-hour....	0.770	0.616	—	1.31	0.865	0.745	—
Per ehp-hour....	0.928	—	—	1.46	1.01	—	—
Per kw-hour.....	1.270	1.06	1.300	2.0	1.38	1.94	1.70

We can accept, as a true average for the coal consumption under ordinary working conditions, the data given by the Tramways Bruxellois for their 450 and 750 hp engines; these are:

At the guarantee tests: 1.300 kg per kw-hour.

In ordinary service: 1.700 kg per kw-hour.

The cost in coal per kw-hour ranges from fr. 0.4 to fr. 0.089, and per car km from 3 centimes to 7.5 centimes.

The total consumption in lubricants varies from:

Fr. 0.003 to fr. 0.010 per kw-hour; that is, 3.9 gr. to 7 gr.

Fr. 0.0012 to fr. 0.009 per car km; that is, 2.5 gr. to 5 gr.

The efficiency of the steam engines varies from 80 to 90 per cent, being 85 per cent as a mean.

Several companies call attention to the influence of varying load on the efficiency and consumption of steam engines. Thus, with a load 45 per cent, the normal one, the coal consumption was found to reach 1.850 kg per kw-hour; this consumption was only 1.700 kg. when the load reached 60 per cent. It is, therefore, of advantage, when operating small systems on which the load is apt to vary widely, to adopt regulating storage batteries.

Gas Engines

No other company than the General Contracting Company, of which the writer is manager, having given information on the working of central stations with producer gas, we are obliged to keep to the information which we possess on the working of our plant in Barcelona and Andrès (Spain). Producer gas installations are in operation in Lausanne, Zurich, Orléans, Poitiers, Reims, Cassel (France), Barcelona-Tibidabo, etc.

The gas engines put up at the Barcelona central station are of the Crossley, four-period type. They are operated by producer or mixed gases. There are, at present, two 165 hp and one 300 hp engines. Their speed is 180 r. p. m. The gas is produced in a gasogene with rotating hearth, of the Fichet and Heurtey system.

The steam necessary for the production of mixed gas which has to be injected into the furnace of the producer, is obtained from a small vertical boiler. At present Messrs. Fichet and Heurtey have replaced the steam by a blast of hot air obtained through the use of a fan.

The coal employed is anthracite, possessing 8000 calories, and from 3 per cent to 5 per cent cinders at a maximum. The price is generally about the same as that of ordinary Cardiff, although now it has risen to 10 per cent or 15 per cent above that.

The mixed gas contains: 50 per cent azot, Az; 20 per cent hydrogen, H; 20 per cent carbon-monoxide, CO; 5 per cent to 7 per cent carbon dioxide, CO^2; 2 per cent to 3 per cent hydrocarbons.

The calorific power ranges from 1200 to 1300 calories.

The cooling of the gas on leaving the producer is obtained by means of a series of vertical tubes, through which the gas is sent; the warming of the blast air necessary for the producer furnace is obtained at the same time. In order to be purified, the gas is then sent through a tower filled with coke, on which water is continually showered; it also goes through cases filled with sawdust and oxide of iron; this purifying substance is regenerated monthly by being exposed to the open air.

The maintenance expenses of the gas engines are not higher

than those for steam engines, excepting the lubrication, which requires great care and materials of good quality.

On the other hand, fewer men are necessary for the handling of the producers than for that of the boilers and an ordinary helper is sufficient instead of experienced stokers. In Lausanne, Barcelona, etc., the maintenance cost for the gas engines and producers reaches, on an average, fr. 0.0025 to fr. 0.006 per kw-hour; they can be estimated at ½ centime per kw-hour.

The coal consumptions in 1902 have been:

	At the Guarantee Test kgs	Under Ordinary Working Conditions kgs
Per eff. hp	0.600	0.625
Per car km	——	0.900
Per kw-hour	——	1.000

The price of coal in 1900 was 62 pesetas; that is, 47 francs a ton; at present the price is 48 pesetas, or 36 francs. (It is to be noted that the tramway line is, throughout, on a grade and that in 1901 the consumption per car km reached 900 watts.) At present, the average consumption of screened anthracite is 850 gr. per kw-hour, or 750 gr. per car km, the number of watts per car km having been reduced to 750 on an average.

The cylinder oil used costs fr. 0.85 per kg.

The engine oil used costs fr. 0.45 per kg.

The average consumption in 1901 reached:

Per eff. hp	fr. 0.009 or	14 grammes
Per kw-hour	fr. 0.013 or	20 "
Per car km	fr. 0.011 or	17 "

At present, this consumption has been reduced by 25 per cent, because the oil is recovered, and after being filtered, is used for the greasing of the cars.

The water consumption for cooling the engines is very slight; 25 litres per ehp-hour on an average, while that for washing and purifying purposes does not exceed 10 litres; the water consumption for steam engines being generally as high as 250 litres per horse. The total cost for the production of one kw-hour with coal worth 62 pesetas aggregated, in Barcelona, fr. 0.10; with coal worth 48 pesetas the cost of one kw-hour is fr. 0.08; with coal worth 30 pesetas the cost of one kw-hour is fr 0.06.

We think it useful to mention the highly interesting contribution on the matter of M. Witz, engineer, professor at the science department in Lille, of which the title is: "Comparison between the Efficiency of Steam and Gas Engines," and which has been published in the L'Eclairage Electrique, of Paris, Nos. 1 and 2, on January 4 and 11, 1902. This article points out the superiority of the gas motor, giving data obtained from tests most scientifically and seriously carried out. The conclusions are as follows:

The thermic efficiency of the gas producer is slightly superior to that of the boiler; the efficiency of the gas engine being much higher than that of the steam engine. The coal consumption per ihp hour, even for the smallest plants equipped with gas producers and engines, is far from being as high as that reached by the largest steam plants using steam superheaters.

If it be understood that for thermic machines the duty of which is to do work by the transformation of heat, the most rational basis of comparison and the most reliable, is that which is derived from the comparison of the respective ratios of transformation of the calories into kilogrammeters, we must acknowledge that the steam apparatus is inferior to those operated by gas.

Generators

Most companies use continuous-current, shunt, compound, or over-compounded 550-volt generators. The smaller generators are belt driven, the larger ones being direct driven. A few companies use three-phase, high-pressure currents with transforming sub-stations; in Marseilles, for instance, the current is generated by 1100-kw alternators at a pressure of 5500 volts. The voltage is lowered in the sub-stations to 340 volts three-phase through the aid of stationary transformers; it is then converted into 550-volt, direct current through means of rotary converters. Very little maintenance is required by the generators.

Information relative to the cost of maintenance of the central steam plant, exclusive of buildings, has only been given by some companies. With the Brussels Tramways it is fr. 0.0028; with the Liége Tramways it is 0.014 (on account of multitubular boilers.)

The oil consumption for the generators, per kw-hour, is about gr. 0.15 to gr. 0.10. The mean efficiency varies from 90 per cent to 93 per cent at full load.

Few companies use storage batteries for lighting purposes. Some companies operate booster dynamos to automatically compensate for the loss in pressure on the feeders used for the loading of the storage batteries housed in two stations situated at unequal distances from the main power station (Compagnie Générale des Omnibus de Paris, Usine de Montreuil).

In Barcelona the central gas power station operates a booster dynamo allowing of the storage battery to be loaded and helping it at times. Such is also the case at the Leipzig, Nuremberg, and Compagnie Générale des Omnibus de Paris tramways (Usine de Billancourt).

Cost of Erection of Steam Stations

The first cost of erection of the station varies with the value of land, according to the towns and location chosen or imposed by the municipalities and also with the machines, according to their size and to local conditions.

With regard to steam power stations, we will mention the information given by the Nuremberg Tramways, whose plant comprises eight 79-kw machines and four 335-kw machines; that is, a total of 1972 kw. The first cost has been:

310,000 fr. for land and buildings;
868,000 fr. for boilers, engines and dynamos.

Total 1,178,000 fr., which shows that the cost of erection per kw for land and buildings alone was 157 francs, and that for the boilers, engines, dynamos, etc., 440 francs. The total cost of erection of the power station reached, thus, 597 francs per kw of the whole installation. This is a very favorable figure and one seldom attained.

We can also mention the Liege Tramways; a small station was built outside the town in 1893 for the operation of a tramway line 6 kw in length. The station comprises two machines and dynamos of 48 kw each; that is, 96 kw available power, with a battery of 160 amp.-hours capacity.

The total cost of installation, including land and buildings, reached 84,000 francs; that is, 875 francs per kw available. This figure, which is very low, considering it is for a small and very complete plant, deserves mentioning.

The Hanover Tramways, which operate several power stations, state that the cost of these, exclusive of land and buildings, reached 3,640,522 marks; that is, 845 francs per kw available.

Finally, at the Brussels Tramways, where the power of the central station aggregates 1450 kw, divided between six units, the cost of land and building has reached 275 francs per kw available, and that for the erection of boilers, engines, dynamos, etc., 690 francs; this brings the total cost of erection per kw available to 965 francs.

Although this figure is higher than the former ones, it really represents the mean cost of such installations. When considering a central station of mean power, the cost of erection per kw available must be estimated at 1000 francs.

For larger power stations, the advantage resulting from location outside the towns and that from the installation of greater units, allows, in general, of this cost being reduced to 700 francs per kw available.

Cost of Erection of Gas Power Stations

The information given under the first question by the Liège General Contracting Company, with reference to the Barcelona-San Andrès Tramway power station, states that there are 440 kw available for traction purpose, a very small portion of which being derived for the purpose of lighting the station and the car houses. The cost of erection comprising land, station, car houses, shops, storeroom, buildings, etc., has reached 525 francs per kw. It must be considered that very large property has been purchased to provide for the installation and centralization of the station, depots and line necessities.

The erection of the gas producers, engines, puffer batteries of 450 amp-hours, gasometers, shops, etc., cost 437,000 francs; that is, 1000 francs per kw available. The total expense per kw available reached, in Barcelona, 1525 francs. This plant was erected in 1900, during which year the materials were most expensive. It is quite certain that the prices are now lower by 25 per cent, and that the expense for the installation of producer gas appliances would not exceed 700 or 800 francs per kw available.

We have recently had the occasion to study the installation of a small station for a tramway line 9 km long; we give hereafter the prices referring, respectively, to steam and gas plant.

Erection of two gas engines of 250 hp or 185 kw each; that is, 370 kw, as a whole, with gas producers, purifiers, gasometers, dynamos and water mains; total cost being 225,000 francs or 608 francs per available kw. With steam engines, including the water mains, the cost reached 165,000 frs.; that is, 445 francs per kw available. In this case the installation of the water mains was very expensive, on account of the long distance from the station to the canal.

Water Power Stations

No answers having been received from the companies who work their stations by water power, we can give no exact information on the subject; besides, we have reasons to believe that the prime cost per kw available is not less than 1000 francs, and

can even be twice as high as this, according to local difficulties and to the length of the water mains, etc. It should be necessary to get information from those countries where these water power stations are in operation.

Various tramway companies purchase the current from outside companies; but this, generally, at a high price. These are some of the prices paid by kw-hour: Fr. 0.13 at the Christiania Tramways; fr. 0.135 at the Zurich Tramways; fr. 0.17 at the Havre Tramways; fr. 0.20 at the Municipal Liege Tramways.

A gas power station has offered, in this last town, to supply the current at a cost of fr. 0.10 per kw-hour. The water power stations supply the current at a cost varying from fr. 0.05 to fr. 0.08 kw-hour.

Cost of Operation Per Kilowatt-Hour

We have condensed into this table the information given by some companies:

Brussels Tramways.	Francs.
Salaries and wages	0,0114
Coal consumption (22 fr. a ton)	0,0400
Lubricant consumption and lighting	0,0060
Maintenance and repair of boilers, engines and dynamos	0,0028
Maintenance of buildings	0,0012
Taxes, rents, etc	0,0090
Total	0,0706

That is: 7 centimes per kw-hour.

Frederiksberg Tramways.	Pfennigs.
Salaries and wages	5,99
Consumption:	
Coal (at 22,47 marks a ton)	7,06
Maintenance and renewal	0,97
Sundry expenses	1,90
Total	15,92

That is: 19,8 centimes per kw-hour.

Hanover Tramways.	Pfennigs.
Wages	0,789
Consumption:	
Coal at 20,80 and 12,42 marks a ton	3,477
Lubricants	0,181
Sundry materials	0,026
Maintenance	0,098
Miscellaneous	0,158
Total	4,729

That is: 5,8 centimes per kw-hour.

Liege Tramways.	Francs.
Salaries and wages	0,027
Consumption in coal (worth 21 francs a ton)	0,091
Maintenance and repair to buildings	0,002
" " boilers	0,011
" of engines and dynamos	0,003
" of storage battery	0,005
Cost per kw-hour	0,139

N. B. This figure includes half the wages paid to the operating fireman and refers to the year 1901 when the coal was worth 50 per cent more than at present.

The cost of one kw-hour has now been reduced to between 10 and 11 centimes (the engines are non-condensing).

Nuremberg-Furth Tramways.	Francs.
Wages	0,0088
Fuel and Oil Consumption:	
Coal at 25 marks a ton } Lignite at 12 marks a ton }	0,0610
Maintenance and miscellaneous	0,0025
Total cost for one kw	0,0722

In adding to this, the managing expenses = fr. 0,0077, the total cost reaches 8 centimes per kw-hour.

Barcelona-San-Andrès Tramways. Producer Gas Power Station:	Francs.
Salaries and wages	0,022
Coal (45.00 francs a ton)	0,046
Lubricants and water	0,007
Maintenance (producers, engines and dynamos)	0,004
" of the storage batteries	0,010
Total	0,089

That is: 8.9 centimes per kw-hour.

N. B. The plant has been provided to deliver an output double its present output; consequently, the engines and storage batteries having only half their load, their efficiency is not so high as at Lausanne, Orléans, etc.

Lausanne Tramways. Producer Gas Power Station. Years 1899-1900):	Francs.
Salaries and wages	0,0182
Coal consumption (34.00 francs a ton)	0,0324
Lubricant and water consumption	0,0064
Maintenance (producers, engines and dynamos)	0,0027
" of storage battery	0,0070
Total	0,066

That is: 6,6 centimes per kw-hour.

Orléans Tramways. Producer Gas Power Station. (Years 1899-1900):	Francs.
Salaries and wages	0,019
Coal consumption (32.00 francs a ton)	0,030
Lubricant and water consumption	0,006
Maintenance (producers, engines and dynamos)	0,003
" of storage battery	0,005
Total	0,062

That is: 6,2 centimes per kw-hour.

Nancy Tramways. (Years 1899-1900):	Francs.
Salaries and wages	0,024
Coal consumption (18,90 francs a ton)	0,039
Lubricant and water consumption	0,005
Maintenance	0,003
Total	0,071

That is: 7,1 centimes per kw-hour.

Great Leipzig Tramways.	Pfennigs.
Salaries and wages	0,9
Coal consumption (lignite, marks 5,2 a ton)	2,0
Lubricant and water consumption	0,6
Maintenance	0,4
Total	4,0

Total cost 4,0 pfennig, that is 5 centimes.

In addition to this, 1,04 pfennig per kw-hour are provided for sinking fund.

Marseilles Tramways. (Formerly Saint-Louis power station.)	Francs.
Salaries and wages	0,013
Coal consumption (half coal worth fr. 29.50 and half lignite worth fr. 17.00 a ton)	0,059
Consumption { water 0,0006; lubricant 0,0069 }	0,006
Maintenance	0,002
Total	0,080

That is: 8 centimes per kw-hour.

We have received no information on the operation of the large Marseilles power station; but we can say that the cost of one kw-hour ranges there from 5 to 6 centimes.

Hamburg Tramways (in 1899).	Pfennigs.
Salaries and wages	3,5
Coal consumption (19,22 marks a ton)	8,1
Consumption { lubricant 1,6; water 0,8 }	2,4
Total	14,0

The maintenance expenses are included in wages.

That is: 18,06 centimes per kw-hour.

Neuilly Tramways.	Francs.
Salaries and wages	0,0261
Coal consumption	0,0312
Consumption { lubricant 0,063; water 0,014 }	0,0077
Maintenance	0,0040
Total	0,0690

That is: 6,9 centimes per kw-hour.

Verviers Tramways.	Francs.
Salaries and wages	0,026
Coal consumption (17,35 francs a ton)	0,035
Lubricant and water consumption	0,005
Maintenance	0,003
Total	0,069

That is: 6,9 centimes per kw-hour.

With reference to the information derived from the different tramway companies, we come to the conclusion that the cost of one kw-hour, including wages of all kinds, coal lubricant and water consumption, maintenance and repairs to boilers, engines and dynamos and also the maintenance of the storage battery necessary with producer gas plants, ranges between the following limits:

For important power stations, operating 1000-hp engines and above, the price of coal lying between 15 and 20 francs a ton, the cost will range between 4 and 6 centimes per kw-hour.

For medium size power stations, operating engines from 300 to 600-hp capacity, the price of coal lying between 15 and 20 francs a ton, the cost will range between 6 and 8 centimes per kw-hour.

For small power stations operating engines from 100 to 200-hp capacity, the price of coal lying between 15 and 20 francs a ton, the cost will range between 8 and 10 centimes per kw-hour.

For producer gas power stations, operating engines from 150 to 200-hp capacity, the price of coal lying between 30 and 40 francs a ton, the cost will range between 5 and 7 centimes per kw-hour.

If the price of the coal be reduced to 15 or 20 francs a ton, the cost will range between 4 and 6 centimes per kw-hour.

The chairman said it only remained for them to thank Mr. Thonet very sincerely for his very able and careful paper, and for the new and interesting facts he had brought out. It was a paper full of details and statistics which hardly lent itself for discussion, and he thought, therefore, it only remained for him, in the name of the members, to thank Mr. Thonet for the paper. (Applause.)

The chairman then said the second subject to be dealt with that morning was the conditions under which tramways may be laid on roads, by Mr. Albert Janssen, the general secretary and director of the Brussels Tramways. The conditions with which Mr. Janssen dealt were especially with regard to the payments made for tramway concessions. Mr. Janssen, in his paper, proposed that the union should adopt resolutions expressing its sentiment that all franchise payments should be a percentage of the net profits of the tramway enterprise, or else should be based upon the excess between the gross receipts and a certain set sum made up from the car kilometers run and a price agreed upon between the authorities and the company as a fair allowance for the expenses per car-kilometer. In this way the city and company would be in a sense partners in any profits which might be made by the enterprise.

Mr. Röhl, of Hamburg, proposed that the congress adopt the conclusions as they stood in Mr. Janssen's paper, except the last one, which he proposed should be cut out. If they agreed to that conclusion it would enable the authorities to force the companies to increase the number of car miles without any advantage to the company. It might happen that the company would not be able to work the increased car miles economically, and therefore it would not be fair that it should be forced by the authorities in the matter. He thought that participation should be based upon the net profits only.

Mr. Lavalard remarked that he agreed with the objections which Mr. Rohl had brought against the last conclusion of Mr. Janssen, and he hoped it would be omitted from the resolutions.

The discussion was continued by Mr. Koehler and Mr. Grialou, who pointed out that the conditions suggested in the paper by Mr. Albert Janssen would suit neither France nor Prussia. In those countries the companies had to keep a certain portion of the road in repair and make certain other returns, and they considered these preferable to a system of percentage on the net profits. The question as to the net profits was a very difficult one to determine, and it gave the authorities an opportunity of inspecting and reviewing the books of the company, a proceeding which was objectionable.

Mr. Leon Janssen remarked that the arrangement between the company and the municipality was really a partnership, and it must therefore be a question of give-and-take on both sides. The municipality supplied the streets, and the company supplied the capital, and it was not right that the municipality should receive anything except the net profits—that was after payment of all working expenses and a fair rate of interest on the shares.

Mr. Albert Janssen said the reserve should also be taken into account, and if after that had been provided for, there remained 1, 2, or 3 per cent over, it should be equitably divided between the municipality and the company.

Eventually the congress adopted the conclusions in the paper with the exception of the last paragraph.

The chairman said he was sure they all wished to thank Mr. Albert Janssen for his paper. (Hear, hear.) It had been a very interesting paper, and, as it seemed by the discussion, on a very thorny subject. He would now ask Mr. Scotter, who was well known to them all, to read his paper.

Mr. Scotter then read a paper in which he briefly reviewed the history of the light railway movement in Great Britain. He stated the length of time required to obtain a franchise in that country and several other countries, and in conclusion recommended united action in developing light railways, between the government, local authorities and private capital. He instanced the National Light Railway system of Belgium as a successful example of this method. In conclusion he urged the compilation of statistics on municipal trading, advantages of uniformity of gage, length of time of concession, and certain other subjects, which data can be used in enlightening the authorities on these important subjects, and in obtaining intelligent legislation.

Mr. Addyman, of Leeds, described some of the difficulties encountered in England in obtaining concessions for tramways and light railways, and urged the importance of the subject in Great Britain.

Mr. Schendweiler said, that, while appreciating fully the enormous trouble that Mr. Scotter must have taken in collecting the information which he had placed before them, he would point out that in referring to Prussia he had unwittingly made a little slip as to the years for which concessions were granted. As a matter of fact, concessions existed in which there was no time limit, and the government had power to force a municipality to allow a tramway to pass through a town.

Mr. L. Janssen thanked Mr. Scotter for his paper, and said that the council of the union would deal with the matter and appoint a committee of gentlemen representing the various countries to collect information.

Mr. A. Trautweiler, chief engineer of the Strassburg Company, then read a paper on "The Arrangement of Car Houses." This recommended the concentration of cars in car houses of not smaller than 100 to 150 cars capacity.

The chairman, in the name of the congress, thanked Mr. Trautweiler for his valuable paper.

The chairman said he was sure that he might thank Mr. Ziffer in the name of all present for the extremely valuable paper with which he had favored them. It was a most interesting contribution, and would form the subject of very careful consideration at home, though it was hardly one that lent itself to discussion at the moment. In conclusion, he thanked the foreign delegates for their presence, and said they were deeply indebted to the various governments for allowing their representatives to come and take part in the work of that congress.

On the motion of Mr. L. Janssen, a hearty vote of thanks was accorded the chairman for presiding, and the congress adjourned until Thursday morning at 9.30.

(To be Continued.)

New York Central's Plans

Supplementing Mayor Low's weekly talk on the transportation problem, the New York Central management has given out some additional information regarding the company's plans for the change of motive power and enlargement of its terminal facilities. It is proposed, within two years, to have in operation a great electric traction system at an expense of $10,500,000 for its installation, and an additional cost of $4,000,000 for changes to be made in the yards from Forty-Ninth Street to Fifty-Sixth Street along Park Avenue; the abolishment of steam as a motive power on its lines within a distance of thirty miles from New York, and the probable erection of a great three-deck passenger station above the Harlem River for the sole use of suburban traffic. W. C. Brown, third vice-president of the railroad company, said that the company is proceeding on the basis that the necessary legislation may be had and that the work will be pushed rapidly forward to completion.

"Then the smoke and steam in the Park Avenue Tunnel will be a thing of the past," said Mr. Brown, "and whether the new proposed 'clearing house' station to be built in the Bronx or the loop under the Grand Central Station be constructed, trains will move with greater frequency and without delay.

"Through trains will be hauled by electric locomotives to Croton Landing on the main line and White Plains on the Harlem Railroad, and with a delay of not more than a minute the change will be made to steam locomotives. Practically, no time will be lost. On suburban trains the motors will be attached directly to the cars.

"Power stations will be built and machinery installed to generate 100,000 hp, which will be necessary to maintain the train service. Two or more such plants will be located at favorable points along the lines of the railroads. The 'third-rail' will be used to convey the electrical energy, and only in a few instances in the yards will it be necessary to install an overhead system.

"Steam will be abolished everywhere, and about the yards even switching will be done with electrical power. The tunnel will be lighted by electricity and all stations within the radius of the electric traction.

Mr. Brown would not state where the great Union Station in the Bronx was to be located.

"In regard to the abolition of the grade crossings in New York," he said, "the company is willing to act in conjunction with the city. These crossings are eleven in number. Several hundred thousand dollars would be required to remove them, but they are dangerous as they exist."

William J. Wilgus, chief engineer of the New York Central Railroad, said that the time used in the change of power by the road would be largely consumed by the erection of the power plants.

"We have made extensive experiments," said Chief Engineer Wilgus, "and will adopt no type of electrical locomotive now in use, but will build from new plans, combining the latest improvements known.

"They will be of sufficient size and power to move the heaviest trains now in operation. Although it has not yet been decided, it is probable that the motor cars for suburban trains will be of our present type of passenger car and of equal size."

The Storm Block Signal System

The Storm block signal system is now being introduced on a number of electric roads, and, since it solves some of the perplexing questions in connection with block signals for electric roads in a very simple manner, a description of the equipment recently placed on a section of single track for the Grand Rapids Railway Company may be of value.

The system is such that the passage of any number of cars into a block at once is so recorded, the signals displayed at the entrance to a block cannot show clear until all the cars that have passed into a block have passed out of it. The circuits of the system are shown in the diagram, Fig. 1. The operation of the signal is as follows. Suppose a train enters a block from the turnout at the right of the diagram. As it enters its trolley wheel makes a momentary contact between the trolley wire and a contact clip alongside the wire. Mounted on the trolley wire at this point and supporting the contact clip is a box containing the signal setting and clearing apparatus, *A*, at the other end of the block is exactly similar apparatus, *B*. This box on the trolley wire is shown in Fig. 3, which was taken from the installation in the Grand Rapids Railway. The trolley wheel of a car passing into a block at *A* establishes a circuit

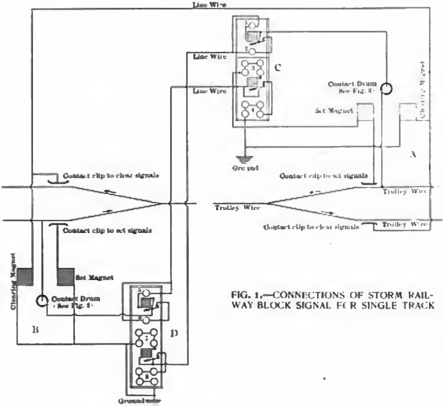


FIG. 1.—CONNECTIONS OF STORM RAILWAY BLOCK SIGNAL FOR SINGLE TRACK

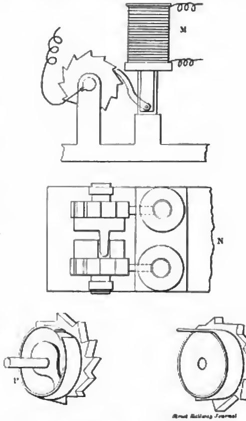


FIG. 2.—DETAILS OF SETTING AND CLEARING DEVICE

which energizes the coil marked set magnet. This set magnet (in a manner which will be explained later) establishes a circuit from the trolley wire through the contact drum in the instrument at *A* into incandescent lamp No. 1 of the signal box, *C*, then to the group of four incandescent lamps, numbered 7, in signal box, *D*, at the opposite end of the block, and thence to the ground. Any car approaching the entrance at the block at *B* would, therefore, see a group of four lamps lighted in the signal box, *D*, while any car following the one which had entered at *A* would see one lamp in the top part of the signal box, *C*. Supposing now the car has proceeded through the single-track block, coming again to the double track or passing switch at the left of the diagram. Its trolley wheel passes under a contact clip on the right-hand track which momentarily establishes a contact through the clearing magnet in the instrument at *B* and also in the instrument at *A*, both these magnets being parallel between the contact clips at the ends of the block and ground. This has the effect of rotating the contact drum at *A* so as to open the signal circuit previously established through lamps 1 and 7 at the two signal boxes. In series with each regular signal lamp or group of lamps is a relay which will throw in another lamp or lamps, in case any lamp in the circuit burns out. For example, suppose lamp 1 should burn out, the current would then fail to pass through the relay magnet just below it in the diagram, and the armature not being attached would make contact so that current would flow through lamp 2 instead of lamp 1. The signal circuits now having been explained, it remains only to take up the details of the contact drum and the signal setting and clearing magnets in the instruments *A* and *B*.

The setting and clearing magnets are mounted side by side. Each one actuates a contact cylinder of its own by means of a ratchet and pawl, which is shown in *M*, Fig. 2, which is a side view, and by *N*, which is a top view showing the two magnets side by side. *P* and *R*, Fig. 2, are the contact drums. Electrical connection for the signal circuit is made through the hubs of the drums *P* and *R*. It will be noted that one of these drums has a contact ring around its entire circumference, except at one point. The other drum, *R*, has a finger which extends over and makes contact on the circumference of *P*, both of these drums being mounted on the same shaft. When this finger is over the point where the contact ring on *P* is

FIG 3.—STORM SIGNAL ON GRAND RAPIDS RAILWAY

omitted, the signal circuit is open. At all other positions which the two drums may take relative to each other the signal circuit is closed by the bearing of the contact finger of *R* on the contact ring of *P*. When there is no car in the block the contact finger of *R* rests on the open circuit position of the ring of *P*. When a car enters the block the signal setting magnet is energized for an instant. The signal setting magnet is energized, and by means of the pawl, the ratchet wheel and contact drum *P* is moved along one notch, so that the finger of *R* establishes contact, making the circuit complete through the signals. When the car reaches the other end of the block the clearing magnet rotates the drum, *R*, one notch in the same direction that *P* was rotated by the setting magnet, and the circuit is again opened. If several cars had entered the block, drum *P* would have been rotated as many notches as there were cars passing the signal instrument. Before the signals can be cleared, therefore, the drum, *R*, must be rotated an equal number of notches. In other words, this instrument counts the number of trolley wheels passing under the instrument, and will not open the circuit to clear the signals until an equal number of trolley wheels have passed out of the block. The signal setting and clearing magnets are normally out of circuit, being energized only at the instant a trolley wheel passed under. This insures practical freedom from burnouts caused by lightning. The whole apparatus is very simple. As will be seen from the diagram, three line wires between signals are required. This signal is made by the Storm Railway Signal Company at Waterloo, Ia.

New Home of James B. Clow & Sons Company

James B. Clow & Sons Company is now settled in its substantial and convenient new building, at Franklin and Harrison Streets, Chicago. This company has for many years been carrying on its large business in steam and sanitary pipe fittings at a warehouse on Lake Street. The new building is even more accessible to Chicago customers, and has in addition railroad and water shipping facilities, as the building fronts on the river just north of Harrison Street Bridge. This building is a thoroughly fireproof, seven-story, steel-frame structure, having 17,800 sq. ft. of floor space. The ground dimensions are 110 ft. x 190 ft. One of the notable things about this company's new home is the splendid brass foundry in which crude oil is used for fuel. The brass furnace is made under patents of the Hawley Down Draft Furnace Company. The furnace is closed, and the oil flame is blown down against the brass in the bottom of the ladle. The products of combustion pass out through a nozzle, which is turned while the brass is being melted so as to bring it under a hood. When the brass is poured the oil supply is shut off temporarily, and the ladle tipped so as to pour from the exhaust nozzle. This apparatus being closed is almost entirely free from the intense radiated heat of an ordinary brass furnace, and the foundry is a very cool and comfortable place, as compared to the average brass foundry. This furnace has a capacity of 600 lbs. of brass per hour, and 180 flasks are filled three time per day in ordinary day work. It is here that the smaller sizes of valves made by this company are turned out as well as fittings for sanitary plumbing. The top floor has also a machine shop, divided into a number of sections, each of which is confined to one special line of work. The light is excellent on this entire floor. The roof is of the saw-tooth pattern with windows entirely on the north slant. Below the brass foundry and machine shop are floors for storage and assembly purposes until the second floor is reached. Here are the general offices, show rooms and city sales departments. In the basement and the yard, adjoining it on the river, are the heavy steam pipe and fittings and the pipe-cutting machinery. This company is said to have the largest stock of cast-iron fittings to be found in Chicago. The yard adjoining the building, which is on the river front and is served by a switch track from the Chicago Great Western Railroad, has a crane for handling material. Cars unload directly into the basement, where goods are taken by any of the numerous freight elevators, or can be unloaded into the yard. Power for the entire building is furnished by motors, located in the different departments, so that there is a minimum loss in belting and shafting. Along with moving into its new quarters it has adopted new systems of bookkeeping and filing, based on the card index and loose-leaf ledger plans, and a very efficient system is being worked out along this line.

Climax Stock Guard

In the description of the cattle guard of the Climax Stock Guard Company, which was illustrated in the STREET RAILWAY JOURNAL, July 19, the dimensions should have been given as 24 ins. long, 8½ ins. wide and 4¼ ins. high. The company announces that the device is receiving very favorable consideration among interurban and suburban railway managers.

New Rule in Regard to Disagreements

Disputes having arisen at different times between passengers and conductors over tickets issued on the lines of the North Jersey Street Railway Company, E. H. Hibbs, auditor of the company, has put in effect a system by which much of the trouble will be avoided. He has issued to conductors printed cards containing on one side the following:

"The rules of the company governing the acceptance of tickets by conductors are uniform and must not be deviated from. In cases where controversy arises between passengers and conductors, conductors will collect fares and refer passengers to this office for adjustment.

"In order to cause passengers as little trouble as possible, the cashiers at Newark, 315 Market Street,

"Elizabeth, Broad Street,

"Jersey City, ferry terminal,

may also be applied to adjust grievances on their respective divisions."

On the other side of the slip is the following blank, to be filled out by the conductor and handed to the passenger who thinks he has a grievance:

Date ....Time ....
Kind of ticket ....
Why refused ....
Conductor ....
Line ....

Mr. Hibbs, in a recent interview, said: "The company desires to adjust all differences with as little inconvenience as possible to its patrons, and believes the new system will be approved by the public. We have certain rules by which our men must abide, and it will simplify things very much for them to refer disputes to headquarters."

Cleveland's Three-Cent Fare Ordinances

The latest development in the 3-cent fare controversy in Cleveland is the dissolution of the temporary injunction granted a few weeks ago restraining the City Council from doing business until the new code bill could be formulated. The injunction was secured at the instance of Judge Boynton, a taxpayer, and was brought by Attorney-General Sheets to prevent the granting of franchises to a proposed 3-cent-fare railroad. Eleven ordinances establishing low-fare routes have passed the Council. The city clerk has advertised for bids for them and they will be opened on Aug. 25. The ordinance which formed the basis of the injunction proceedings was signed by the Mayor, together with ten others, shortly after its passage, and sent to the official paper and published.

To remove one of the reasons assigned by Judge Boynton for beginning the suit for injunction against the members of the City Council, Mayor Johnson erased his name from the ordinance and sent it to the city clerk's office together with a veto message, in which he gave the following reasons for his action:

I learn by the newspapers that Judge W. W. Boynton, who filed suit and secured an injunction restraining the City Council from acting on certain matters of legislation, gives as his reason for bringing the suit that the property owners on his section of East Madison Avenue are strongly opposed to a 3-cent fare street railway on that street. Rather than see the entire movement for 3-cent fares delayed I am in favor of not only vetoing this ordinance, but doing everything that can be done to prevent the building of a 3-cent fare railway in that thoroughfare until a new form of government is established. I recommend that the Council take this view.

The opinion among the Councilmen is that the Mayor has exceeded his authority, and that he had no right to erase his signature of approval of the ordinance. Director of Law Beacom, however, held that the Mayor had the right to do so, as final publication of the ordinance had not yet been made.

Power Brakes for St. Louis Street Cars

The committee appointed by the president's department of the Board of Public Improvements to investigate the practicability of power brakes for street railway cars adopted a report, July 26, which was later presented at the meeting of the Board.

The committee recommends the approval by the Board of the Christensen compressed air brake, with either motor or axle-driven air compressor pump; the Standard (Westinghouse) compressed air brake, with either motor or axle-driven air compressor pump; the Westinghouse electro magnetic track and wheel brake, and the Neal hydraulic brake.

The report contains descriptions and plans of the brakes recommended, and states that stops by the brakes, made by experienced motormen, are without discomfort to passengers, except in case of emergency. The brakes never fail, it is stated, if kept properly inspected and maintained in good order and operated by trained motormen.

Yerkes' Plans in London Successful

At a meeting held July 30 the Parliamentary committee on the proposed tube railways in London decided to make a report giving the Yerkes underground railway interests the right of way for the completion of its entire system. The Morgan Company's bills to authorize the paralleling of the main portion of Yerkes' routes have been put over until next session.

The contest between the Morgan and Speyer-Yerkes interests affects connecting links in the London underground system. The Speyer-Yerkes franchises cover lines already in operation within the city; the Morgan group controls outside transportation lines. The agreement made by Charles T. Yerkes, Speyer Bros. and the Old Colony Trust Company last Spring was to register their new company to be known as the Underground Electric Railway, Ltd., with a capital of £5,000,000, for the purpose of electrifying the District Railway and building four other lines—the Brompton & Piccadilly, the Great Northern & Strand, the Charing Cross, Euston & Hampstead and the Baker Street & Waterloo Railway. The estimated cost of construction of the new lines is £15,000,000.

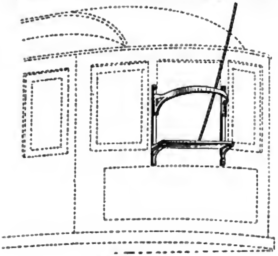
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JULY 29, 1902

705,583. Electric Signal; Arthur J. Haycox, Mansfield, Ohio. App. filed April 10, 1902. One terminal of a signal lamp is connected with the trolley wire, the other leading through a manually operated switch, to the return circuit, whereby the signal can be operated at pleasure.

705,611. Adjustable Brake Head; Gilbert P. Ritter, Chicago, Ill. App. filed May 15, 1902. The brake head has a journal opening, and a grip tongue coincident therewith engages the end of the beam whereby adjustments may be made to accommodate the various heights at which the beam is hung.



PATENT NO. 705,705

705,705. Safety Attachment For Trolley Car Vestibules; Susie E. Pressler, Toledo, Ohio. App. filed May 5, 1902. Rearwardly extending brackets against which the motorman may lean when adjusting the trolley wheel to the wire to avoid falling backward.

705,783. Street Car Fender; Ole Olesen, St. Louis, Mo. App. filed Aug. 7, 1901. A canvas apron is connected to a jackstay fixed to a skeleton frame.

705,798. Trolley; W. L. Von Hardenburg, Brooklyn, N. Y. App. filed June 22, 1901. A spiral groove on each side of the wheel conducts the wire back to the tread whenever it becomes displaced.

705,848. Electric Railway; Charles J. Kintner, New York, N. Y. App. filed Oct. 29, 1900. Renewed Feb. 28, 1902. A series of rotary tubular switches inclosing a current feeder are turned by the car engaging with a spiral groove therein.

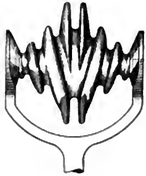
705,814. Fender or Guard for Tramway Cars; John Bauer, New York, N. Y. App. filed March 19, 1902. A V-shaped fender located beneath the car platform.

705,825. Trolley Head and Wheel; W. A. E. Davis, Toledo, Ohio. App. filed Dec. 18, 1901. Overhanging side-plates to prevent the wheel from leaving the wire.

705,882. Trolley; Thomas W. Sutton, Pittsburgh, Pa. App. filed May 7, 1902. Fingers which prevent the wheel from leaving the wire can be moved readily to detach the wheel.

705,886. Car Fender; John W. Wehmeyer, St. Louis, Mo. App. filed Feb. 24, 1902. Details.

705,918. Car Fender; Charles Giblin, Cleveland, Ohio. App. filed Aug. 12, 1901. A fender having sideboards, and a tilting bottom.



PATENT NO. 705,798

705,927. Brake-Shoe Adjuster; Edwin M. Herr, Pittsburgh, Pa. App. filed Dec. 7, 1901. A track brake provided with means for automatically adjusting the shoe support when the shoe wears down to a certain point.

PERSONAL MENTION

MR. ARTHUR HOLLAND, who has been acting president of the United Railroads of San Francisco, has been appointed president of the company.

MR. HOWARD PORTER, for some time assistant superintendent of the Cincinnati Traction Company, has become superintendent of the street railway at Paducah, Ky.

MR. M. J. LOFTUS, JR., for some time superintendent of the Newark & Granville Electric Railway, has resigned to become general manager of the Indianapolis & Martinsville Rapid Transit Company.

MR. O. E. OLESON, for six years chief engineer of the power plant of the Toledo Railways & Light Company, has resigned to accept a similar position with the Rapid Transit Company, of Minneapolis.

MR. EDWARD SPELLMAN, of Cleveland, has been appointed superintendent of the Ohio Central Traction Company's lines, which are the property of the Pomeroy-Mandelbaum Syndicate, of Cleveland.

MR. RICHARD EMORY, formerly vice-president and general manager of the Nashville Railway, and recently assistant to the general manager of the Milwaukee Electric Railway & Light Company, has recently accepted a position with the Appleyard Syndicate, of Boston, as manager of a part of its Ohio properties. Mr. Emory will have his headquarters at Columbus.

MR. R. T. GUNN, superintendent of the Norfolk Railway & Light Company's system, has been appointed superintendent of all of the Norfolk, Portsmouth & Newport News Company's lines with terminals in this city. Mr. H. R. Palmer has been appointed superintendent of the power plant of the company in Norfolk, as well as that in Berkley. Mr. G. A. Hatch will act as superintendent of the Berkley Street Railway, as well as the Atlantic Terminal line.

MR. F. A. ESTEP, president of the R. D. Nuttall Company, of Pittsburgh, Pa., recently returned to New York after an extended trip abroad in the interests of his company. Mr. Estep attended the exhibition of tramways supplies, held in London during July, in connection with the convention of the International Tramway Association, at which he had an exhibit, and also made a trip on the Continent, where the Nuttall Company has enjoyed an extensive business.

UNITED STATES SENATOR HANNA was presented a handsome cane by the employees of the Cleveland City Railway Company, of which he is president, on August 4. About 800 employees of the company gathered at a public hall to which Senator Hanna had been summoned, and the presentation was then made. In acknowledging the gift, Senator Hanna expressed his sincere thanks to his employees for their gift, and incidentally spoke on the relations that he hopes to see soon established between capital and labor.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Aug. 6, 1902.

So far as the immediate condition of the money market is concerned, everything is satisfactory to borrowers. Call money continues to loan in abundance on the Stock Exchange at 2¼ per cent. Time money is firmer, especially for the distant periods, yet even time loans can be made on good collateral at 4¾ per cent for the six months from now to February. Local bank reserves are lower than they were two weeks ago, partly because of heavy gold exports to Europe, and partly in consequence of renewed loan expansion. The gold shipments are apparently over for the present, however, rates of exchange at Paris and Berlin, to which the recent consignments have been made, having recovered well above the gold import level. As for the movement of loans, this is not something that can be so easily predicted. The quieting down of speculation on the Stock Exchange, however, is rather a fair indication that no further increase of importance will occur during the immediate future. In contrast to these easy present conditions, the outlook a month or so ahead is not so reassuring. Treasury expenditures, which ran heavily in excess of receipts during the first two weeks of July, have fallen off greatly, as had been expected. Last year there were very large surpluses from now on, ranging from $6,000,000 in August to over $10,000,000 in October. The abolition of the war internal revenue taxes makes it probable that the surplus this year will be considerably smaller, but the reduction does not promise to be great enough to make the treasury a debtor instead of a creditor in the money market. In a few weeks' time, moreover, the autumn currency demands will begin, and local cash holdings will be rapidly depleted by country bank withdrawals. All this is to occur, moreover, with New York surplus reserve at the exceptionally low figure of $13,000,000.

The Stock Market

The customary quiet of midsummer has once more settled down upon the Stock Exchange. The brief outburst of speculative activity in July raised the general price average substantially, but otherwise it has left conditions practically as it found them. There has been no important distribution of stocks in the hands of the outside public. Holdings remain concentrated to an unusual extent with the larger speculative and financial interests, and this element, although suspending its efforts to advance prices, seems inclined to check any tendency toward decline. The outside situation meanwhile continues highly favorable. Progress of the crops is altogether satisfactory, and an extremely heavy yield of the staple products seems to be more than ever assured. Reports from the various industries are also uniformly encouraging, and although the end of the coal strike is not yet clearly visible, events appear to be shaping themselves toward a gradual break-up of the miners' resistance. As a logical reflection of the prosperity, present and prospective, railroad earnings keep on piling up increases over the totals of the previous year. The question uppermost in the minds of serious investors is, however, whether the rapid advance which has taken place during the last four months has not gone as far as it is safe to go, for the time being, toward discounting the favorable outside conditions. This question is answered now quite unanimously in the affirmative. As a further incentive to caution there is the uncertain outlook already described in the money market. Even the boldest of the speculative fraternity have come to realize the wisdom of going slow until the solution of the autumn money problem can be more clearly seen. The Rock Island proposals for heavy increase in capitalization are a more recent development, which have cooled the enthusiasm of speculative buyers. Altogether, while sentiment, as a rule, is not pessimistic, it is extremely cautious, and the reflection of it is likely to be seen for the present in a dull and hesitating market, such as we have had during the past week.

Among the local traction stocks interest has centered chiefly in Manhattan Elevated. The course of the stock in the recent trading has strengthened the view frequently expressed in these articles, and held by intelligent observers that the shares have been quietly but steadily absorbed for some time past with the purpose of holding for considerably higher prices. Talk of a lease of the property to the New York Central on a 6 or 7 per cent guarantee has been revived by the plans of the Central management, announced last week, for extending its terminal facilities and substituting electricity for steam in its local service. But there appears to be no good reason as yet for placing much faith in these stories. The Manhattan's exceedingly good show of present earnings, with the prospect of further expansion under full electrical equipment, are logical reasons enough for the recent accumulation of the stock. There is little feature to the recent dealings in either Brooklyn Rapid Transit or Metropolitan. Attempts to stimulate outside buying of Metropolitan Securities have so far not met with much success.

Philadelphia

The feature of the traction movement in Philadelphia has been the heavy buying of the new Rapid Transit Company shares and of Union Traction, the leased line issue. Rapid Transit, which was first quoted a month ago at 9, and which sold two weeks ago at 11½, rose steadily in the remaining interval to 13⅞, while Union Traction went up from 44⅞ to 47⅛—a new high record for that stock. It is claimed that the present Union Traction Company is earning enough to pay the guarantee on its stock, and leave a balance of $300,000 (on the basis of the last year's earnings) for Rapid Transit stock. The negotiations for purchase of outlying suburban lines have furnished an additional incentive, and as a part of the general movement Fairmount Park Transportation shares have risen 5 points, from 22 to 27, on unusually large dealings. Apart from possible legitimate causes for the advance, it should be noted that only a small proportion of either Union Traction or Philadelphia Rapid Transit stocks are held by the outside public. If the syndicate which carried through the consolidation deal were desirous of making a market for the new securities it would be easy for them to engineer just such a rise as has occurred. Other Philadelphia sales during the fortnight comprise Philadelphia Traction, at a slight advance, to 99⅞, American Railways, which rose a point and a half to 47¾, and later reacted to 47, Railways General at 4¾, Easton Electric at 19⅞, and Rochester Railway common, 200 shares of which sold at 66½.

Chicago

Chicago elevated shares have, as a rule, been strong and fairly active in the recent trading, partly on heavy traffic receipts and partly on discussion of future financial plans. Northwestern Elevated common, in which scarcely any dealings have occurred during the last few months, was exceptionally strong, rising nearly 2 points to 37. This advance was connected with the visit of a New York banking representative, when plans for improving and extending the system were considered, and it also reflected the increase of 15½ per cent reported in July earnings over the month last year. Metropolitan earnings for the same period increased 23½ per cent, and even Lake Street showed a gain of 10 per cent. Metropolitan shares were strong on this showing, the common getting up to 39½ and the preferred to 92½. Lake Street, however, on the uncertainty regarding the terms of the impending reorganization, continued heavy, selling down from 10 to 9¼. Among the surface line securities, City Railway rose rapidly on the buying of fractional lots from 205 to 220. Chicago Union Traction was firmer for the preferred shares, at 50, but lower for the common, which declined from 16⅝ to 15¼.

Other Traction Securities

The two weeks have been exceedingly quiet in the Boston traction stocks. On light trading Massachusetts Electric declined to 40⅛, then recovered to 41, while the preferred held steady at 98. Boston Elevated sold in a few lots, between 164 and 166, West End common between 94½ and 96, and the preferred at 114. In Baltimore excitement subsided in the Nashville Street Railway securities, but they were steady and somewhat higher, the recovery extending to 5⅞ for the stock, and 73½ for the trust certificates. United Railways of Baltimore common, after an advance to 16⅞ fell back to 16. The general 4 per cents went to 97¾, and back to 97¼, while the incomes remained about stationary, at 70¼. Anacostia & Potomac 5s, on unfavorable rumors concerning the company's financial position, dropped sharply from 103 to 99¾, but later recovered to 103½. Other Baltimore sales comprise Lexington Railway 5s, at 104; Charleston Consolidated Railways, between 93¾ and 94¾; Norfolk Railway & Lighting 5s, at 95¼, City & Suburban (Baltimore) 5s, at 102½; Atlanta Railway 5s, at 106, and City & Suburban (Washington) 5s, at 102 and 102½. The feature of the Louisville traction market was a sharp advance in Louisville Street Railway common, five shares of which sold at 141, against a quotation of 126 bid two weeks ago. Trading in New Orleans securities has been quiet at a slight reaction to 16.

for the common and 56¼ for the preferred. Toledo Railway & Light is also dull but strong around 34.

Last week was one of the most active on record for the Cleveland Stock Exchange. Tractions held the center of the stage, and nearly 10,000 shares changed hands during the week. The strong bull movement which started two weeks ago has continued, and nearly everything on the board advanced. Cincinnati, Dayton & Toledo lead the activity, with sales of 3186 shares. It opened Monday at 23 and advanced to 27 during the week; closing sale was at 26¼. Detroit United followed with sales numbering 2742 shares, which were brought into the market at an advance from 84 to 87½. It is the general opinion that this stock will continue to advance to about the 90 mark unless New York should withdraw its support; a contingency which is not feared. Toledo Railways came in for 850 shares, on an advance to 34½. News of a million dollar tax suit against the company has since caused it to sag somewhat. Northern Ohio continues its steady advance. It started at 40½ for the common and closed at 45, over 700 shares selling. Southern Ohio continues to advance with the new Cincinnati, Dayton & Toledo, which supersedes it. Five hundred of the shares still out changed hands, at from 71½ to 73⅜. Lake Shore Electric is showing remarkable strength in view of the fact that the proposition has not yet been financed. It opened at 14½ and advanced to 17⅞; sales 437 shares. Cleveland Electric continues strong at 85, 125 shares selling, with plenty of bids for more. Syracuse Rapid Transit sold for 349 shares, at 70 for the preferred, 2 points higher than last previous. Western Ohio continues firm at 25 and 25½. Sales numbered 365 shares. Monday, 100 Lake Shore common advanced to 18½, the highest yet. Northern Ohio sold for 45 for 100 shares, and Cleveland Electric advanced to 86 for 100 shares. Two hundred Cincinnati, Dayton & Toledo sold at 26, a drop of 1 point from last sales.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid July 22	Closing Bid Aug. 5
American Railways Company	46¾	47
Boston Elevated	165	164
Brooklyn R. T.	71	69
Chicago City	210	215
Chicago Union Tr. (common)	16¾	15½
Chicago Union Tr. (preferred)	52	50
Cleveland Electric	82½	86¾
Columbus (common)	52	52
Columbus (preferred)	108	107¼
Consolidated Traction of N. J.	69½	69½
Consolidated Traction of N. J. 5s	110½	110½
Detroit United	79¾	85⅝
Electric People's Traction (Philadelphia) 4s	99¾	99½
Elgin, Aurora & Southern	41½	43
Indianapolis Street Railway 4s	87¾	87¾
Lake Street Elevated	10¼	9½
Manhattan Railway	133½	131¼
Massachusetts Elec. Cos. (common)	42	41
Massachusetts Elec. Cos. (preferred)	97½	97¾
Metropolitan Elevated, Chicago (common)	38	39
Metropolitan Elevated, Chicago	92	91½
Metropolitan Street	150¾	149
North American	126	123½
Northern Ohio Traction (common)	39¾	41½
Northern Ohio Traction (preferred)	89	89
North Jersey	30½	30½
Northwestern Elevated, Chicago (common)	35	37
Northwestern Elevated, Chicago (preferred)	80	81
Philadelphia Rapid Transit	11¼	13¾
Philadelphia Traction	99¾	99⅝
St. Louis Transit Co. (common)	31	31½
South Side Elevated (Chicago)	110	110
Southern Ohio Traction	..	72
Syracuse Rapid Transit	..	27¾
Syracuse Rapid Transit (preferred)	65	76
Third Avenue	132½	132
Toledo Railway & Light	30¾	30
Twin City, Minneapolis (common)	121½	123½
United Railways, St. Louis (preferred)	84	83½
United Railways, St. Louis, 4s	87¼	87¼
Union Traction (Philadelphia)	44⅞	47
Western Ohio Railway		25½
New Orleans Railways (common)	17¼	16
New Orleans Railways (preferred)	56	56¼

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

With the exception of billets, where the conditions are distinctly easier, demand continues to run far ahead of production in the leading branches of the iron trade. In basic pig iron the bulk of the orders now being taken are on contracts running well into next year. For prompt delivery fancy premiums have to be paid. The Eastern foundry interests are coming to depend more and more upon imports of the foreign material. Meanwhile it is estimated that 1,200,000 tons of steel rails are already booked for next year's delivery, and an additional 400,000 tons will be carried over from this year's. Quotations are $21.75 for Bessemer pig, $33 for steel billets and $28 for steel rails.

Metal

Quotations for the leading metals are as follows: Copper, 11.90 cents; tin, 28 cents; lead, 4⅛ cents; spelter, 5⅛ cents.

MACON, GA.—Tucker, Anthony & Company, of Boston, have sold the Macon Consolidated Street Railway Company and the Metropolitan Street Railway Company, both of Macon, Ga., to Nashville and Savannah parties. These properties have been controlled in Boston since 1894. The Macon Consolidated Company controls the Metropolitan Company. It has $350,000 bonds and $500,000 stock, and the system comprises about 20 miles of road. It is understood that purchase price for a controlling interest was in the neighborhood of $600,000.

CHICAGO, ILL.—Metropolitan Elevated directors have declared a semi-annual preferred dividend of 1½ per cent, payable Aug. 30. Books close Aug. 16 and reopen Aug. 30.

BOSTON, MASS.—The treasurer of the West End Street Railway Company received proposals July 23 for $500,000 West End Street Railway 4 per cent bonds dated Aug. 1, 1900, and maturing Aug. 1, 1915. This issue is to refund a matured issue of $500,000 Highland Street Railway Company 5 per cent bonds. The award was made to Lee, Higginson & Company at better than 104. Bids ranged down to 103, and were eleven in number.

BOSTON, MASS.—At a special meeting of the stockholders, held July 25, it was unanimously voted to authorize an increase in the capital stock of the Boston Elevated Railway Company from $10,000,000 par value to $15,000,000 par value, and an increase in the number of shares from 100,000, par value $100, to 150,000, par value $100, the proceeds to be applied to defraying the cost of construction and equipment of the road, with expenses incidental thereto, and to paying the indebtedness already contracted for that purpose. Gen. Bancroft said he was unable to state accurately how much money the road would require for these purposes, but to complete what had already been undertaken by the company would take somewhere between $3,000,000 and $4,000,000. Only stockholders of record will be allowed to subscribe for the new capital stock.

BOSTON, MASS.—Judge Colt of the United States Circuit Court on July 28 authorized William Odlin, receiver, to sell the property of the Stoughton & Randolph Street Railway Company. The road is 8.2 miles long. The villages of Stoughton and Randolph form its termini.

NASHVILLE, TENN.—The Nashville Railway bondholders' committee recently issued a statement from which we take the following facts and figures:

Capital stock (authorized $6,500,000) outstanding		$5,470,000
First consolidated mortgage 5 per cent bonds authorized		6,500,000
Held by trustee to redeem underlying bonds	$2,549,000	
Held in treasury for future requirements	1,651,000	
Outstanding in hands of public	2,300,000	6,500,000
Receiver's certificates		$500,000
Gross earnings for six months ended Dec. 31, 1901		$391,456

The earnings of the company for six months ended June 30th show a good increase over same months in 1901. The comparison by months from January to May inclusive, June not yet to hand, is as follows:

GROSS EARNINGS NASHVILLE RAILWAY, JANUARY TO MAY, 1902, INCLUSIVE

	1901	1902
January	$57,941.73	$63,220.64
February	50,928.90	56,583.11
March	59,064.89	65,772.04
April	59,109.15	65,225.87
May	63,509.10	76,900.63

Hambleton & Company, of Baltimore, in commenting on these figures, say:

"The company, we estimate, earned in gross for the year ended June 30, 1902		$900,000
"Estimating the operating expenses at 55 per cent		495,000
"Estimated net earnings		$405,000
"Interest on underlying bonds	$146,020	
"Interest on receiver's certificates	30,000	
"Taxes (abnormally large)	78,716	
"Interest on $2,300,000 consolidated mortgage 5s	115,000	
		369,736
"Estimated surplus		$35,264

"We do not see why these estimates should not be realized. The money received from the sale of receiver's certificates is being spent in betterments and improvements, which, when completed, will add largely to the earning capacity of the property. The attitude of the city authorities is said to be friendly, and a reduction of taxes and the granting of new privileges are assured. It looks as if the Nashville Railway Company will soon be out of its difficulties."

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., June '02	67,681	36,540	31,041	14,121	17,021
	1 " " '01	58,191	32,122	26,069	13,056	15,946
	6 " " '02	318,937	185,362	133,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,166	136,162	130,004
	12 " " '00	513,722	* 317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co. ..	1 m., July '02	140,209	89,013	51,197	23,866	27,331
	1 " " '01	134,370	79,638	54,732	......	......
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,076	......	......
	1 " " '01	15,678	9,341	6,337	......	......
	10 " " '02	187,658	103,986	83,672	......	......
	10 " " '01	169,756	94,355	75,401	......	......
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,836,597	3,532,899	2,896,360	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,496	1,862,648	937,206	925,442
	12 " " '00	5,518,837	4,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., June '02	1,163,288	* 732,152	431,136	......	......
	1 " " '01	1,181,023	* 732,740	448,283	......	......
	12 " " '02	12,780,706	*8952214	3,837,491	......	......
	12 " " '01	12,101,198	*7970635	4,130,563	......	......
BUFFALO, N. Y.						
International Tr. Co .	1 m., May '02	264,184	146,787	117,398	97,330	20,068
	1 " " '01	291,666	161,077	130,589	92,030	38,559
	1 " " '00	209,309	115,487	93,823	78,250	15,572
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co....	6 m., May '02	400,572	208,325	191,948	75,826	115,422
	6 " " '01	245,745	150,425	95,320	76,714	9,007
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., June '02	17,750	7,065	10,685	......	......
	1 " " '01	17,253	6,196	11,057	......	......
	6 " " '02	78,940	38,021	40,919	......	......
	6 " " '01	65,461	34,403	31,058	......	......
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	......	......
	12 " " '00	757,954	378,661	379,293	......	......
Union Traction Co.	12 m., June '02	7,942,168	4,570,719	3,371,749	6,619,277	† 247,528
	12 " " '01	8,158,809	3,942,194	4,216,615	4,058,040	158,575
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	......	......
	1 " " '01	2,435	3,016	† 581	......	......
	12 " Dec. '01	47,976	* 32,002	15,974	13,023	2,951
	12 " " '00	49,646	* 33,272	16,374	13,294	3,080
Cleveland & Eastern..	1 m., Feb '02	4,916	3,616	1,300	......	......
	1 " " '01	3,535	4,047	† 512	......	......
	12 " Dec. '01	90,390	52,022	38,368	41,678	† 4,310
	12 " " '00	62,896	36,675	22,221	36,148	† 9,927
Cleveland El. Ry. Co..	1 m., May '02	217,568	......	......	......	......
	1 " " '01	187,049	......	......	......	......
	5 " " '02	962,800	......	......	......	......
	5 " " '01	854,594	......	......	......	......
	12 " Dec. '01	2,296,898	1,265,953	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western...............	1 m., June '02	25,198	13,026	12,172	......	......
	1 " " '01	22,236	9,736	12,501	......	......
	6 " " '02	128,392	77,728	50,664	......	......
	6 " " '01	107,027	64,259	42,768	......	......
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,608	102,303	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., June '02	17,747	9,520	8,227	......	......
	1 " " '01	15,748	8,036	7,711	......	......
	6 " " '02	79,337	44,679	34,857	......	......
	6 " " '01	65,449	36,228	29,221	......	......
	12 " Dec. '01	161,971	* 87,102	77,869	72,500	5,369
	12 " " '00	141,112	* 69,592	71,520	72,500	† 980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., June '02	77,545	* 42,671	34,875	15,614	19,261
	1 " " '01	72,201	* 42,147	30,054	15,746	14,308
	6 " " '02	422,150	*247,877	174,273	93,025	81,248
	6 " " '01	384,638	*235,852	148,786	94,105	54,681
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,516	66,583	57,963	32,865	26,119
	1 " " '01	116,857	62,866	53,490	31,304	22,186
	4 " " '02	481,348	261,118	220,230	131,259	88,972
	4 " " '01	435,267	236,915	198,362	125,622	72,739
	12 " Dec. '01	1,507,298	818,321	688,965	383,180	305,785
	12 " " '00	1,302,200	722,438	579,839	374,291	205,548
DETROIT, MICH.						
Detroit United Ry....	1 m., June '02	291,470	* 159,333	132,137	......	......
	1 " " '01	260,109	* 139,412	120,697	......	......
	6 " " '02	1,600,675	* 907,044	693,631	396,739	297,892
	6 " " '01	1,384,181	* 775,347	608,834	345,119	263,715
	12 " Dec. '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1459058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " '01	28,877	18,062	10,816	9,692	1,124
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., June '02	48,497	22,136	26,361	9,655	16,706
	1 " " '01	39,265	20,076	19,189	9,188	10,001
	6 " " '02	245,406	132,413	112,992	57,844	55,148
	6 " " '01	208,539	119,803	88,736	54,765	33,970
ELGIN, ILL.						
Elgin, Aurora & Southern Tr..........	1 m., June '02	33,874	20,148	13,726	8,333	5,393
	1 " " '01	32,614	17,659	14,956	8,333	6,622
	6 " " '02	186,457	115,526	70,931	50,010	20,931
	6 " " '01	167,648	102,924	64,724	50,000	14,724
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co..........................	1 m., June '02	20,714	9,900	10,805	......	......
	1 " " '01	16,257	8,909	7,348	......	......
	6 " " '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	18,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	9,125	7,500	1,625
	12 " " '02	358,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT.						
London St. Ry. Co.....	1 m., June '02	13,643	8,558	5,084	2,297	2,787
	1 " " '01	13,917	7,907	5,920	2,046	3,874
	6 " " '02	65,064	43,167	21,897	13,593	8,304
	6 " " '01	60,112	39,951	20,161	11,932	8,229
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.................	1 m. June '02	222,450	107,193	115,257	66,015	49,242
	1 " " '01	202,416	94,470	107,986	62,780	45,207
	6 " " '02	1,274,629	612,304	664,325	249,554	372,771
	6 " " '01	1,123,765	566,463	557,302	365,328	171,976
	12 " Dec., '01	2,442,342	1,185,534	1,256,808	755,130	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	824,065	266,947
MINNEAPOLIS, MINN.						
Twin City R. T. Co....	1 m., May '02	266,991	136,964	160,028	58,733	101,294
	1 " " '01	251,946	114,340	137,606	56,633	80,971
	5 " " '02	1,356,566	649,008	707,558	292,810	414,752
	5 " " '01	1,178,257	563,664	614,593	273,093	341,496
MONTREAL, CAN.						
Montreal St. Ry. Co...	1 m., June '02	187,662	80,655	107,007	19,391	87,615
	1 " " '01	180,926	97,782	83,144	14,272	68,871
	9 " " '02	1,445,180	846,896	598,287	144,290	453,989
	9 " " '01	1,365,026	841,469	573,557	90,298	423,258
NEW YORK CITY.						
Manhattan Ry. Co.....	3 m., Dec. '01	3,068,485	1,404,971	1,688,465	758,135	880,329
	3 " " '00	2,728,598	1,340,696	1,387,902	749,857	638,045
	12 " Sept. '01	10,455,872	5,328,640	5,127,222	2,683,132	2,444,091
	12 " " '00	6,960,785	5,196,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry..	3 m., Dec. '01	3,867,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,796,040	1,699,649	2,096,391	1,138,467	947,914
	12 " June '02	15,896,641	7,396,883	8,490,758	4,813,421	3,665,337
	12 " " '01	14,720,767	6,755,131	7,965,636	4,584,068	3,421,567
OLEAN, N. Y.						
Olean St. Ry. Co......	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PHILADELPHIA, PA.						
American Railways ..	1 m., May '02	97,701	......	......	......	......
	1 " " '01	73,406	......	......	......	......
	11 " " '02	908,356	......	......	......	......
	11 " " '01	764,560	......	......	......	......
ROCHESTER, N. Y.						
Rochester Ry.... ..	1 m., June '02	89,236	46,800	42,426	24,754	17,672
	1 " " '01	85,227	45,514	39,413	26,704	12,709
	6 " " '02	527,742	288,006	239,737	148,606	91,130
	6 " " '01	495,206	306,906	188,250	147,157	41,103
SYRACUSE, N. Y.						
Syracuse R. T. Co....	1 m., June '02	60,863	34,780	26,064	16,085	7,089
	1 " " '01	56,952	30,942	26,010	18,947	7,063
	12 " " '02	693,281	384,265	309,019	228,246	80,773
	12 " " '01	621,249	340,830	280,469	223,918	56,550
TOLEDO, O.						
Toledo Ry. & Lt. Co...	1 m., June '02	122,692	65,143	57,539	37,854	19,685
	1 " " '01	112,900	53,923	58,978	24,271	34,707
	6 " " '02	671,284	352,382	318,902	227,033	91,869
	6 " " '01	598,928	303,402	295,526	145,665	149,901
	12 " Dec. '01	1,311,084	* 636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	* 616,946	565,571	409,061	156,510
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	1 m., June '02	56,636	35,622	21,018	25,000	† 3,986
	1 " " '01	56,936	35,600	22,336	25,000	† 2,663

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Mr. Edison's Prediction

At the recent opening of the Copenhagen Exhibition, a letter was made public from Thomas A. Edison on the future of electric traction. Mr. Edison was asked as to his opinions concerning electric traction and aerial navigation, and replied as follows: "I believe that within thirty years nearly all railways will discard steam locomotives and adopt electric motors, and that the electric automobile will displace the horse almost entirely. In the present state of science, there are no known facts by which one could predict any commercial future for aerial navigation."

This seems at present a very bold prediction, but it is no more than if Mr. Edison, fifteen years ago, had said that 95 per cent of the street railways in the country within the same space of time would be in operation by electricty, yet this has come about within a half of three decades.

Block Signal Systems for Electric Railways

Several bad accidents which have occurred on electric railways during the past three or four weeks have called attention to the demand for reliable block signals on electric railways, and a correspondent in this issue suggests that the "staff" signal system, which is employed on steam railroads, is well adapted to electric railway operation. This is a very old system and consists, in its simplest form, in making the engineer of the locomotive, when leaving a turnout, carry with him a short staff, which gives him control of that section, as no other train is allowed to enter the section without this passport to it. The engineer leaves the staff at the next turnout to be taken back to the first turnout by the first train coming in the opposite direction. Modifications in the system have been made so that trains do not have to pass alternately in one direction and the other, by providing several staffs at each end of the section and an electrical connection between the two turnouts by which the removal of a staff in the signal box at either end locks the box. We are aware that the system is in use upon a great many steam roads, but we must confess that it does not appear superior to the usual method of signalling with lights, as it requires a stop at the turnout, and certainly as much delay, if not more, than with the usual electric system. As we have already pointed out editorially, the electric railway is at a disadvantage in some respects with the steam railroad when it comes to the introduction of a block signal system, because on the latter the rails can easily be insulated from each other, so far as the voltage of a low primary battery is concerned. This fact can be utilized in a block signal system, so that the passing of a train over the track can be used to short circuit the rails through the car axles and thus operate the block signal apparatus. On the other hand, the electric railway has an advantage over the steam railroad through the fact that a 500-volt circuit is always available, and this current can be employed for signalling purposes in a way not possible on the steam railroads. We do not claim, by this, that any or all of the present methods of block signalling in use on electric railways are perfect, but we do believe that the greatest factor in any system of this kind is the carefulness of the employees, and the maintenance of an intelligent set of rules for the manipulation and use of the safety appliances. Thus, the incident mentioned by the correspondent of the motorman or conductor on the road observed by him delegating the work of changing the signals to a passenger on the car who happened to be his friend, was, of course, a gross infraction of discipline. On the other hand, the danger of signals being tampered with by unauthorized persons, we believe, is very remote. In the first place, in any system depending upon the hand manipulation of the signals, the boxes usually are, or should be, locked so that no one but the person having the key can open them; again, any unauthorized change of signals of this kind in most States is a severe penal offense, as it should be, and we have never heard of a case of signals of this kind being mis-set. It might be said that mischievous or criminally inclined persons have an ample opportunity for changing the signals without being observed, as the signal boxes are often

in parts of the country where such acts could not be detected, but there is the same danger that persons of this character could cause as much damage by placing ties or other obstructions on the track, and there is but little more opportunity for doing one than the other.

* * *

Another example of the importance of having some reliable system of block signalling on high-speed interurban electric railways was shown last month, by a very bad head-on collision on the new third-rail electric railway extending from Milan, Italy, to Porto Ceresio. This line, which was formerly operated by steam, extends from Milan north to Lake Lugano, and is equipped with the third-rail electric system. The line, which is about 30 miles in length, carries, at this time of the year, a very large traffic of excursionists to the Italian lakes. It is also very popular with many of the business men of Milan, who, to escape the hot nights in that city, have built country residences along the beautiful shores of Lake Lugano, and who use the line every morning and evening in going to and from their places of business. The precautions against accidents have seemingly been fairly good, in that the trains are despatched from regular turnouts by employees of the company, and no train is allowed to proceed beyond a turnout without special orders. The accident in question, however, indicates that any system of this kind which depends upon human judgment is fallible. The station master at Porto Ceresio, finding that the train which was due at that point at a certain time was late, assumed that he could stop it at the preceding turnout, at Biasuschio, and telegraphed to the station master at that point to hold the train there. Then without waiting for an answer he ordered the train at his station to proceed. The north train, however, had left Biasuschio before the receipt of the telegram, and the result was a bad collision between the turnouts, in which two passengers were killed and thirteen were badly wounded. Unfortunately, it did not occur to either of the despatchers after the trains had left their stations and they knew that an accident was almost inevitable to switch off the current from the third-rail. This, of course, would have brought both trains to a stop, and the engineers of both could have been notified of the condition of affairs. This possibility of the control over a train after it has left the station is one great safeguard in electric railway operation, although in this particular case no advantage was taken of it.

The Mediterranean Railway Company, which is the owner of the Milan-Porto Ceresio line, is now planning to introduce some system of automatic block signalling which will prevent a recurrence of any accident of this kind, a step which should have been taken before.

New York's Transportation Facilities

Mayor Low's letter upon the transportation needs of New York, which we published last week, is attracting much attention, as it is generally accepted as an official outline of the policy which the present city administration will pursue. The fact that the Mayor is a member of the Rapid Transit Commission lends additional weight to this utterance; his position and powers, moreover, will enable him to exert more influence in directing legislation upon this subject than any other individual engaged in the solution of these grave problems. It is gratifying, therefore, to find evidences at every step of careful and intelligent study of the subject. The Mayor appreciates fully the importance of the part which the transportation companies are playing in the development of the commercial interests of the city, and is evidently eager to afford them every opportunity of extending their sphere of influence.

* * *

Naturally, the first point taken under consideration is the necessity for relieving the congestion of traffic between Manhattan and Brooklyn. All plans providing merely for temporary relief are put aside. Whatever is now done must eventually form a part of the comprehensive plan which will ultimately secure complete unification of the several boroughs. It is proposed, first of all, to rebuild the suspended structure of Brooklyn Bridge, so as to adapt it to the largest possible use as a railroad thoroughfare. This would enable the operation of six-car trains instead of four, and at once increase the train capacity 50 per cent. Admitting that the moving sidewalk, which has been advocated so persistently by the present Bridge Commissioner, would double the present carrying capacity of the bridge, the plan is condemned by the fact that it would be a makeshift at best, and could not become a part of the completed system. The time and money spent in such a scheme would, therefore, be wasted, and would really entail further delay and additional expense in accomplishing the great permanent improvement which is now recognized as necessary to the future growth of the city. We cannot agree, however, with the Mayor's view that the southern connection, leading from the bridge to the financial district of Manhattan, can wait. Such delay would be an injustice to the great army of Brooklynites whose business brings them every day to the lower end of Manhattan. Everything possible should be done to relieve the present conditions, and the plans proposed by Mr. Parsons to solve this problem ought to be taken under consideration at once. The recommendations concerning the new Williamsburg Bridge and Blackwell's Island Bridge are along the lines proposed in Mr. Parsons' plan and are generally approved.

* * *

The needs of the northern section of the city form the subject of an interesting discussion, particularly that portion dealing with the service of the New York Central. The company's assurance that it will co-operate with the city in establishing points north of the Harlem River where passengers can change from the suburban trains to the subway and elevated lines is certainly a valuable advantage and ought to assist materially in securing a practical solution of one of the greatest problems that has confronted the Rapid Transit Commission. It is pointed out that it will not be necessary for the railroad company to secure additional powers from the Legislature to carry out these plans, and this removes an obstacle which might cause serious delay.

* * *

The last recommendation deals with the subject of increased facilities along the river front on the West Side, and does not seem practicable at this time. We doubt the wisdom of introducing an element into this discussion that cannot fail to arouse opposition, especially as it involves the handling of freight as well as passenger traffic. The volume of business that could be cared for by the plan proposed would be only a small percentage of that handled upon the river, and there is, moreover, no pressing demand for such a service. It seems to us in consideration of these facts that it would be much wiser for the Commission to deal simply with the question of furnishing adequate transportation facilities for passengers.

Regulation of Street Railways

The sentiment favorable to placing street railways under State regulation is growing in many sections where trolley lines are no longer restricted to local traffic, but have extended their field of operation to neighboring cities. The strongest objection that has been urged against this plan is that it is a serious invasion of the administrative powers of local authorities, but the force of this argument is lessened somewhat by the fact that the service now performed by electric railways is more in the nature of that which the steam roads are giving, and by the consideration that a municipality should not be permitted to regulate a system when the city may form only a part of the territory served. The change is advocated, in many cases, as, for instance, in Massachusetts, when Governor Crane's bill was under consideration, on the ground that local authorities are no longer to be trusted to regulate the transportation business, because it has outgrown the scope of municipal jurisdiction.

Before the introduction of electricity street car systems were

almost entirely local in their character, but the displacement of horses by electricity has revolutionized methods, and now many street car companies operate in the municipal areas of a dozen or more cities and towns. For services of this kind it is essential that regulations should be adopted in many respects different from those which obtained in former times. There was no need ten or fifteen years ago for State Railroad Commissioners to concern themselves with the question of street railway locations, for the reason that it was distinctly a local subject, and local interests could be depended upon to secure adequate service. If the restrictions imposed upon a street railway company by the local authorities were such that the efficiency of the service was materially impaired, public opinion could be counted upon to correct in time such mistakes of this character as might occur. Now, the danger seems to be that the local authorities might enact restrictions that would affect not only their municipality, but an entire State. Public policy requires that local authorities shall not be permitted to interfere with the general well-being, and it is recognized that it would be dangerous to vest such power in the hands of irresponsible boards.

It is pointed out, for instance, that an electric railway may be planned to run through several independent municipalities, where the service may be of great advantage to the majority; yet in the case of one or two, immediate advantages in the way of transportation facilities may not be so evident, though there is little or no disadvantage in granting the interested company the location that it desires. But because the route is to be of manifest advantage to other communities, and is not immediately demanded by the people of one of the towns through which it passes, the board of that place considers itself justified in withholding approval of a location until a number of conditions have been accepted by the petitioning company. We have in mind one project where an electric railway was planned to extend through several small places, and a few larger ones, and the builders were met with many demands on the part of the local authorities, many of which were simply absurd. It must, for example, widen and pave at its own expense the street in which its tracks were to be laid; it must keep the roadway sprinkled and in repair; must light it at night and remove the snow from it in winter; it must carry the school children of the town either at a reduced fare or without charge. In this way financial burdens would be imposed greatly exceeding any possible return that could be obtained from the town itself, and some other community on the line would have to pay the bill.

Another consideration for established companies is possible interference where local authorities are empowered to revoke franchises. A wave of so-called reform is liable to sweep over any community and leave its institutions in badly crippled condition when the aldermen or trustees are left to their own sweet will, and there is nothing to prevent them from indulging in a destructive warfare upon corporations. In the case of an electric railway, for instance, having a continuous line running through several towns, it might at any time have its service cut in two by a revocation of its franchise in one of the midway towns until it would consent to make liberal donations in the way of public improvements.

These are some of the considerations that must influence corporations and communities in considering proposed legislation of this kind, providing for placing supervisory powers in the hands of State boards, instead of local officials. In some places very strong objections have been urged against such measures, as for instance, in Chicago; but on the whole the sentiment seems to be growing more and more favorable as the electric railways expand and the benefits of interurban systems become more apparent.

The Municipal Ownership Heresy

No civic subject has been more acrimoniously debated than this matter of the municipal ownership of public utilities, and none, to our knowledge, less fruitfully. Both sides of the question have legitimate arguments in their support, but in point of fact these have generally cut precious little figure in the discussion, which has usually turned to mutual abuse and misstatement. The end has been as futile as when Predestination and Free Will stormed in theological circles a century and a half ago. It is needless to say that we have consistently upheld the superiority of wise and well-regulated private ownership, but we must own that we occasionally smile at some of the stock reasons adduced in its favor, as well as at some of those advanced by the municipal socialists. Their old standby is the success of municipal street building, waterworks and the like, and they raise a querulous cry of triumph over these, and demand why municipal gas and electric lighting and street railways should not be equally successful. To which is promptly made the retort discourteous, by proving with a deftly marshalled array of statistics, that as a matter of experience municipal gas and electric works, when the accounts are rigorously overhauled, never do pay and that is the end of it. That municipal ownership and operation of waterworks pays, and would be necessary even if it did not pay, on the score of public health, cannot be doubted. The same is the case with the maintenance of the streets, for however corrupt the public works department may be it can be reached via the ballot-box with reasonable promptness, while under our present judicial procedure an unwilling corporation can not be forced to do anything without the expenditure of years and thousands.

Those who argue about gas and electric lighting and street railways, however, are generally heedless of the fact that these public utilities differ very widely from streets and waterworks in two important particulars. First, the former are, however desirable, to a certain extent, luxuries. In other words, they are not necessary, irrespective of whether they pay or not, as when public health and safety are involved. And, second, they differ very widely from street and waterworks in that they require a considerably larger proportion of skilled labor. Now, in a street cleaning gang it makes no difference whether the component heelers are of one political party or the other. The strenuous efforts of the foreman will, in either case, shake them into tolerable efficiency within a few days. But the higher in the scale of labor one goes the greater the difference between bad and good workmen, and the more serious the results of inexperience and inefficiency.

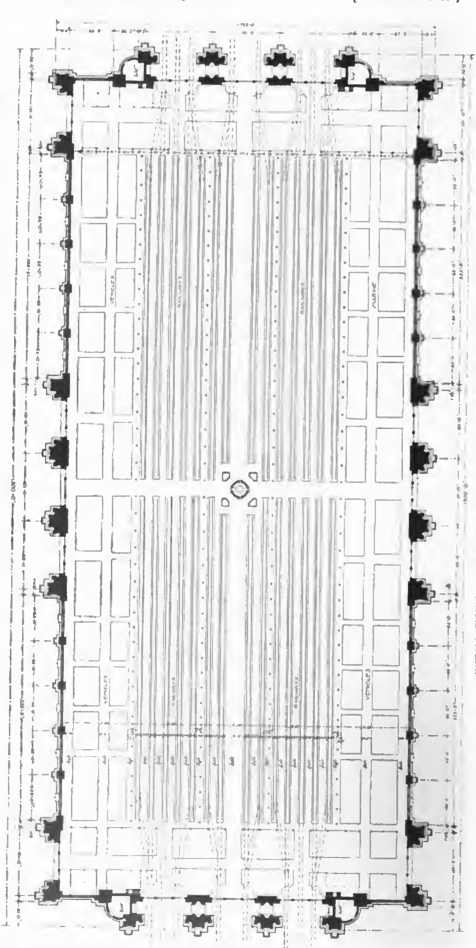
Hence, one may safely lay down the general principle that, under existing political conditions, the less skilled labor required on any municipal work, the better the relative efficiency attainable. Of course, we assume here the usual frank venality and unscrupulousness that is a normal characteristic of municipal politics. The less difficult and elaborate the work undertaken, the less chance for the gang to cover pickings and stealings, and the less mischief will be done by lack of skill. Here is, at once, a perfectly simple and adequate reason for the great and real practical difference between municipal waterworks and municipal tramway operation, or even municipal lighting. The former involves no large amount of skilled labor, and bad work is its own evidence, while the latter calls for a picked body of men, carefully trained, in order to insure either good returns or the safety of the passengers. The kind of gang we should get upon an American municipal tramway system, under existing political conditions, can better be imagined than described, and if our dear theoretical friends—the reformers—really want to make municipal ownership a thing to be tolerated even in hypothesis they will have to begin by reforming municipal politics. When they have done this they can fairly ask for a hearing on the merits of the case, and not until then. It is little use in involving civil service methods as a panacea, for in spite of indubitable merits in theory, in practice they too often act as a shield for inefficient mediocrity, and good or bad they are about as difficult to secure as is political purity in general. All things considered, it is a vast wonder that municipal lighting plants have even come within hailing distance of success, and Heaven help the city that tries municipal tramways. It is a beautiful thing for *doctrinaires* to chortle about, but in the concrete it would be a nightmare.

Transportation Exhibits at St. Louis

The plan for the transportation division of exhibits of the St. Louis World's Fair has been approved, and is presented herewith. The building will be 1,300 ft. long and 562 ft. wide. The cut shows the arrangement of tracks, by which cars and locomotives can be hauled into the building and exhibited under conditions which will give those interested in the department an apportunity to judge of their respective merits and general appearance A main aisle extends through the center of the building, 31 ft. wide, and another aisle about half the width crosses through the middle of the structure. It will be noticed that "Railways" are given the most conspicuous position, facing the main aisle throughout the entire extent on both sides, and occupying altogether about two-thirds of the available floor space. Back of these exhibits on each side are others, including vehicles not of the railway class and marine apparatus. The railway tracks will enter both ends of the building, and there will be ample facilities for handling exhibits of every class. The electrical features of the exhibit will be included among railways, but it is hoped that the management will also make provision for operating modern electric street cars on the grounds outside of the building.

The general plan of the building is rectangular. There will be no court. The distinguishing feature is the massing of the three entrance ways so that they will form an arcade, and this feature will be repeated along four sides of the structure. The three arched entrance ways will take up almost the entire facade on the east and west sides. On the north and south sides these arcade entrance ways are to be placed in the center.

This building will occupy the extreme northwest corner of the grounds. It is the most expansive structure yet designed for the Exposition, and when all the buildings are up it will be exceeded in size only by the palatial Agricultural Building. The east and west fronts will have three magnificent arches, which will comprise more than half of the entire facade. Each of these arched openings will be 64 ft. wide and 52 ft. high. Through these archways fourteen permanent railroad tracks will be laid from one end of the building to the other. At the sides of these three openings the projecting angles will be accentuated by tower or pylon effect, reaching to a height of 150 ft. to the base of the crowning statue. On the north and south fronts the architect has deemed it well to repeat the three massive archways, which will form the center feature of smaller fronts. This treatment is intended to break the unwieldy facade of 1,300 ft. On the north and south fronts the pylon feature will be omitted, but massive piers will be repeated at intervals and lend dignity to the design. Flanking these three openings on the long fronts will be great rows of magnificent windows as wide as the archways. Not only will visitors be admitted through the twelve huge portals, but subsidiary entrances will be provided at frequent intervals in the remaining stretch of walls. Over each of the big archways will be a



INSTALLATION PLAN FOR TRANSPORTATION DIVISION OF EXHIBITS AT ST. LOUIS FAIR

lofty curve, which supplies a background for the architectural features.

The statuary will be placed in front and at the base of the main piers at the sides of the grand openings. This affords sixteen groups, which will illustrate Transportation in all its phases as well as the progress made by the United States in this science. There will also be four groups of statuary surrounding the four pylons, placed at the east and west fronts. The architect has subdued the use of sculpture in the building, depending on mass effects and on the grouping of masses; that is, on architecture rather than on tawdry decorations. The entire width of the building is spanned by five well designed uniform trusses. Special endeavor has been made to afford plenty of illumination by day without the use of skylights. Light will be introduced through the monitor windows over each span of the five trusses.

The building will contain about four miles of standard gage railroad track. Even with this immense trackage two entire bents of the building are left free of rails, to afford an exhibit space of 270,000 sq. ft.

Shifting Elevated Tracks at Chicago

The Metropolitan West Side Elevated Railway Company, of Chicago, has recently extended its Garfield Park branch from Forty-Eighth Avenue to Fifty-Second Avenue. The structure for that distance is an incline, landing passengers at a station on the surface at Fifty-Second Avenue, where a transfer depot and terminals have been built for connection with the Aurora, Elgin & Chicago Railway, which terminates at that point.

The incline structure proper is about 1200 ft. long from Forty-Eighth Avenue to Fiftieth Avenue. When the structure was first built the company could not buy a certain piece of property which was directly in a straight line between the present Forty-Eighth Avenue terminus and the future terminal at Fifty-Second Avenue. As the Aurora, Elgin & Chicago Railway was nearing completion, the structure was built around the property which was obstructing the right of way, but this was done with a view to straightening the road as soon as the property could be condemned.

Before the incline was ready for operation the property was secured, and the accompanying engraving shows the work of moving the structure in progress. One straight section, 1000 ft. long, is being moved in one piece. At the ends where there were curves, of course, short sections had to be detached and moved independently. The method of procedure can be seen from the views herewith. The columns are jacked up and slid along on T-rails supported on false work. A Chicago house-moving company has the contract for the moving, as the methods used and tools required are similar to those used in moving large houses. Of course, structural ironworkers are needed for disconnecting and joining the structure at the ends. The work was pushed night and day, and clusters of incandescent lamps on stakes, together with the necessary wires, formed a fence around. W. S. Menden, chief engineer of the Metropolitan West Side Elevated Railway, supervised the undertaking.

METHOD OF MOVING STRUCTURE

GENERAL VIEW OF ELEVATED STRUCTURE

At the lower end of the incline structure the tracks enter a fenced-in terminal yard in which will be not only the transfer and terminal depot but shops and storage tracks for the Garfield Park division of the road.

METHOD OF MOVING STRUCTURE

Decorative Effects at Manchester

Many of the tramway companies of Great Britain and the city corporations which operate electric railways made elaborate arrangements for utilizing their trolley systems in the celebrations which were to be held throughout England, June 26 and 27, at the time of the coronation of the King. Owing to the unfortunate and unexpected illness of Edward VII., the festivities throughout the kingdom were partially abandoned, but the news in regard to His Majesty's condition, on June 26, was so favorable that, at the express desire of the royal patient, many of the more quiet evidences of loyalty which his subjects had arranged were carried out according to the programme.

Although the advent of the trolley into Great Britain on a considerable scale is of comparatively recent date, the possibilities in the way of decorative effects were utilized on some of the systems, and some very tasteful displays were produced. Through the courtesy of J. H. F. Bale, resident tramways engineer of the Manchester Corporation, views of two of the features prepared by that company for the coronation celebrations are presented herewith. The first one of these is a handsome, double-deck car carrying 600 lamps. These were green, white and red in color, and arranged to show a coronet and spell "Long live the King." The top seats were left for a brass band, so that the car could make a tour of the principal streets.

The second illustration shows an attractive illuminated sign in the form of a trolley car of full size, which was hung on the front of the company's offices on Piccadilly. The sign contained 400 lamps. This method of decorating which, as far as is known, is original with Mr. Bale, was most effective and attracted wide attention.

ILLUMINATED CAR, MANCHESTER

OUTLINE OF CAR FOR DECORATIVE EFFECT

It is interesting to note, in this connection, that illuminated trolley cars were also prepared by the Liverpool Corporation Tramways, the Glasgow Corporation Tramways, and others, and evoked a great deal of admiration in their trips through these several cities.

The Convention of the International Tramway Union—II

In the last issue of this paper a report was published of the proceedings of the above association during the first two days of its convention in London last month. A report of the proceedings during the two final days follows:

THURSDAY, JULY 3

Mr. John Young, general manager of the Glasgow Corporation Tramways, was invited to preside at the meeting on July 3, and accepted. The chairman, who was well received, in a short opening address, said he had a very high honor that morning that he did not expect. He had been asked to take the chair for a few minutes before going to another meeting, and he did so with great pleasure. He had been asked to address a few words to the delegates, and as a tramway man he was, like every other tramway man, glad to welcome any gentleman to London or to this country who was either willing to give or to receive information on tramway matters. He was specially delighted, as a tramway man from Glasgow, which was a remote place in the northern part of this island, to be present, and to welcome tramway men from all parts of Europe. He had had the pleasure of being present at the congress in Paris two years ago, and of reading the papers which had been submitted there, from which he had derived a great deal of information, and he was glad that Englishmen were now able to reciprocate the many kindnesses that they had received from their friends on the other side of the channel. He desired to assure them of the hearty welcome that the congress received in this country from all tramway men. (Cheers.)

Mr. Poetz, engineer-in-chief of the Strassen-Eisenbahn Gesellschaft, of Hamburg, then read a paper on "Tramway Brakes," which will be published in an early issue. Mr. Poetz added to the information contained in his paper some figures with respect to a number of tests which had been made on the Continent with various types of brakes. The tests showed that when running at 14 km per hour the Helios electro magnetic brake pulled up in 15.5 m, and four other brakes in a distance of 9 m. At 20 km the results were as follows:

Siemens & Halske electromagnetic brake, 13 m; Schuckert, 15 m; Standard air brake, 16 m; Carpenter air brake, 16.7 m, and the Helios electric magnetic brake, 21 m.

In 28 km the results were: Siemens & Halske, 17.8 m; Schuckert, 24.5 m; Standard air brake, 23.6 m; Carpenter, 24.2 m, and Helios, 27.2 m.

In 32 km the results were: Siemens & Halske, 27.2 m; Schuckert, 43 m; Standard air brake, 38.8 m; Carpenter, 35.8 m, and Helios, 43.5 m. The conclusions he had arrived at were that electric brakes were more simple, and did not need so much attention, but the two systems were equally effective for ordinary work.

Mr. Thonet, in opening the discussion, said he could practically confirm the conclusions which had been arrived at by Mr. Poetz in his paper. There were two figures he would like to give the congress. The first was that the cost of the installation of the air brake at Marseilles was 2000 francs per motor and trailer, as against 600 francs for the electric. The results of the trial of speed—all at a speed of 20 km per hour—were in meters.

For one car, 14.0 for the air brake.
For one car, 12.5 for the General Electric brake.
For one car, 11.6 for the Thomson-Houston brake.
For one car and one trailer, 18.1 for the air brake.
For one car and one trailer, 15.6 for the General Electric brake.
For one car and one trailer, 11.7 for the Thomson-Houston brake.
For one car and two trailers, 20.7 for the air brake.
For one car and two trailers, 19.4 for the General Electric brake.
For one car and two trailers, 14.7 for the Thomson-Houston brake.

Mr. Gustave Koehler said he had the two systems running at Berlin. He did not agree with the conclusions come to by the author as to the superiority of the magnetic brake. His company started in Berlin with the electric brake, but they had now gone back to the air brake. Security was the great thing to be considered, and they found that they could obtain much greater security with the air brake than they could with the electric. The air brake had the advantage of being always ready for use; the conductor could always tell whether he had the power right by simply looking in his gage. That could not be done with the electric brake, and in many cases of accident they had not been able to fix the responsibility upon the conductor because his electric brake had not acted. He did not agree with the author as to the cost. He thought it was a good deal higher than that. The magnetic brake caused dirt to collect on the apparatus, and thus a bigger expense was caused for cleaning. The electric brake was nothing like so smooth in its working as the air, and it caused a good deal more shock in pulling up the cars. As far as expense was concerned, he went over the figures given by Mr. Poetz in his paper, and said that the cost of the electric brake for the car itself was 625 marks, for the trailer 425 marks, in all 1050 marks; for the air brake, for the car 1000 marks, for the trailer 200 marks, making 1200; that was to say 1200 for the air, as against 1050 for the electric. As regarded repairs, he found that the electric came out at 170 marks, as against 127 marks for the air; a net saving, roughly, of about 40 marks per car. Therefore, he could not agree that they should give a preference to the electric brake—on the contrary, he was decidedly of opinion that they should give the preference to air. However, he did not think that the question was sufficiently far advanced for the congress to be able to vote categorically on the question, and he therefore proposed that the subject be deferred and brought up at the next congress.

Mr. Poetz remarked that he could not agree with the objections raised by Mr. Koehler, for the reason that the Sperry (electric) brake was adopted by the Berlin Company five years ago, and that since that time very considerable improvements had been made in electric brakes, and the brake they were now using in Hamburg was a decided step in advance of the brake that was being used in Berlin. The higher cost which Mr. Koehler had attributed to the electric brake was due to the fact that instead of adopting the ordinary magnetic brake, they had adopted one which was more expensive in its installation.

Mr. Peiser said it was a very important thing in case of accidents for the conductor to be able to stop his wheels absolutely, and a good deal of the information they had had put before them was wanting in completeness. For one thing, they had no statistics or data of the actual power that was exercised by the shoe on the rim of the wheel.

Mr. d'Hoop said what they wanted to get, if possible, was such a brake that if the trailer parted from the motor car going up an incline, the brake should be able to pull up the trailer automatically.

Mr. Poetz observed that neither the brake used in Hamburg nor the Standard air brake would do that, and he did not think the point was of much importance.

Mr. Peiser asked what the improvements were which had been introduced since the Berlin tramways chose their brake five years ago, and which rendered the brake used in Hamburg superior to that used in Berlin.

Mr. Von Leber, speaking on behalf of the Austrian Government and not on behalf of the company interested, said that in Vienna they had tried a large number of different systems, including the Sperry brake. He agreed more with the conclusions arrived at by Mr. Poetz than with Mr. Koehler, and the experience they had gained in Vienna did not corroborate the experience gained in Berlin. In Vienna they were going in for the use of the electric brake, and not for the Sperry brake.

After further discussion it was agreed that the matter should again come up for consideration at a future congress.

Mr. de Burlet then read a paper on "Gages for Light Railways."

Mr. de Burlet's paper was devoted to light railways in general, for which he recommended a narrow gage, although he acknowledged that most of the companies in the Union using electric power recommended a standard gage. His argument was based on the much lower cost of construction, and he gave the following tables of costs for different characters of country:

COST OF CONSTRUCTION PER KM.

Nature of the Ground	Gage of the Lines: 1 m 450	Gage of the Lines: 1 m 00
Plain	Fr. 37,500 à 62,500	Fr. 25,000 à 40,000
Slight undulation	" 57,250 à 87,500	" 37,500 à 62,500
Strong undulation	" 75,000 à 112,500	" 57,250 à 75,000
Slightly broken	" 100,000 à 150,000	" 62,500 à 87,500
Much broken	" 137,000 à 175,000	" 75,000 à 112,500
Slightly mountainous	" 162,500 à 200,000	" 100,000 à 137,500
Very mountainous	" 187,500 à 250,000	" 125,000 à 175,000

COST OF OPERATION

	Standard Gage		Narrow Gage	
	Per km	Per Train km	Per km	Per Train km
	Francs	Francs	Francs	Francs
Maintenance and renewal of the rolling stock and cost of traction	2,475	0.49	1,975	0.39
Maintenance, renewal and inspection of the track	1,725	0.34	1,475	0.29

Mr. Leslie S. Robertson said this was a subject to which he had given considerable attention, and he had had the opportunity

on various occasions of visiting nearly all the light railways on the Continent and elsewhere, and although he knew that in this country engineers looked with certain distrust and certain disfavor on anything less than 4 ft. 8½ ins., yet he thought that there was a considerable amount of prejudice which had grown up, due to the question not having been studied with an open mind. No English engineer, he thought, would put down a 2-ft. 6-in gage, or a 2-ft. gage, where he could possibly put down a 4-ft. 8½-in. gage, but there were cases where they could not get the money for a 4-ft. 8½-in. gage, and it was a question of a district going without railway facilities for a considerable number of years, and the whole of the property would not rise in value as it would if they put down a line which would pay on a small scale. He thought the talk of people about the inconvenience of transshipment was a good deal exaggerated. It certainly cost 1d. a ton, or a little more, but after all was said and done, the disadvantage of having to transfer goods from a small car to a bigger car was a bugbear, which was made too

Mr. de Burlet said he wished to lay stress upon the fact that he was not discussing electrical tramways there. It was clearly a question of light railways, and they could not argue from one to another. The figures which had been given were not estimates, but were actual figures presented to the general meeting of their society last year, and they were absolutely correct. The figures given for Saxony were by Mr. Ziffer, and those for India were taken from the government statistics, and in England they would all admit that there were no more reliable figures than those relating to the Indian railways. Mr. Schendweiler had said that they were using curves of a very small radius. If they once got to standard gages, and enabled the railway stock of big companies to run over it, they would at once impose their own conditions. The question of transshipment was, he thought, made more of than it need be. They started with 25 centimes—about 2½d.—per ton, and they had now got it down to 1d. Of course, there was a little question of time, but he did not think that was of much importance.

GROUP OF DELEGATES AT EXHIBIT HALL, MR. JANSSEN, PRESIDENT OF THE INTERNATIONAL TRAMWAY UNION, IN THE CENTER

much of when it was a question of either making a railway or not. It was better to have railways with transshipment than to have no railways at all. (Hear, hear.) What could be done by a small gage had been wonderfully shown in South Africa. The standard gage there was 3 ft. 6 ins., but the whole of the war material, and the whole of the troops had been carried, and all the rest of the work done by the Cape Government Railways on a 3-ft. 6-in. gage. No doubt they would like in South Africa to have a 4-ft. 8½-in. gage if they could, but they had not the money. Then they could also take the military lines in North India, which were on a 2-ft. 6-in. gage, and they knew what a great deal could be done by that. But, as Mr. Burlet rightly remarked, each case must be considered separately, on its own merits, and they could not lay down any hard or fast rule in every case.

Mr. Janssen remarked that he would very much like to have the question considered from the point of view of the future, and as to what was to come when these two systems of broad and and narrow gage were fused under one management. He would very much like to have the opinion of the learned author of the paper on that point.

They found that the secondary lines which they had put down were working very satisfactorily as feeders to their main lines.

The congress adjourned until 9.30 Friday morning.

In the afternon a number of the delegates, through the courtesy of Lieut.-Colonel Crompton, paid a visit to the Crompton Electrical Works at Chelmsford. Later in the afternoon the train was taken to the Crystal Palace, where a dinner was served in one of the dining-rooms connected with that building. The dinner was entirely informal, and at the close, after a short speech by Vice-President Röhl, toasting the absent president, the party adjourned to a balcony, which had been reserved, and from which a handsome display of fireworks was observed.

FRIDAY, JULY 4

The sessions of the union opened at 9.30 a. m. with President Janssen in the chair. The first business transacted was the presentation of a paper on the "Carriage of Luggage, Goods, and Mails," by Mr. G. Marsal, manager of the Biella Light Railways. It indicated that very little was done in this direction by European companies. There was no discussion.

Mr. Peiser, chief engineer of the Grosse Berliner Strassenbahn

then read a paper on the heating of cars. According to Mr. Peiser, electric heaters were in use in Berlin, Hanover, Aachen, Christiana and Zurich.

An important report was then presented by Mr. Leon Janssen, managing director of the Brussels Tramways, and Mr. Geron, director of the Cologne Tramway Company, on the subject of a uniform system of accounting. The system differs considerably from that in use in America. It divides the expenses into nine "primary" accounts, viz.: 1. Management. 2. Operation. 3. Traction. 4. Electric conduits. 5. Rolling stock. 6. Tracks. 7. Buildings. 8. General expenses. 9. Sundries. Each of these is, in turn, divided into ten secondary accounts. For example, No. 1 (management) would be divided into the following secondary accounts (1):

10. Salary and emoluments of manager.
11. Salaries of the manager's staff.
12. Different expenses of the manager's staff.
13. Expenses for supplies.
14. Expenses for post, telegraph, telephone, etc.
15. Heating, lighting, cleaning.
16. Maintenance of fittings.
17. Assignable according to requirements.
18. Id. id.
19. Sundries.

In the same way primary account 2, *operation*, would be subdivided into the following ten secondary accounts:

20. Salary and emoluments of the operating manager and his office staff.
21. Salaries of the staff of the stations.
22. Salaries of inspectors, conductors and wattmen.
23. Equipment of the traffic employees in uniforms, etc.
24. Office expenses, office supplies as far as they relate to traffic.
25. Expenses for the traffic staff.
26. Heating, lighting and cleaning of the traffic offices.
27. Assignable according to requirements.
28. " " "
29. " " "

Mr. Janssen, after a few introductory remarks, proposed they should accept the principle of the scheme for electric tramways, and that the secretary and five members be appointed to form a committee to report on the details, so that they might lay a scheme before the union at a subsequent meeting.

Mr. Grialou, of Lyons, pointed out the difficulty of comparing car miles, as in some places the cars carried 100 passengers, while in other places they only carried twenty-six; therefore he considered that the report should be clearly indicated what was meant by a car.

Mr. Geron, in reply, said that by his scheme everything could be sub-divided. There was an elasticity in the scheme which enabled everything to be mentioned somewhere or other, either in the primary, secondary, or other sub-divisions. He believed it would not be a difficult point to settle what was to appear in the different accounts.

It was agreed that the committee, as suggested, be appointed.

Mr. P. V. McMahon, chief engineer of the City & South London Railway, read a paper on underground tube railways, which is published in another column.

Mr. Boulvin, of Brussels, asked for some information as to the coal consumption on the Central London Railway.

Mr. McMahon replied that he had not been able to get this information, but would endeavor to procure it.

A vote of thanks was accorded the reader of the paper on the proposition of the chairman.

Mr. Röhl said he had been asked to report whether anything new had been discovered or found out in reference to accumulators since the last meeting. There was something new, and that was that at the last meeting one gentleman who was interested in the Hanover Tramways, and who manifested a paternal liking for the accumulator system, and spoke in its favor, had now found out, in the course of time, that accumulators were absolutely ruinous, and that they had brought his enterprise to the brink of ruin. The system was too dear, and was absolutely unreliable. It had been found that the idea that the cost of the accumulator could be partly covered by the sale of the old lead was altogether erroneous, and that the lead did not bring in sufficient money to in any way lessen the cost. Accumulators were being given up everywhere, and, although in Hanover the authorities insisted upon having them, they had now been given up even there, and at Hagen, the birthplace of accumulators, they had been given up. It had been thought that in the case of automobiles accumulators would render them independent and reliable at all times, but in the case of snow with great unanimity automobiles stopped running altogether. He thought that the question might now be considered to be buried, although the process of burying it had cost an enormous amount of money.

Mr. Thonet said he could confirm everything Mr. Röhl had said as to the inefficiency of accumulators, and a striking illustration was to be had in the case of the Dunkirk Tramways. Those tramways were worked for nineteen years by horse traction, and paid a very fair dividend. Then the accumulators were put in, and immediately what used to be a paying concern became a losing one. Horse traction cost 86,000 francs per annum, and the accumulator system cost just about double. It was found that the batteries only lasted about five months; they got about twelve stoppages a day with the cars; in fact, the whole traffic was so disorganized that the authorities had to interfere. Having spoken of the enormous waste in batteries, and the large expense incurred, Mr. Thonet said that in nine months the cost of running eleven motor cars was 158,000 francs, and even then they had to be helped out with horses occasionally. The authorities had since insisted upon the substitution of the overhead trolley system, and had extended the concession twenty-five years in consideration of the difficulties and the expense to which the company was subjected by the accumulator system.

Mr. Koehler said that the future of the accumulator system in Germany was sealed and done for. Even in Berlin, where the authorities had first insisted upon the accumulator system, they had now turned completely round, and had insisted upon their use being discontinued. There were still two or three carriages run on the accumulator system, but they would be put out of work in a short time. The experience in accumulators, which had luckily been very short, had cost four million marks. Fortunately, owing to the shortness of the time the batteries were in use, they had not absolutely ruined anybody, although they had gone very near to doing so.

Mr. Boulvin said that at the congress in 1900 he mentioned that he had not much opinion of accumulators, and it was stated then that probably they would be so much improved as to be of practical use. At the time he said that, in his opinion, horse traction was better than traction by accumulators, but it was then considered that he made a joke. The experience, however, of the last two years confirmed the opinion he then held, in spite of the improvements which had been brought to bear. Facts had been brought to his notice which confirmed that opinion. For instance, the battery was supposed to be sufficient to take the car for 36 km, but as a matter of fact it only lasted for seventeen, and as the daily run of a car was 123 km, it followed that they had to be recharged five or six times a day. The coal consumption and maintenance of the cars, and generally the working expenses, came about the same as had been stated, viz., twice as much in the case of accumulators as in the case of the overhead trolley.

Mr. Lavalard said he had had experience of accumulators in Paris, and could confirm the opinions of the previous speakers as to their unfitness. In Paris they had to be used because the authorities objected to overhead wires. He would submit figures and other details in support of his views, which would appear in the minutes of the congress' proceedings.

Mr. Max Von Leber confirmed what had been stated by previous speakers, as regarded the accumulator system of Austria, where, indeed, it had been buried. As, however, persons were still endeavoring to push accumulators forward, the congress should pass a resolution to the effect that, having heard the previous writers and speakers on the subject, they unanimously confirmed the opinion that accumulators were costly, uncertain in their working, and were not to be recommended in any way.

Mr. Grialou questioned whether Mr. Von Leber's resolution was strong enough. He thought the congress ought to state plainly, in the interests of people who were thinking of establishing tramway lines, that the accumulator system was not only costly and uncertain, but was absolutely impracticable.

After some further discussion the following resolution was agreed to: "That the congress, having heard all the speakers on the subject of the accumulator system, affirm that this system is not to be recommended, either on account of its costliness or on account of its uncertainty, for any regular system of traction."

The president then delivered a speech, closing the congress, which was afterwards translated by Mr. Scotter. He said that the discussions at that, which was the twelfth international congress, had been very interesting, and especially had that been the case on many minute matters of importance. There had been several new elements introduced into the discussions which he hoped would be very useful to all engaged in the tramway industry. Their annual reunions were becoming year by year of more importance. They were becoming more and more the occasion for discussing all points in connection with the exploitation of tramways upon which they required enlightenment, and many

points of importance had been put before them which constituted the beginnings of what might be great reforms. The congress had been distinguished by many important features. There were representatives present of many different nationalities, and the spirit of confraternity and union had found its way into all their deliberations. The delegates had applied themselves with great zeal to obtain those fruitful results which he felt sure would follow from the papers and the discussion. He hoped that the papers would be carefully read, and that members would return answers to the various questions, for the benefit of the coming general assembly. Any new points which any member might consider of sufficient importance, he invited them to send up, in order that they might be embodied in next year's programme. In the course of their visit to London they had received a most hearty reception, the cordiality and charm of which he was sure was appreciated by all the foreign delegates. He wished especially to thank the Tramways and Light Railways Association, of which Sir Charles Rivers Wilson was the honorable president, and also the proprietors of the "Tramway and Railway World." The reception committee deserved their gratitude, and especially would he desire to mention Mr. Scotter, the chairman, and Mr. Benedict, the secretary, for the work they had done. The arranging of excursions must have entailed a vast deal of labor upon those gentlemen and the committee, seeing the crowded state of London at the present time, and they had to thank them very heartily for the activity and zeal they had displayed in the matter. He thanked them in the name of the union with all cordiality. The congress also thanked the speakers who had taken such great trouble to prepare the replies to questions, and had done so much for the elucidation of many other points. The congress thanked the Mayor of Islington, the Tramways and Light Railways Association, the reception committee, Mr. Gerald Balfour, the Society of Mechanical Engineers, Mr. Cunningham and Mr. Graham (of the Central London Railway), Mr. Shenck (of the Crystal Palace), Mr. and Mrs. Swinburne, the Institute of Electrical Engineers, and the president of the Institute of Civil Engineers and Mrs. Hawkesley. The courtesy the members had received would be remembered by all of them. It was a very great pleasure, especially to see the delegates from foreign governments represented at the congress, and he hoped that all who were present would carry away with them the feeling that they had done some very excellent work. Finally the president thanked the members for the great attention they had paid to the congress, and the kindness they had extended to him personally.

Professor Luigi Rava, of Italy, briefly thanked the president and the congress generally for the kind words which had been used, especially in reference to the presence of delegates from foreign governments.

Mr. Schendweiler humorously referred to the difficulties in conducting a congress in which three languages had to be used, and said he felt those difficulties were likely to increase as the scope of the union increased, and they looked forward to it reaching as far as China. However, so ably had the translation been made that he believed the difficulties would not be insurmountable. In conclusion he called for three cheers for the president, which were heartily given.

The union then adjourned for the banquet in the evening.

The banquet, which was extended to the members of the union by the Tramways and Light Railways Association, was held at De Keyser's Royal Hotel and was very largely attended. The Right Hon. James Bryce, M. P., presided, and among others present, besides the foreign members of the union, were Lord Vaux, of Harronden; T. P. O'Connor, M. P.; J. Atherly Jones, M. P., and Alexander Siemens. Speeches were made by Messrs. Bryce, Janssen, Swinburne, Scotter, Perouse, Jones, Röhl and others. Mr. Ziffer and Mr. Von Leber presented an invitation to the association to meet in Vienna in 1904, a suggestion which was heartily applauded. The association, it is understood, has also received an invitation from the Brussels Tramways Company to hold its next meeting in that city, and the selection will be made by the executive committee.

Mr. Bryce in proposing "The Union Internationale Permanente de Tramways and the Electrical Traction Industry," said the delegates had just held the first of those international congresses connected with tramways and light railways which had met in England. He was glad to know that they had had a successful meeting. They had despatched their business with a rapidity not encumbered by any of that obstructive legislation which had checked the pace of tramways in this country. They had effected several permanent gains. They had helped in the direction of securing standardization, and they had undertaken to procure for the Board of Trade a statement as to the laws in force in regard to the electrical industry in foreign countries. We in England had been a little behind most of our Continental friends in this matter. In 1894, when he first saw light railways in an Alpine district, and subsequently in North Italy, he was struck by the fact that in England we had remained apparently blind, if not indifferent, as to what might be done by this means in country districts. In 1895, the government of which he was a member took steps, which had since been followed up, to develop the light railway interests, which had now undergone considerable expansion, but we were still behind Western and Northern Europe. He hoped the effect of their meeting would be to accelerate the progress which that industry had begun to make in England. When he saw what other countries had done, he was astonished that a land so populous as his own, and one that had suffered so much from agricultural depression, had not been more active in establishing easy and cheap communication. When he thought of what was effected in cheapening the transit of goods from the rural districts to the towns, and in affording facilities to the urban populations to live in the country, it seemed to him that they were doing one of the most important works that could be done at the present day.

Although the official proceedings of the union closed on Friday evening, a number of the delegates remained in England several days to visit the more important points of interest, and several accepted the invitations cordially given by W. M. Murphy, chairman of the Dublin United Tramways, to visit that city, and from the Lorain Steel Company to inspect the surface contact system installed by that company in Wolverhampton. Among those who took the Dublin excursion were Messrs. Lavalard and Coste, of Paris, Grialou, of Lyons, and Ziffer, of Vienna.

Tube Railways in London*

BY P. V. McMAHON,

Chief Engineer City & South London Railway

In 1884 when, after considerable opposition, the City of London and Southwark Subway got an Act of Parliament authorizing the construction of two tunnels from King William Street to the Elephant and Castle, the most sanguine had not even then dreamed of what was to follow, as shown by the number of tube railways (as they are now called) before Parliament this session. In 1887 another Act was obtained sanctioning an extension to Stockwell, and in 1890 the Act authorizing the extension to Clapham was passed, and the name of the undertaking changed to the City & South London Railway. The opening ceremony was performed by His Majesty, the King (then Prince of Wales) in November, 1890, and opened for public traffic on December 18, following.

About the time of the opening, the railway was looked upon, not only by English and Continental engineers, but by Americans, as a fine piece of engineering; the public, too, were loud in the applause for a while. The line, however, went on quietly carrying its 7,000,000 passengers per annum, and its existence was forgotten, except by its passengers, until the opening of the Central London Railway, when the pioneer line seems to have been rediscovered. It is true that the original line, although fulfilling in every way its functions as a railway and supplying a long-felt want, was not at first what could be called a huge financial success as a dividend-paying concern. Nevertheless, it paid a dividend from the start, and improved upon it every year, but the investing public preferred to speculate in other directions, and gave very little encouragement to the Waterloo and City Railway or the Central London Railway; in fact, it can safely be said that if the construction of these lines depended upon the investing public they would not now exist. The success of the Central London Railway, running through what is undoubtedly the finest route in the world, seems to have awakened the investing public to the fact that neither it nor its two predecessors were altogether philanthropic schemes. This, coupled with the fact that our enterprising American cousins came over to get a look in and have succeeded, seems to have roused up a sort of mania for tube railways, which, judging from the number of schemes before Parliament, are promoted upon the smallest provocation.

Looked at from the utilitarian standpoint, it appears that the tube railway is the only solution of the rapid transit problem in the interior of large cities. And it is only in large cities, where there is good traffic, that it is possible to make a tube railway pay, on account of the very expensive construction.

The question of a speed limit does not apply as in the case of a surface tram, as much higher speeds can be run in the tube, the limit being the cost, as high speeds on short runs are only obtained by rapid acceleration, and it will be shown later that very rapid acceleration will not pay unless one is forced to adopt

* Paper read at the meeting of the International Tramways Union, London, July 4, 1902.

it through competition. The question of safety must not, however, be overlooked in recommending very high speeds, on account of the short sections with intermediate signals, and it would appear that this point was not fully considered by some engineers who lately suggested speeds for tunnel work far in excess of anything we have at present.

Comparing the tube railway with the shallow tunnel tramway, it appears to the author that the deep-level tube line has the balance of advantages in its favor. Unless the shallow tunnel is made in a new street, the extra cost involved in diverting sewers, gas and water pipes, electric-light cables, etc., will bring the total cost per mile as high as the tube line. Again, if trams with top-seats are to be used, or the surface trams run below to avoid the passenger changing from one vehicle to another, the tunnel must be considerably larger and more costly than the tube. If a passenger has to change he might as well be taken down 50 ft. or 60 ft. in a lift and up again at the other end as walk down 20 ft. and up again. Experience has shown that the tube lines are free from fog, and it is questionable if this state of things would obtain in a shallow tunnel system.

The question as to whether separate locomotives or motor cars are more suitable for tube lines is, it appears, one which will have to be settled by experience, as opinions at present differ widely on the subject. Eleven years' experience on the City and South London Railway has shown that separate locomotives have many advantages; in fact, it may be mentioned that a motor car train was actually constructed and run in traffic about seven years ago, but was abandoned in favor of separate locomotives. This train certainly gave greater seating capacity for the same total weight, and, consequently, the coal consumed per passenger carried was slightly less than with separate locomotives. It was found, however, that a certain amount of time was lost unnecessarily at the terminal stations, due to the driver and assistant having to change positions from one end of the train to the other. With a crowded platform the time lost was increased. Thus, when the signal was given for the train to start, the driver was invariably not ready to start, and with a two and a half or three minutes' service a quarter minute lost in this manner was appreciably felt. An electrical failure, however small, may put the whole train out of running, but with a locomotive the same failure does not so seriously interfere with traffic arrangements. For the same reason, more spare carriages are required than with separate locomotives. Another objection to motor car trains is the siding accommodation. When the ordinary daily examination and overhauls have to be executed in the tunnel the sidings must be constructed of a larger diameter tunnel, on account of continuous inspection and repair pits in the case of motor car trains. With separate locomotives these pits are shorter and more getatable.

With traffic conditions such as obtain in London or any other large city—i. e., a couple of hours' very heavy traffic in the morning and again in the evening, with light or fairly light traffic during the remainder of the day—the matter of running trains lightly loaded deserves serious consideration, but has not yet been satisfactorily solved, so far as tube lines, pure and simple, are concerned.

On the City & South London line, after experimenting with motor car trains, two-coach trains were run during the period of light load and three-coach trains for the heavy morning and evening traffic. A short experience proved that the extra shunting involved with the two different sets of trains consumed quite as much coal as the heavier trains running all day. This state of affairs, of course, only applies to a line with sidings under ground and in a continuous line. If the train could easily be run to the surface and stabled as in ordinary fantail sidings, the expense and interruption to working would not be nearly so great, and this is borne out by experience of working on the Waterloo & City Railway. At the Waterloo end of the line the trains run out into an open yard with sidings branching out in the ordinary manner. Single motor car trains, weighing twenty-six tons average, are run from 11:30 a. m. to 4 p. m., and again between 7:30 p. m. and 10 p. m. At other times the four-coach motor trains, weighing 100 tons, are run, commencing at 7:30 a. m. The multiple unit system should afford a complete solution of this problem; but from the foregoing remarks it is apparent that to be quite satisfactory the grouping of cars, etc., must be performed in the open.

Having dealt with what appears to be the general condition met with in tube railways, a brief description of the three existing tubes and a few results of working may prove interesting. The City & South London Railway with its extension is now about 6¼ miles long, and runs from Clapham Common through the city to the Angel at Islington, with thirteen stations, the average distance between stations being about 850 yds. The generating station is situated at Stockwell, about one mile from the south end of the line. Originally the line to King William Street was worked on the ordinary two-wire system at 500 volts, but with the extension north the two-wire system at 500 volts was no longer available, and the method of distribution was changed to the three-wire system with 1000 volts across the outers, the running rail forming the middle wire. There are two sub-stations, one at London Bridge, 2¾ miles from Stockwell, and the other at the Angel, 5¼ miles from the generating station. These sub-stations are fed from Stockwell on practically a five-wire system, i. e., 2000 volts across the outers. A particular feature of the system is, that although distribution is effected at 2000 volts, the maximum voltage across any one commutator is 500 volts and only half of the electrical energy sent to the sub-stations is transformed, and thus a high efficiency is maintained.

One or two novel points had to be settled before installing the system. In the first place, there had been the problem of getting from the negative to the positive side, and several automatic devices had been considered, but the way out of the difficnlty had finally resolved itself into a simple break of 30 ft. in the working

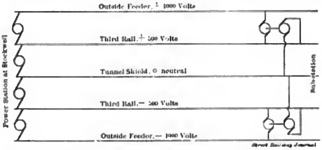


FIG. 1.—DIAGRAM OF DISTRIBUTION SYSTEM, CITY & SOUTH LONDON RAILWAY

conductor at the crossings. That had given rather a flickering light in the train, but the break had been reduced afterward to 15 ft. by putting conductors in the middle and a fuse between, so that if, by any chance, two locomotives were crossing and caused a short circuit, the middle piece would become disconnected from the main conductor. Another question decided had been whether two machines should be used at 500 volts, one on each side of the system, or 1000-volt machines across the outers, with smaller machines for balancing. Many things had pointed to the use of generators working at 1000 volts, but one point that had seemed to be very important was that a bad short circuit, such as might be caused by a car running off the road and directly connecting the third-rail to the ordinary running rail, might raise the pressure to 1000 volts between the running rail and the working conductor. The circuit-breaker would probably work, but in the meantime the pressure might be raised on the motor and lamps, and a lot of the lamps would be blown out by the temporary rise in voltage.

Reference was made above to the sub-station efficiency, and it may be mentioned that the continuous-current, high-tension reducers have an efficiency of 90 per cent at quarter load, 94 per cent at half load, 96 per cent at full load, and about 96 per cent at 50 per cent overload. This high efficiency is especially noticeable at the sub-station at the Angel, where the high tension reducer system with reversible boosters in connection with a large battery was in use; a very high efficiency, indeed, was obtained, because the high-tension feeders supplying the sub-station at 1000 volts had an almost steady load all day long of between 75 amp. and 80 amp., while the current going from the sub-station bus-bars to the line varied between zero and 450 amps. If a system of that sort were applied all over, the size of the units in the generating station and the size of feeders could be reduced for the same number of trains. At London Bridge sub-station there was a battery almost as large, but it had failed to take the peaks with the ordinary boosters, and was not much good as a regulator; in fact, it would do very little work at all, unless additional cells were switched in and the battery was allowed to discharge on the whole. It was used in case of a heavy load, and the cells had to be switched in to make a discharge.

The lift and lighting circuits were fed from the same bus-bars, but in the case of a heavy short circuit on the working conductor an automatic cut-out operated, and threw the lifts and lights onto the battery, thus maintaining the station lighting and lifts supply in case of the working conductor blowing its fuses.

Comparing the continuous-current three-wire system used on the City & South London Railway with the three-phase system, it would be seen at once that a good deal less needed to be spent

in copper, on account of the steady load on the feeders. There was very little difference in the rail drop between 5¼ miles and about three miles, and it would seem that the limits for the three-wire system had not, by any means, been reached. Previous to the installation of the system it had been thought there might be some difficulty in the balancing, but none had occurred. Ordinary balancers were installed at Clapham Common, Moorgate Street and the Elephant and Castle, and it was found that the continuous-current reducers acted so well as balancers that only one of the balancers needed to be used. The ammeters in the reducer motor armature circuit at the sub-station showed that the current was fairly steady, while the generator armature currents were varying from zero to the maximum, showing that they were acting as balancers as well as reducers.

The present City & South London train consists of four bogie carriages, having a total seating capacity of 128 passengers. The empty train weighs 28.16 tons, and 36.16 tons fully loaded.

The locomotives are each fitted with two gearless motors, one of which is capable of doing the work in case of the other getting temporarily disabled. The locomotive weighs complete 13.65 tons. Thus, the locomotive and fully loaded train weighs 49.8 tons. The maximum number of trains running at one time is twenty-five, giving a service slightly under three minutes between trains in busy traffic. This service is reduced to about eighteen trains during the periods of light load. The average speed, including stops, is 14.4 miles per hour, and, excluding stops at stations, 16.75 miles per hour.

The kw-hours per ton mile at the above speed measured on board the locomotive are 0.0552. At the generating station switchboard the unit per ton mile for the past half year was .068. This figure includes shunting, sub-station and cable losses, which are not, of course, included in the measurement on board

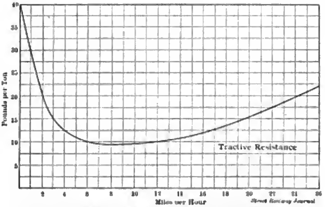


FIG. 2.—DIAGRAM SHOWING TRACTIVE RESISTANCE, CITY & SOUTH LONDON RAILWAY

the locomotive. For the same period the number of train miles run were 650,000, and the passengers carried, about 9,000,000. The coal per unit generated was 3.9 lbs., which includes all boiler house losses getting steam and banking fires. This result was obtained with North Country and Midland small coal. With a coal of a slightly higher calorific value, during a month of this period, the coal per unit (kw-hour) was 3.28 lbs., including all boiler-house losses.

Expressing this result as in steam railway practice, we get a coal consumption of about three ounces per ton mile, which compares favorably with main line practice, when one considers that published steam locomotive tests are specially taken and over a short period only. Also the traction resistance in tunnels, as shown by exhaustive tests on the South London line, is about double that which obtains on main lines, and short sections, which means that the train is being accelerated for about half the total running time. The output in Board of Trade units per half year is 3,781,000. The tractive resistance per ton in the City & South London Railway is given in Fig. 2.

While on the question of speed it may be well to discuss the matter of very rapid acceleration, which is receiving a lot of attention at the present moment. When the present South London locomotives were designed it was carefully considered how far the company could go in the direction of rapid acceleration without paying too much for it. It was found that with the locomotive under consideration, locomotives and trains weighing about 49 tons with passengers, the time taken on a short section of 2700 ft. would be 130 seconds, the maximum speed being 19.7 miles an hour, and the units per ton-mile 0.054, with an average speed of 14.25 m. p. h. It had been thought that a much better service might be obtained by having a four-motor equipment, the total weight remaining at 49 tons, but with a reduction in seating capacity. The units per ton-mile were reduced to 0.0377, the maximum speed was 20.6, and the average 14.25 m. p. h., as before. This reduced units per ton-mile were obtained by increasing the acceleration, but the peaks at starting were increased from 300 amps. to 600 amps. That had a very important bearing on the size of a generating station, and the copper in feeders and the size of the working conductor. The results given above assumed that the current could be shut off as soon as full speed was obtained and the locomotive allowed to coast, but that would hardly apply in practice. Running the above locomotives at their maximum speed and keeping the current on until the brakes were applied, the times for a 2700-ft. section were 122 seconds and 103 seconds, while the units per ton-mile were 0.0659 and 0.0745, respectively. Considering this effect on the power station of a line with ten such sections, allowing ten seconds at each station, and running a two-minute service with thirty trains leaving the terminus per hour, we found that the maximum current demand was 2085 amps., and with four motors, 4300 amps. The time for the journey with the two-motor equipment, was 21.8 minutes, and with the four-motor equipment 18.67 minutes. The difference was an increase of 13.5 per cent in the units per ton-mile, with the higher acceleration, and the power house had to be enlarged by 63 per cent, while only 14.3 per cent was saved in time. Unless the competition with trams and other means of locomotion was very severe, such extra expenditure, in order to obtain very high rates of acceleration, was not warranted. Another thing was that the power turned out would not be turned out so economically with a very varying load. It would almost

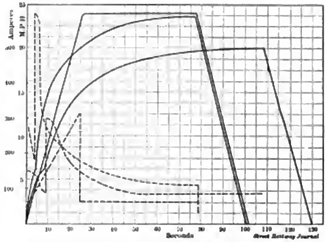


FIG 3.—DIAGRAM OF STARTING CURVES WITH TWO AND FOUR-MOTOR EQUIPMENTS

appear that when a very rapid acceleration was required some such system as the Ward-Leonard system, where there were not very high peaks, would meet the case, although it had not been tried.

However, the diagram (Fig. 3) shown illustrates the results of such a system in comparison with the two and four-motor equipment above referred to. The starting current is much lower, and a uniform acceleration obtained. Compared with the four-motor equipment the time for the section is the same, but the four-motor consumes less energy, taking 98.6 watt-hours as against 105 for the Ward-Leonard; but the latter requires a maximum current of only 318 amps. as against 600 amps. for the four-motor equipment. The two-motor equipment requires the same energy as the Ward-Leonard, but takes 20 seconds longer to run the section.

A practical example of the effect of very rapid acceleration may be found in the new motor on the Liverpool Overhead Railway, where the old motors took starting currents of 140 amps. to 150 amps. for an average speed of 12.5 m. p. h., and the new motors 700 amps. to 800 amps., the average speed being 19 m. p. h. The time for the journey is, however, reduced from 32 to 20.9 minutes. The increased generating plant, feeders, etc., is no doubt justified by tramway competition.

The Waterloo & City Railway, the second of London's tube railways, connects Waterloo Station, on the London & Southwestern Railway, with the Bank and the Central London Railway. The line is about 1½ miles long, with a station at each end, there being no intermediate stations. The generating station is at the Waterloo end of the line, and works on the two-wire system at 500 volts direct current.

At each station the line practically runs to the surface, and there are no lifts, which to a certain extent, helps to keep down the ratio of expenditure to receipts.

On this line motor car trains are used, there being two types to suit the varying traffic conditions. For the heavy morning and evening traffic four-coach trains are in service. The front and rear carriages have two motors on the leading and trailing bogie; these carriages seat forty-six passengers each, and the two intermediate carriages fifty-six each, making a total seating capacity of 204 passengers per train.

The motors have a normal rating of about 42 B. H. P., and a maximum of 60 B. H. P., representing a current of 70 amps. to 100 amps., at 500 volts per motor. These four-coach trains are run for about three and a half or four hours in the morning and evening. The weight of the train and motors, with the average load of passengers, is about 100 tons. The time taken for the journey from one station to the other, is five minutes, giving an average speed of about 18 m. p. h. The kilowatt-hour consumption being 0.05 per ton-mile at the above speed.

During the periods of light load, that is 11:30 a. m. to 4 p. m. and 7:30 p. m. to 10 p. m., the single motor cars are run. These cars weigh about 26 tons with average load, and require four minutes from station to station, the average speed being 22.5 miles per hour. A maximum speed of 40 m. p. h. is reached with these cars, and they ascend the 1 in 60 gradient at 30 m. p. h.; the kilowatt-hours consumption per ton-mile is .08.

The coal per unit generated taken over the half-year and including all boiler-house losses is 5 lbs. of Welsh steam coal.

The number of passengers carried per half-year is about 2.5 millions, and the train miles 82,800. The output of the generating station for the same period being 420,000 units.

The Central London Railway, the latest, and undoubtedly the finest of London's tubes, runs from the Bank to Shepherd's Bush, a distance of six miles, through what may be safely called the finest district for traffic in the world. There are thirteen stations, the average distance between each being very similar to the South London line. This railway was opened for public traffic at the end of July, 1900.

The generating station is situated at Shepherd's Bush, with substation stations at Notting Hill Gate, Marble Arch, and the post-office. Current is generated at 5000 volts three-phase, and reduced at the sub-stations by stepdown transformers and rotary convertors to 550 volts continuous current. The efficiency of the stepdown transformers and rotary convertors is given as 83 per cent at quarter load, 90 per cent at half load, 93 per cent at full load, and 92 per cent at 50 per cent overload, from which it will be seen that the double transformation is not quite as economical as the continuous current reducers in use on the South London line.

The train on the Central consists of seven carriages on eight-wheeled bogies, the total weight when unloaded being about 98 tons. The seating capacity is for 336 passengers. Separate locomotives are at present in use, but some new motor car trains are in the course of construction. The locomotives are fitted with four gearless motors, each of 117 hp; the motors on each bogie are mounted rigidly, the only springs being those between the bogie frame and the turnplate on which the body of the locomotive rests. In this respect the locomotives differ from those on the South London, whence practically the whole of the weight of the motor is spring borne. To this difference, no doubt, the vibration on the Central, which is absent on the South London, can be attributed. The spring borne load per axle on the Central being 3 tons and the unspring borne 8 tons, while the South London figures are spring borne 5.175 tons, unspring borne 1.65 tons per axle.

The maximum current which the locomotive is capable of taking at full load is about 1200 amps., and the weight about 44 tons. The train mileage for the half-year ending December, 1901, was 614,517, and the passengers for the same period were 20,802,650. The number of Board of Trade units output from the generator appear to be about 8¼ millions per half-year.

Meeting of the Pennsylvania Street Railway Association

The next annual meeting of the Pennsylvania Street Railway Association will be held at York, Pa., on Sept. 10 next. The meetings of this association are always well attended, and will undoubtedly be especially so this year, as the officials of the York street railway system have entertained the association before, and their bountiful hospitality is well known. The officers of the company this year are: John A. Rigg, president; John Ruth, secretary, and W. H. Lanius, treasurer, while the executive committee is made up of John A. Rigg, William B. Given, B. F. Meyers, S. P. Light and W. H. Lanius.

Plotting Speed-Time Curves—IV

BY C. O. MAILLOUX

The *Interpolation Method* is one in which the "component" curves are obtained by the modification of certain "fixed" reference curves. The method requires a "Chart of Acceleration," such as shown in Fig. 8, and a "Chart of Retardations," such as shown in Fig. 11. Each chart should contain various speed-time curves corresponding to several up-grades, to zero grade (level track), and to several down grades, together with the distance-time curve corresponding to each speed-time curve. The curves in Figs. 8 and 11 correspond, as already stated, to "zero" grade, and to 0.5 per cent, 1 per cent, 1.5 per cent and 2 per cent of both up-grade and down-grade, the down-grade curves being above and the up-grade curves below the curve for level track in both cases. The speed-time curves in both charts can be readily and quickly plotted by the "chart method" hereinbefore described. Where greater refinement is desired the curves may be plotted for every fifth of a per cent instead of every half per cent of grade. The distance curves are plotted from co-ordinates obtained by the integration of the corresponding speed-time curve by the planimeter or by the integraph, in the manner already explained. The scales of speed and time values used on these charts should, for obvious reasons, be exactly the same as those used in the run curves.

It may be interesting to note the fact that the acceleration curves in Fig. 8 have all been plotted on the assumption that the curve N on the Chart of Accelerations (Fig. 9) begins at the point a instead of the point b. This means that no allowance has been made in the curves for the increase in train resistance due to static friction at the time of starting. Theoretically the dip in the curve N at the point b should cause a short bend convex to the axis of x in each acceleration curve, such that a line tangent to the straight portions would not pass through the origin of x but through some point to the right of it. It will be doubtless interesting and perhaps reassuring to learn that, practically, the error resulting from the assumption aforesaid is less than one-twentieth of a second, and is consequently negligible even when the time values a and b have been determined by the curve or reciprocals giving the greatest accuracy (F in Fig. 10), and further, that the discrepancy in time values practically vanishes when using reciprocal curves corresponding to speed increments of 0.5 m.p.h. or 1.0 m.p.h. (curves B and A).

Fig. 14 gives an enlargement of the portion of Fig. 8, containing the speed-time curves comprised between the speeds of 45 m.p.h. and 60 m.p.h. and the time interval between the twentieth and fiftieth second of time, and also an enlargement of the corresponding distance-time curves. The heavier lines represent portions of run curve referred to later.

In using the interpolation method it is necessary to first plot the run curve upon tracing paper or tracing cloth, after which the curve may be transferred to or reproduced upon another sheet if desired. A tracing sheet having been placed upon the Chart of Accelerations (Fig. 8) we proceed to plot thereon the portion of run curve corresponding to the portion of $O\ A$ of service run No. 11. The run curve over this portion will, obviously, begin at zero speed. The form of the curve will depend upon the "net equivalent grade" for this portion, which, according to Table II, is $+ 0.283$ per cent, or the same as the actual grade, there being no track curvature. If an acceleration curve for this gradient be plotted in the regular way by the "chart method," beginning the plotting on the tracing sheet at the same point as the acceleration curves on the Chart of Accelerations, this curve will be found to pass between the curve for a level track (solid line) and the curve for a one-half per cent grade (first dotted line below the solid line), being slightly nearer the dotted line curve than the solid line curve. Let us now proceed to plot the same curve by "interpolation" between the solid line curve and the first dotted line curve. Since 0.283 of *one* per cent is equal to $0 + 283 \times 2 = 0.566$ of *one-half* per cent, it follows that the interpolation points will be 0.566 of the space between the two curves aforesaid, reckoning from the solid line curve. In this way any desired number of points may be located between the two curves. In practice the work of doing this may be simplified by using proportional dividers adjusted for the ratio 57.100, or by using proportional scales or other methods of proportional subdivision, well known in the drafting-room. On drawing this curve it will be found to coincide very closely with the curve previously plotted by the chart method. The divergence between the two curves represents the error due to the interpolation method. This

NOTE.—The first instalment of this paper appeared in the STREET RAILWAY JOURNAL July 5; the second part July 26, and contained Figs. 1 to 10, and the third part, Aug. 9, and contained Figs. 11 to 13.

error, however, is so slight that, in most cases, it may be considered negligible.

The method of interpolation may also be applied to the distance-time curve. The method would, in fact, have relatively little value if this could not be done—its principal advantage being to simplify the operation of "cutting off" each portion of curve at the proper distance points.

The distance curve corresponding to any interpolated acceleration curve is also prepared by interpolation in exactly the same way as the acceleration curve.

In Fig. 14, in the upper portion of the diagram, the line drawn with heavy dashes represents the upper end of the run curve corresponding to the portion of run, *O A*, and in the lower part of the diagram, the heavy line, *D*, represents the corresponding interpolated distance curve. The process of determining the terminal point *A* at which this portion of the curve should be cut off, is simple. The length of the portion *O A* being 0.306 mile, according

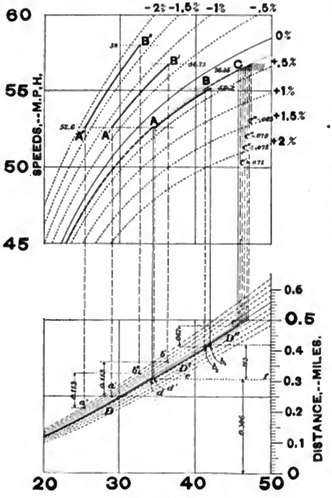


FIG. 14

to Table II, a horizontal line *e-f* is to be drawn in pencil on the tracing sheet at a point equal to this distance when measured by reference to the distance scale at the point *f* at the right-hand end of the diagram. This line is prolonged to the left until it intersects the distance curve *D*, at the point *d*. A vertical line (*d A*) is then drawn in pencil at this point until it meets the run curve at the point *A*, which will be the terminal point, or the point at which the portion of the curve *O A* is to be cut off. The point *A* corresponds in this particular case to a speed of 52.6 m.p.h., as indicated on the diagram.

We will now proceed to plot the second portion (*A B*) of the run curve, which, according to Table II, is 0.113 mile in length, on an up grade of 0.283 per cent, and has a track curve of 1 deg. 30 minutes, the net equivalent grade, including correction for track curvature, being + 0.351 per cent (Column VII). Without disturbing the tracing sheet, a portion of acceleration curve, corresponding to the portion of run *A B*, is to be plotted and drawn on the sheet. This portion of run curve will obviously begin at some point on the horizontal dotted speed line passing through the terminal point *A* of the portion *O A*. If the "equivalent" grade (Column VII) were, for example, — 1.75 per cent, the curve would begin at the point *A"* and would have the form represented by the heavy full line *A" B"*. If the equivalent grade were — 0.75 per cent, the curve would begin at the point *A'* and it would extend to the point *B'*. For the actual equivalent grade (+ 0.351 per cent), the curve will begin at *A* and will run to *B*, being located about 0.7 of the distance between the curves for 0 per cent and + 0.5 per cent, so that it passes slightly to the right of the continuation of the previous curve (shown in dotted line).

To determine the length of the second portion (*AB*), we first drop a vertical line (*Ad'*) from the beginning of this portion as far as the corresponding interpolation point (*d'*) in the portion of the chart giving the distance curves. If this portion of run curve were on a — 0.75 per cent grade, beginning at *A'*, the proper "interpolation" point in the distance curve would be at *a'*, while if the curve were on a — 1.75 per cent grade, beginning at *A"*, the proper interpolation point would be at *a"*. Wherever this point may fall, the procedure will be the same; a horizontal line is to be drawn on the tracing sheet in pencil at a distance which, measured by the distance scale, at the right-hand end of the diagram, represents the length of the portion of run *A B*, namely, 0.113 mile, as given in Table II. On this line the terminal interpolation point (*b'*) is located. The interpolated distance curve (*D'*) itself may then be drawn, if desired, although that is scarcely necessary, it being sufficient to have the terminal point clearly indicated by a dot, such as shown at *b"* and *b'*. A vertical line drawn from this terminal point to meet the interpolated acceleration curve will cut the curve at the proper time point. If drawn from the point *b"* this line would cut the curve *A" B"* at *B"*; if drawn from *b'* it would cut the curve *A' B'* at *B'*; in the actual case, the proper line is the line *b'B* which cuts the curve *A B* at the point *B* (55.2 m.p.h.). The acceleration curves *A" B"* have been purposely added to the diagram in this case to show graphically the important effect produced on the form of the acceleration curve by variations in grade. These curves show graphically the fact that the rate of acceleration increases greatly with the percentage of down grade, the direct effect of this, of course, being that the speed attained at the end of the corresponding portion of the run is very much higher on down grades of higher percentage, as clearly shown by the relative positions of the terminal points, *B*, *B'*, *B"*.

In the third portion of run *B E* it becomes necessary to anticipate, and to make allowance for, the track curve of short radius, which occurs in the fourth portion (*C H*). The speed at the end of the portion *B E*, or the beginning of the portion *E H*, is, as previously stated, set at 25 m.p.h. This is, therefore, a case in which we must plot in both directions—"forward" from the point *B*, and "backward" from the point *E*. The portion, *B-C-E*, will have three "component" curves, including an acceleration portion, *BC*, a drifting portion, *CD*, and a braking portion, *DE*. The real problem in this case is the determination of the points *C*, *D*, at which the drifting curve *CD* will begin and end. This has to be done largely by a "cut-and-try" process. We begin by plotting an acceleration curve for a net grade of + 0.283 per cent, starting from the speed point *B*, (55.2 m.p.h.), and making the curve arbitrarily of some convenient length, such as may be thought suitable for the purpose. A vertical line (*B-b*) is dropped from the beginning of the portion *BC* to the proper interpolation point for the corresponding distance curve *D"*. Near the end of the portion plotted, a certain number of vertical lines (*c' c" c'"*, etc.) are dropped from the acceleration curve to the distance curve, and the distances corresponding to each of these vertical lines having been noted by reference to the distance scale, it is recorded in pencil opposite the letter or symbol representing each line, as indicated in the upper right-hand portion in Fig. 14. Thus, in Fig. 14, the distance covered, when the curve *B C* is cut off by the vertical line, *c*, would be 0.67 mile. The corresponding distances, when the curve is cut off by the vertical lines, *c' c" c'"*, etc., would be, respectively, 0.071, 0.075, 0.079 mile, etc., each successive line representing a "slice" whose area represents a distance of 0.004 miles. The number of such vertical lines, and their distance apart, may, of course, be varied as desired, and as may seem best in each particular case.

The next step is to lay out a braking curve, working backwards from the point *E*. This case is analogous to the upper portions (*FG* and *GH*) of the braking curve in Fig. 12, and, consequently, will correspond with either Problem 2 or Problem 3 in Appendix D, according to the term which is made the unknown quantity. It will correspond to Problem 2 when the distance covered, *s*, is given, and the entering speed (at the point *D*), is the unknown quantity to be determined. It will correspond to Problem 3 when the entering speed is assumed, and the distance covered, *s*, is the unknown quantity to be determined. It may be necessary to try both ways, assuming a given value for the distance in the first case, and for the entering speed in the second case. A few preliminary calculations made both ways, based upon different assumptions, will enable a rough approximation to be made, both as to the distance

covered, and the entering speed, for the braking portion of the curve.

The next step is to plot, on a separate tracing sheet placed upon the chart of retardations (Fig. 8) a portion of drifting curve corresponding to the net equivalent grade (+ 0.283 per eent) indicated in Table II, and of such length as may seem proper to form a connecting link between the points C and D, allowing extra length at both ends. The corresponding distance curve is to be drawn by interpolation on the same sheet. This sheet is then superposed upon the traeing sheet containing the acceleration portions. Let us assume that it has been superposed in such manner that the upper end of the drifting curve crosses the continuation of the acceleration curve, $B\ C$ (in Fig. 14), at a point corresponding to the vertical line, c'''. If preliminary calculations have been made for the braking curve in the manner previously indicated, the distance covered while braking, as obtained from these calculations, should be added to the distance covered during the acceleration portion BCc''', which, as indicated in Fig. 14, is 0.079 mile. The sum of the two distances corresponding to the braking and accelerating portions, subtracted from the total distance of the portion BE, namely, 0.374 mile, will give the distance remaining for the drifting curve ($C\ D$). If this calculated distance is greater than the distance indicated by the distance curve corresponding to the portion of drifting curves comprised between the vertical line, c''', and the vertical line corresponding to the assumed entering speed, D, it is an indication that this assumed value for the entering speed, D, is too high, or that the acceleration curve has been cut off to soon; and *vice versa*. We may first try the effect of changing the entering speed, D, and of locating it at different points along the drifting curve. In this case, the entering speed, D, being now known; we have a case corresponding with Problem 3 (Appendix D), and the distance covered is to be determined by reference to equation (i). The effect of changing the point D, however, is to also ehange the distance covered by the drifting curve. It may, therefore, be necessary to change the relation of the drifting curve to the acceleration curve, so as to change the point of intersection between these two curves. In many cases, the distance allowed for braking can be fixed, and, consequently, the entering speed, D, can be calculated as a case of Problem 2 in Appendix D, by means of Formula (1). This being done, the lower speed point of the drifting curve will also beeome fixed, and it will now be possible to make sub-divisions at the upper portion of the drifting curve similar to those made on the acceleration curve in Fig. 14, by the vertical lines c, c', c'', c''', etc., the distance corresponding to each line being recorded in pencil on the tracing sheet. When this can be done, the process of finding the point C becomes greatly simplified. For each position of the drifting curve, with respect to the aeceleration curve, the distance values corresponding to the two component curves can be readily calculated. If the sum of the two distances is too small, the two curves must be moved farther apart; if too large, they must be brought closer together. In the actual case, the proper point of intersection between the acceleration curve, BC, and the drifting curve, CD, takes place at the point C, corresponding to the vertical line Cc, representing a distance covered, under acceleration (Fig. 14), of .067 mile, the speed at the point C being 56.35 m.p.h. The drifting curve beginning at this point continues until the speed has fallen down to 53.2 m.p.h., the distance covered being 0.129 mile. The braking curve represents a reduction of speed from 53.2 m.p.h. to 25 m.p.h., and a distance covered of 0.178 mile. The three component curves for this portion of the run aggregate exactly 0.374 mile, which is the distance given in Table II.

The fourth portion of the run ($E\ H$) also has three component curves, the first being the acceleration curve, which is to be plotted by interpolation, in the manner already described. It is cut off arbitrarily when it reaches the speed point of 35 m. p. h., that being, as already stated, the limit of speed for the track curvature occurring in this portion of the run. The distance covered is determined by the interpolated distance-curve, in the manner already indicated. A drifting curve for the portion $F\ G$ is then plotted, either on a separate sheet or by placing the same sheet over the Chart of Retardations. The length of this drifting curve may be varied arbitrarily. This being an express run, it is desirable to regain a higher speed with as little delay as possible when leaving the curve. It is usual to turn on the current and to let the train again accelerate in speed before passing entirely out of the curve, it being found practicable and safe to run out of a curve at a considerably higher speed than would be allowable at the beginning, or in the first portion of the curve. In this case the current was turned on after drifting down to a speed of 31.1 m. p. h. and at a point .041 mile from the end of the curve. The acceleration curve, $G\ H$, having been plotted by interpolation in the way already indicated, and having been cut off by means of the distance curve at the point corresponding to the proper distance (.041 mile), the two succeeding portions, $H\ I$ and $I\ J$, could then be plotted without difficulty, either on the same sheet or on separate sheets. On reaching the point J it beeomes neeessary again to anticipate for the final braking at the end of the run and to plot both ways. The process to be followed in determining the point K is substantially the same as that followed for determining the point C, and need not be further detailed.

After all the "component" portions of the entire run curve have been determined they are to be assembled on one sheet. This can be done easily by tracing these portions on another tracing sheet or the curves may be redrawn on a separate sheet after a certain number of co-ordinate points for each portion have been plotted on the sheet.

The curve DDD in Fig. 13 is the distance-curve obtained by integrating the service-run curve, $OABC$..........N. Its highest point corresponds, by reference to the seale of distance, exactly with the total length of the run (namely, 1.625 mile). The various bends in the curve are an indication of the irregularities in the service-run curve. The height of the curve at any time point, when gaged by the distance scale, measures the distance covered up to that time point.

Subsidiary Curves.—After the service-run curve has been plotted it becomes possible to plot various other curves, which could not be plotted without it, and which, for this reason, are sometimes designated by the general term, "subsidiary curves." The complete discussion of these curves is beyond the scope of this paper, but some of the curves are so closely related to the service-run curve that a brief reference to them is really necessary in order to give a general idea, at least, of some of the important uses which may be made of the service-run curve in determining many of the important factors of a given electric railroad problem. The distance curve, DDD, just referred to in Fig. 13, is an example of a "subsidiary curve." The most important of these curves are the electric-power input curves, the current-input curves, and also the integral curves derived from them.

The power-input curve is a time-function curve, showing the instantaneous values of the energy applied to a train. This eurve begins when the current is applied to the motors, and it ends when the current is cut off. Each acceleration cycle in the service-run eurve therefore corresponds to and is characterized by a power-input curve (and also an energy-input curve). Thus, in service run No. 7 (Fig. 12), in which, as already seen, there is only one acceleration cycle, there is only one power-input curve, which is indicated by a dotted line in the figure. On the other hand, in Fig. 13, where there are three acceleration cycles, there are also three power-input curves, which form the outlines of the three shaded areas in the figure.

The power-input curve and its integral curve, the energy-input curve, serve for the determination of many important factors, including the energy required for a given serviee, and also the size and character of power station necessary. The co-ordinate points for the power-input curve are calculated by reference to the "corrected" speed curve (C) on the sheet of motor characteristics (Fig. 5). The current value, corresponding to each speed value, multiplied by the mean voltage available at the motor terminals, gives the power value in watts corresponding to that speed. In this way the power values corresponding to all the speeds may be calculated. These values may also be plotted in the form of a power characteristic curve, in which speed and electric power (preferably expressed in kilowatts) are the co-ordinates. It should be borne in mind that when the series-parallel system of motor control is used the energy applied to the motors, while the motors are connected in series, as is the case when running below a certain critical speed, will be, for a given current value per motor, only one-half as much as when the motors are connected in parallel. In the case of the two service runs shown in Figs. 12 and 13 the critical speed at which the change from series to parallel connection occurs, is 19.6 m. p. h. This circumstance accounts for the low portion of the power curve at the beginning, as indicated at P in Fig. 13. The voltage available at the motor terminals is not really applied to the motors themselves, as is well known, until the controller resistance has been entirely cut out. However, since, in reality, we desire to know the energy ***applied to the train***, whether this energy be applied wholly to the motors themselves or whether it be partly expended in heating the controller resistanee, the portion P is plotted just as if the energy were expended entirely in the motors. In this case each car is assumed to have a four-motor equipment, and the acceleration current, as previously stated, is assumed to have a mean value of 400 amps. per motor. The mean voltage is assumed to be 600 volts. At the time of starting, there being two pairs of motors connected in series per car, the power input will be:

$$600 \times 400 \times 2 = 480 \text{ kw.}$$

This is the ordinate value of the portion P of the power curve,

as will be found by reference to the scale of kilowatts per car at the left-hand end of the diagram in Fig. 13.

After the resistance has been entirely cut out, the rate of acceleration would diminish, unless the controller is changed from the series to the parallel connection. This will be made clear by a comparison ot the acceleration curves marked *A* and *C* in Fig. 11. The lower of the two curves marked *A* is substantially the same as the acceleration curve for level track (solid line) in Fig. 7. The lower curve marked *C* is the acceleration curve that would be obtained if the parallel connection were not used—that is to say, if the acceleration were allowed to take place on the last step of the series connection, with the motors still connected in series, but with the controller resistance entirely cut out. (The upper curve, in each case, is that which corresponds to a higher gearing ratio than the gearing ratio used for the curves shown in Fig. 7.) When the change from series to parallel connection takes place, the total current per car will jump from 800 to 1600 amperes, and the power input curve also instantly jumps up to twice its value; it attains its highest point, *Q*, and there remains constant, as indicated by the straight line, until the controller resistance has again successively and entirely been cut out. It is at this moment that the acceleration begins to decrease (in accordance with the curves shown in Fig. 7, or with the curve *A* shown in Fig. 11), because the counter e.m.f. due to the increase of speed, begins to reduce the current passing through the motors. The power applied to the car therefore, begins to fall very rapidly, as indicated by the curved portion *R* of the power input curve in Fig. 13. The point (*C*) in Fig. 13 being, as we previously found, the point at which the acceleration ceases, it of necessity corresponds to the point at which the power is cut off; and the power curve suddenly drops down to zero at that point. In the second acceleration cycle, in Fig. 13, the speed (25 m.p.h.) at which the current is turned on, is higher than the "critical" speed; consequently the motor controller must be in the parallel position, with only a part of the resistance cut out. As the whole of this resistance has not yet been cut off by the time the speed point *F* is reached, where the current is again turned off, it follows that the power curve (*S*) will be straight. In the power curve corresponding to the third acceleration cycle, the curve begins with a straight portion, but as the speed soon attains the point (39.2 m.p.h.), at which the controller resistance is all cut out, the power values again rapidly diminish same as in the first cycle, as indicated by the curved portion, *U*

It should be noted that the portions, *P, Q, S, T*, will not, in actual practice, be absolutely straight lines. They will, in reality, be serrated or saw-shaped, with a number of humps or notches equal to the number of steps in the controller, or equal, rather, to the number of movements of the controller which the motorman makes during acceleration. These humps or notches are due to the fact that when the controller is moved from one step to the next, the current instantly jumps up to a higher value, and is then gradually reduced by the increase in e.m.f. due to the rising speed of the motor, the same process being repeated for each step or notch of the controller. With the Sprague multiple-unit system of control, it is possible to restrict, to some extent, the amount of fluctuation in current while the controller resistance is being cut out, so that the notches or teeth in the actual energy curve at the points *P, Q*, etc., will not be so large. This is due to the fact that the process of cutting out the controller resistance can, in this system, be made automatic, being controlled by the current passing through each motor. These current fluctuations theoretically react upon the acceleration, and tend to produce slight waves in the acceleration curves. Practically, however, their influence is negligible, being virtually obliterated by the inertia of the car.

Energy Curve.—If we integrate the area of each power or kilowatt curve, we obtain the value of the energy in kilowatt seconds (which may be reduced to kilowatt-hours) expended during the corresponding acceleration cycle. This is a valuable and useful quantity. If we integrate the power curve "by parts," we obtain the energy curve for each acceleration cycle. This has been done in Fig. 13, where the portions of curve, *Ea, Eb, Ec*, represent, respectively, the portions of energy input curve corresponding to the three acceleration cycles. The horizontal portions between the inclined portions merely indicate the fact that the total energy remains stationary between the different cycles. The aggregate energy for the three cycles, when read by reference to the scale of kilowatt-hours per car at the right-hand end of the diagram, will be found to be 14.22 kilowatt-hours. The portion of the total energy corresponding to each cycle may, likewise, be read separately by reference to the same scale.

Energy Consumption.—Having obtained from the energy curve the energy consumption during the run, and the weight of train and length of run being both known, the energy required in watt-hours per car-mile, or per ton-mile, may be easily calculated. The resulting data are given in Fig. 12 and Fig. 13. It will be seen that while in Fig. 13 the energy consumption is only 114 watt-hours per ton-mile, it rises in Fig. 14 to 168 watt-hours per ton-mile, notwithstanding the fact that run No. 11 is shorter than run No. 7. This is, of course, due entirely to the presence of the sharp curve in run No. 11, which necessitates reduction of speed and subsequent accelerations, as already indicated.

Current-Input Curve.—The current-input curve is obviously of exactly the same form as the power-input curve, its ordinate values being different from those of the power curve by a constant equal to the mean voltage assumed in computing the ordinates of the power curve. The current curve may, therefore, be derived from the power curve, or the power curve itself may be used, as if it were the current curve, with a different scale of ordinates. The current curve is useful in calculations regarding the feeder and distributing systems necessary for transmitting electrical energy to the car motors. It is also useful in determining the losses to be expected in the conductors as well as in determining the heating of the motors. For the latter purpose the current input curve should be integrated twice successively. From the second integration the value of the *mean square* can be obtained; the square root of this value will be the equivalent heating current for the run. The work of integration will be greatly simplified by the use of an integraph or of a so-called mechanical integrator. The well-known, highly ingenious "Amsler" mechanical integrator has been found by the writer to be very convenient and satisfactory for this purpose. While it does not draw the integral curves like the integraph, it has the advantage over the integraph in this case, of giving at one single operation the results of both integrations, namely, the current-time integral or the coulombs ($a/y\ d\ x$) and the current-mean-square-time integral ($b/y^2\ d\ x$), and even a third integration ($c/y^3\ d\ x$) if desired. A detailed description of the modus operandi is beyond the limits of this paper.

Intrinsic Power Curves.—These curves show the instantaneous values of the power actually utilized in maintaining the speed during the entire run. The formulæ usually employed for calculating these power values give the result in mechanical horse-power. It is preferable, however, to convert the horse-power values into equivalent kilowatt values. The curve showing the instantaneous power values has been called the "intrinsic power curve." The integral of this curve would be another curve called the intrinsic energy curve. When the intrinsic energy curve and the energy-input curve are both drawn to the same scale the ratio of final ordinates of the intrinsic energy curve to the energy-input curve, will represent the mechanical efficiency attained during the run.

The intrinsic power and energy curves are of interest and of utility in the minute analysis of railway problems.

(To be Continued.)

Taxes of Cleveland Railways

The two Cleveland companies have voluntarily increased their tax returns to nearly double the valuation placed on the property last year. This action immediately followed the defeat of Mayor Tom L. Johnson's plan to increase the tax valuations of all the big public service corporations. This defeat came in the shape of the overruling of the suit to compel the auditor to restore to the tax duplicate, the additions made by the board of equalization to the tax valuations of the five corporations, and these additions were subsequently taken off by the State board of tax remission. The action of the two companies in voluntarily increasing their taxes, is looked upon as a sharp move on the part of Mark Hanna, president of the Cleveland City Railway Company, and a large stockholder in the Cleveland Electric Railway, to defeat Mayor Johnson's bid for popularity, and the political control of the situation in Cleveland and Ohio. Further indication that Senator Hanna desires to detract from the weight of Johnson's argument about 3-cent fare and tax-dodging corporations, is seen by the fact that a committee appointed by the building trades' council, representing many thousands of voters, is investigating the books of the two big companies with a view to determining the lowest figure at which a street railroad can be operated, allowing for a good profit to the stockholders. Senator Hanna has informed this committee that he and his company would be willing to reduce their fares to a point where a fair profit on the investment remained possible.

The total valuation placed by the Cleveland Electric Railway on all tangible property was $1,693,924, compared with $868,000 in 1901. The returns of the Cleveland City Railway last year was about $600,000, and this year about $1,000,000. The tax rate is fixed at about 60 per cent of the cash value.

Leading officials of both companies deny the frequently published reports that they are about to ask for extensions of franchises on the basis of universal transfers and seven tickets for a quarter.

Block Signal Systems for Electric Railways

BY H. D. EMERSON

The recurrence or rather the increase of collisions on high-speed electric railroads is beginning to alarm the public, and popular newspapers of the yellow variety are making a feature of the full publication with details as harrowing as possible of accidents which occur. The thoughtful student of electric railway operation has realized for some time that the conditions which exist on electric railroads do not differ materially as far as the operation of trains is concerned from those which exist on steam railroads. That is to say, that many years of experience in operating trains by means of steam has developed certain rules and principles which cannot be violated without danger of accident. On the other hand, the conditions which exist on most trolley roads are more favorable to safe operation, especially as regards collisions, than on steam roads.

It would seem that a principle and a method which has been in use for many years, and which is being used with extreme satisfaction and absolute safety on steam roads, and which is particularly adaptable to the operation of high-speed trolley lines, should not be overlooked. When, in addition to the fact that the principle is right and the method simple, the cost of the appliances are less than any other form of signaling apparatus, it would appear that its use would be much more extended on trolley lines than it is at present. I refer, of course, to the block system and its application by means of the "train staff." Nearly all of the single-track steam railroads in Great Britain are operated by means of the train staff, and under various modifications it is used all over the world.

The steam road proposition usually is to operate a number of trains of various speeds in contrary directions at extremely irregular intervals. The ordinary steam road train schedule, for example, provides for a number of trains into a large city in the morning and an equally large number returning in the afternoon; running contrary to these trains are a comparatively few, so the making of a schedule of this kind provides for trains following each other and meeting a less number in the opposite direction. But this passenger schedule is complicated by freight trains, both regular and extra, and is also daily disturbed by express and through trains, which may be many hours off their proper time. The result of many years of experience in conducting the operation of American railroads has resulted in a system whereby the movement of the trains is controlled from a central point by one man, called the train despatcher, who gives orders direct to the crew of each train. He fixes the points at which the trains meet and pass, and changes these points as the exigencies of the service may demand, in order to facilitate and accelerate the train movement. This system works very well up to a certain point, beyond which experience proves that other systems are more economical and safe. These latter systems are all variations or modifications of the so-called block system. In England all steam railroads are operated on the block system, but in this country, owing to the perfection and adaptability of the train despatcher system, the block system has been adopted only by railroads of large traffic; hence it is that most people, in considering methods of train operation, take it for granted that the block system is adaptable only to roads of dense traffic. This idea has been impressed and emphasized on the minds of the public by the expensive signaling apparatus installed in this country on the roads of heavy traffic, in order to facilitate the use of the system. It should be noted, however, as a matter of fact, that the block system can be used on any railroad and that the appliances absolutely necessary are extremely inexpensive. It is not necessary to erect block signal stations nor even to construct a telegraph line to get the full benefits of absolute safety, if it is so desired.

Electric railroads lend themselves particularly to the use of an absolute block, because trains are usually run at definite intervals and at constant speed. Some trolley lines have installed so-called block signal systems: that is, they have installed apparatus designed to indicate whether or no the next block or section of track was occupied or not. Some of these systems are worse than useless, because of the fact that if the signals are not properly operated and understood they may mislead the motorman and causes him to run at higher speed and with less care than he would if the road was not provided with this apparatus. As a case in point I noticed on a trolley road, some weeks ago, which runs cars weighing twenty-five tons at extremely high speed, that when we approach the end of the block the motorman asked a friend to get off and throw the handle of the so-called block signal. The indications to the motorman are by a combination of lights, the handle by which the signal is operated is located at easy reaching distance to anyone standing on the ground, but cannot be reached from the platform of the car. When I got off the car at a wayside point I was interested to note the length of time it would take the car to run the succeeding block, and so stood watching the signal. Presently a man came along and moved the lever, changing entirely the indications of the light. Whether the man that moved the lever was an employee of the road or not and whether the signal indicated safety or danger I do not know. On returning to the terminus of the line that afternoon, I inquired as to the success of the operation of the railroad and was told that they had several collisions within a comparatively short time, one of which was very serious, being a head-on collision of two heavy cars going at high speed. Instances of this kind, and others, illustrating a lack of knowledge of the basic principles of the block system are numerous; this particular instance is cited, because it illustrates the violation of the two most fundamental principles of blocking which are, first, a definite positive indication which cannot fail to be understood; and, second, such discipline of employees that they can only, by the grossest carelessness, which will be obvious to the most casual observer, violate the rules of the block.

The block system simply means that the railroad be divided into sections of suitable and convenient length, and that but one train or car be on each block at once. The simplest form of apparatus for indicating and carrying into effect this principle is the old English staff system. When a train approaches the end of a block it must come to a standstill, and before it can proceed into the next block the engineman must receive the staff controlling the block. As there is but one staff for each block, there can be but one train on the block at one time. On receiving this staff, the engineman proceeds into the block, and at the end of the block delivers his staff over to the proper official. The next train going into the opposite direction receives the staff and returns it to the other end of the block. This system had to be modified for steam railroad operation, as it presupposes an equal number of trains in opposite directions and each train alternated on each block by a train in the opposite direction. The modification, in order to adapt this system to steam railroad operation, is called the electric staff, a very ingenious device which has a number of staffs enclosed in boxes at each end of the block. When one is removed the boxes at both ends are locked and another staff cannot be taken out until the one removed has been replaced. But electric railway operation has exactly the condition described for the operation of the train staff system. Trolley schedules provide for an equal number of trains or cars passing over the road and alternating each with the other on successive blocks, so it would seem that there would be no reason why the absolute block system, as operated by the train staff, should not be adopted on all high-speed electric railroads. The staff might consist of a large ring 10 ins. in diameter, with a metal tab showing the number of the block, a simple hook could be placed on a pole with the corresponding number painted on the pole. This should be placed near enough to the track so that the motorman could reach out and remove the staff from the hook and hang it on a hook in the car without stopping his car, and at the end of the block he would replace the staff on a hook and take aboard the staff for the next block. There are objections to this system, but none which are serious and none which outweigh the absolute safety which it provides against both head and rear collisions.

One objection which will be raised to this system of operation is that it does not provide sufficient flexibility to care for increased traffic. This objection is only partially true, for extras can be run over the road at any time with absolute safety. Their number, of course, is limited by the length of the blocks, and consequently the permanent interval between cars. Perhaps the best method of giving increased carrying capacity to the road, and yet not to increase the number of cars or trains sufficiently to cause vexatious delays, is to increase the carrying capacity of each car or train. This can be easily accomplished by coupling two or more cars together, and if steam railroad operating experience goes for anything, this method will result in diminished operating expense. There are very few high-speed trolley lines which require a service of oftener than once in fifteen minutes and a frequency of thirty minutes is undoubtedly sufficient for the majority. Assuming then, that the superintendent works out an operative schedule with passing points properly placed for a definite frequency, he can train his men to run on it and protect against collisions absolutely by using the train staff system. When additional carrying capacity is desired, he simply increases the capacity of his regular cars or trains. If the company is a prosperous one and is earning dividends, so that the directors are willing to have expenditures made for permanent improvement of the plant, permanent block signals can be installed which will be operated either automatically or by hand. If operated manually, they

should be so arranged that the lever is out of reach of people standing on the ground, and when it is thrown for the block can not be changed until the car has passed the block. Automatic signals are excellent, and there is a great variety on the market which are economically operated and safe. Any block signal should be so arranged that if any accident happens to it or the line becomes deranged or the mechanism out of order, it will show the danger indication.

If it is desired to use the block theory and operate by means of permanent signals controlled either by electricity or air at the ends of the block, certain principles thoroughly established by many years of disastrous and heart-breaking experience should not be overlooked. The first is that the signal should be simple and should have but two indications, it should say definitely, clear or definitely blocked; that is, it should say "go" or "stop." This can be best accomplished by the semaphore arm. When it is horizontal or extending over the track everyone understands that it means "stop," whereas if it is dropped at an angle it indicates "clear," and the car can proceed. In the same way the lights for night signaling should be position signals; two red lights horizontally placed indicating "stop" and two green lights vertically indicating "clear." This is the result of signal practice the world over, and is understood and is understandable by all concerned in railway operation and by most of the patrons of railroads. The cost of providing signals, as described, would not be any greater than the cost of providing the present signals now installed on many lines.

Restrictions on Electrical Supply by Street Railways

BY ALTON D. ADAMS

Interurban extensions of street railways have carried them through many towns where there are no public systems of electrical supply. The present rapid expansion of these railway systems is constantly adding to the number of such towns. Even the older type of 500-volt direct current distribution to street railway lines is readily adapted to general electrical supply, through the medium of sub-stations, and the newer alternating lines are even more easily available for lighting and power to stationary motors. Managers of electric railways have not been slow to perceive the advantages of a lighting load for their stations, the heaviest part of which would come at times when the demands of traction are not at a minimum, and would have engaged in general electrical supply long since but for legal restrictions. In the great majority of cases the charters of street railways have not given them lighting powers, and such powers when applied for have frequently been denied by State legislatures. At the present time the lack of legislative consent is the main impediment to the rapid acquisition of large loads by electric railways in the general supply of light and power. The practical problem is thus to secure this consent in the various States. One of the main difficulties to be overcome is the disinclination in the minds of legislators to give a public-service corporation a varied field of activity, but electric lighting by street railways is so clearly for the public good that the arguments in its favor must ultimately prevail. The easiest means by which street railways can gain legal entry to the field of electrical supply are perhaps as various as the legislation of the several States, but a plan that has proved successful in Massachusetts may he useful elsewhere. During several years the street railway companies of Massachusetts have struggled for the legal right to enter directly the lighting field, but without success.

In the Legislature of 1902, a bill, House No. 171, was introduced giving street railway companies the right to furnish electric light in cities and towns where no public service of this sort exists, provided the consent of the local authorities be first obtained, but this bill failed of passage. Besides this general measure some half dozen or more bills were introduced at the same session, giving certain street railway companies the right to do electric lighting in specific towns, on consent of their local officers, but these bills fared no better than the one applying to all the electric roads.

What could not be done directly was next attempted and accomplished indirectly. Street railways could not secure authority to engage directly in electric lighting, but they were authorized to sell electrical energy to any town that contains no general system of electrical supply, and wishes to distribute electric light for either public or commercial purposes. This authority is contained in Chap. 449, Acts of 1902, approved June 5 of the present year. Both street railways and the class of towns named are thus left free to enter on contracts that should prove of decided advantage to all concerned. The main object of the street railways is to sell energy, and a business done in bulk with each town will probably be quite as desirable as one done with a large number of small consumers.

Under the plan provided for by the act in question, the entire expense and care of the local distribution systems falls on the towns, and the street railways simply deliver energy through one or more meters in each town. After a town and a street railway company have entered into a contract for the purchase and sale of electrical energy, the contract must be approved by the Railroad Commissioners before it becomes operative. This provision of the law will no doubt prevent the sale of energy at prices that do not represent fair profit on the cost of its production, since sales below cost would interfere with the functions of the street railways as common carriers. When only a single street railway enters a town it will usually be unwilling to sell energy without making a fair profit, but with two or more railways in the same town, as is often the case, the interposition of the Commissioners may sometimes be necessary to keep up rates. At the start neither a street railway or the town are under any obligation to make any contract or purchase or sell any electrical energy. After a contract that has been freely made for the sale of energy expires, however, if the town and the street railway company concerned are unable to agree on the manner in which the energy is to be furnished to the town in the future, or on the price to be paid for it, then the town may apply to the Railroad Commissioners to determine these points, and the Commissioners are required to fix the manner in which the energy shall be furnished and the price to be paid for it. The street railway company is then required to furnish the energy in the manner and at the price determined by the Commissioners. While large powers are thus placed in the hands of the Commissioners, it is no greater than that which they already exercise as to rates of fare on steam and electric lines, and their conservative rulings in the past are a good indication of what may be expected in this new direction.

This legislation opens a wide field for street railways in electric lighting. All the cities of Massachusetts are already served by systems of general electrical supply, and do now come within the provisions of the above act. The State, however, contains 319 towns, and of this number only about 100 contain electric lighting systems, so that more than 200 towns are free to contract for supplies of energy from the circuits of street railways. Many of the towns that are now without electric lighting already contain street railways. Most of the remaining towns will soon be reached by the trolley lines that are fast uniting the remote corners of the Commonwealth.

Consolidation of Manufacturing Companies

S. Marsh Young, of the American Union Electric Company, announces that the company, in addition to its purchase of the Union Railway Power & Electric Company, Morris Electric Company, The Falcon Electric Manufacturing Company, Electric Motor Specialty Company, Fountain Manufacturing Company, The Federal Manufacturing & Specialty Company and Refrigerator Machine Company, has added to its line of purchases the Metropolitan Switch Board Company. The American Union Electric Company has purchased all the capital stock of the Metropolitan Switch Board Company from Charles L. Eidlitz, T. J. Murphy and G. A. Annable.

The American Union Electric Company intends to continue to operate the factory of the Metropolitan Switch Board Company at West Twenty-Ninth Street as an auxiliary to its plant at Ampere, N. J., and in the Twenty-Ninth Street factory will handle all switchboard and special panel board work under the supervision of T. J. Murphy, former president of the Metropolitan Switch Board Company.

The purchase of the Metropolitan Switch Board Company by the American Union Electric Company carries with it the ownership of the "Murphy" patents, which cover all forms of installation of panel boards, as well as built-up panel boxes and the divisible panel board.

There has been considerable controversy between the Metropolitan Switch Board Company and the several manufacturers of paned boards, but the American Union Company announces that it will probably turn in these patents to the general benefit of the panel board business, and will issue licenses to about a dozen of the principal panel board manufacturers, its object being to strengthen the general situation and to enable the legitimate panel board manufacturers to receive a fair return on their investment.

The new additions to the factory of the American Union Electric Company at Ampere, N. J., covering about 23,000 sq. ft. of floor space, are about completed, although plans are being prepared for the still further addition of a new brick building, 300 ft. x 50 ft., for a general machine shop, as well as office building and warehouse.

Topics of the Week

The Rapid Transit Commission, Board of Aldermen and Pennsylvania Railroad Company were represented at a conference last week, in which Mayor Low presented arguments in favor of an immediate settlement of the question of granting a franchise to the railroad for a tunnel from Jersey under Manhattan and through to Long Island, with terminal facilities in New York. It was decided to have committees appointed to represent the Board of Aldermen and Rapid Transit Commission to prepare a contract that would meet the objections raised to the first one. The company intimated that it would accept the following modifications: The franchise to be controlled by a subsidiary company to be organized under the laws of the State of New York; the department of health to have sanitary supervision of the tunnel; the granting to the city of the use of the tunnels for fire and police telegraph wires; indemnifying the city against suits for damages by the closing of Thirty-Second Street; the Mayor and Board of Aldermen to have a voice in the readjustment of the compensation at the end of the twenty-five-year period; that the compensation for the first twenty-five years shall not be taken as a precedent for the fixing of the payment for the second or subsequent terms, but that the readjustment shall be made on an entirely new basis, and the company to name a definite time within which it will avail itself of the franchise, and the elimination of the power of the Rapid Transit Commission, as now provided, to extend the time for the completion of the work. The conditions desired by the Aldermen, upon which no agreement was reached yesterday, were: The insertion of a clause fixing eight hours as a day's work; the payment of the prevailing rate of wages; the limitation of the life of the franchise, and the building of pipe galleries in the tunnel.

A prominent business man in a Western city, who has been deeply interested in the development of street railway enterprises, recently withdrew from the management of a company which was seeking a franchise for an interurban road, and explained that he had found it utterly impossible to make any progress in securing the passage of an ordinance through the City Council without the liberal use of money, to which he declined to be a party. The franchise ordinance of this company has been blocked repeatedly, and there is talk of withdrawing the application so far as it relates to the town in question. The road would open up a rich farming country.

The people of Cuba are anxious to enjoy, not only the blessings of liberty, but all the advantages and material comforts of a free people. They are already displaying a fondness for such American institutions as seashore resorts, connected with the cities by trolley lines, and several enterprises of this character are now under way. American capitalists are building an electric railway 12 miles long, connecting Havana with the seashore. A casino, theater, hotel, summer gardens and other features are planned for the beach resorts, which is to be opened by the railway.

"How not to do it," is the title of a graphic illustration of the manner in which most women alight from a street car. It is published in a Western daily newspaper, with the explanation that most of the accidents for which the street railway companies are blamed, are really due to the carelessness of patrons and the habit of facing the rear and trusting to Providence when they leave a car. In winter the conductors can guard against these accidents in a large measure, but with open cars it is often impossible to prevent patrons from stepping off backwards.

An example of the methods employed in conducting the affairs of cities is afforded by the finding of a certificate of stock owned by the city of Rochester, which entitled the city to draw semi-annual dividends from the Rochester and Genesee Valley Railroad Company (Erie road lessee), at the guaranteed rate of 6 per cent per annum on $300,000. All that any present city official knew about the matter was that the city had bonded itself years ago in the amount of the stock and received the certificate. The bonds have nearly all been paid off, but the certificate was missing. The document was found in the city treasurer's office. The records of the city showed that the certificate must have been lost in 1885, and as several changes have since been made in the administration of this office, the matter evidently was entirely forgotten.

The Northwestern Elevated Railroad Company, of Chicago, has made that city a gift of a public playground for children in a crowded district. The piece of property so donated is 300 ft. long and 85 ft. wide, located along Alaska Street, between Larrabee and Town Streets. The company will not only donate the land but fit it up for a playground. As it is in one of the poorer districts it should be a great benefit to the neighborhood.

New York has been agitated during the last week on the question whether there would be a strike on the elevated railway. The engineers, who receive $3.50 a day, claimed that the company was requiring them to make more trips in a day with the new electric trains than with the steam equipment and that they were being worked longer hours. Several interviews were had with General Manager Skitt on the subject, and in the final conference, held Aug. 12, the disputed points were finally settled. The agreement made at that meeting was not made public, but the following statement was officially issued, covering the principal points in question: "The matters in dispute were finally narrowed down to the question of hours for a day's work, and the limit of ninety miles per day. The engineers waived the question of miles and the company conceded the nine-hour day. Agreement was signed and conference ended."

Papers at the Detroit Convention

A complete list of the papers to be presented at the convention of the American Street Railway Association, at Detroit, has been announced by the secretary. It is as follows:

"The Registration of Transfers," by C. D. Meneely, of the Brooklyn Heights Railroad Company; "The Benefit Associations," by Oren Root, Jr., of the Metropolitan Street Railway Company, of New York City; "The Discipline of Employees by the Merit System," by W. A. Satterlee, general manager of the Metropolitan Street Railway Company, of Kansas City, Mo.; "Transportation of Light Express and Parcel Delivery," by Geo. W. Parker, general express and passenger agent of the Detroit United Railway; "Steam Turbine Engines," by E. H. Sniffin, of New York; "Signals for Urban and Interurban Railways," by some officer of the Old Colony Street Railway Company, of Boston; "Adjustment of Damage Claims," by M. B. Starring, counsel of the Chicago City Railway Company.

In addition to the above papers reports are expected from the committee on standards, which was appointed two years ago, and which rendered a report on this important subject last year, and also from the committee on rules for the government of employees, which has been appointed during the last year by President Vreeland, in accordance with action taken by the association at its last annual meeting. These two committees are composed as follows:

COMMITTEE ON STANDARDS

N. H. Heft, New Haven, Conn.
E. G. Connette, Syracuse, N. Y.
C. F. Holmes, Kansas City, Mo.
John I. Beggs, Milwaukee, Wis.
E. A. Newman, Portland, Me.
R. T. Laffin, Worcester, Mass.
Will Christy, Akron, Ohio.

COMMITTEE ON RULES FOR THE GOVERNMENT OF EMPLOYEES

J. C. Brackenridge, Brooklyn Heights Railroad Company.
E. C. Foster, Old Colony Street Railway Company, Boston, Mass.
T. E. Mitten, Buffalo Railway Company.
W. E. Harrington, Camden & Suburban Railway Company, Camden, N. J.

Bishop M. J. Hoban, John Mitchell, president of the mine workers; Wm. C. Corliss, president of the Scranton Typographical Union; W. F. Hallstead, former general manager of the Delaware, Lackawanna & Western Company, and W. H. Taylor, a merchant, comprising the board of arbitration to settle the dispute between the Scranton Railway Company and its union employees, rendered a decision Aug. 6. One of the clauses of the agreement made at the close of the six months' strike on April 7, 1902, was that after a certain time preference as to runs should be regulated by length of service. The company maintained that this meant that the returned strikers should have their term of service date from April 7, when they came back to work. The men contended that it was understood they should be credited with the time they had served prior to the strike.

The arbitrators decided in favor of the men, but made a ruling that the non-union employees who came to work during the strike and who were retained by the company shall not be disturbed. If the company cannot provide regular runs for all the former strikers, who by "length of service" should be preferred to the men who took runs during the strike, it is to pay them a bonus that will make their wages equal to those they would receive if they had regular runs.

Automatic Car-Type Circuit-Breaker

The protection of railway motor equipments by the use of a fuse has until recently been generally recommended, but the fuse frequently fails to blow at the proper time, or to give the equipment the best protection under all conditions of service. The necessity of carrying extra fuses, as well as the inconvenience of stopping the car to replace a blown-out fuse, is another objection,

WESTINGHOUSE AUTOMATIC CAR CIRCUIT-BREAKER

and many railway companies are now replacing the fuse block with the automatic car circuit-breaker, which will open automatically when the current reaches the value for which it is set.

Aside from the protective feature of a circuit breaker the convenience in resetting it is obviously of great value. The motorman in throwing the handle of the breaker after a heavy overload or short circuit, is not required to leave his position at the controller to put the car in service. In most cases it is not necessary to stop the car, as the breaker can be reset while drifting.

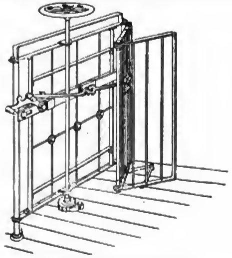
The automatic car circuit-breaker manufactured by the Westinghouse Electric & Manufacturing Company performs the function of the fuse block by opening an overload or short circuit. It is also intended to replace the platform or canopy switch, in that it provides a hand-opening for the circuit. In construction the instrument is thoroughly fireproof, of the best material and workmanship throughout, and all parts are interchangeable. Its design prevents any arcing at the current-carrying contacts, as the arc is broken on extra contacts, especially provided for the purpose, and assisted by a powerful magnetic blow-out, which will open the severest short circuit without damage. The breaker is calibrated, and can be set to open at any current within the limit of its range. The automatic opening device insures action when the current reaches the predetermined value.

An Improved Platform Gate for Elevated Service

The accompanying illustration gives a good idea of the details of a new platform gate now being put on the market by the R. Bliss Manufacturing Company, of Pawtucket, R. I. This gate combines the well-known features of safety and economy of space which has made the gates manufactured by this concern for surface cars so popular with a large number of operating men throughout the country, with the combination of an actuating handle for opening and closing from the middle of the platform. The gate is a modification of a high gate for elevated service, recently perfected by the Bliss Company, but instead of having lazy tongs at the top of the gate they are placed at the bottom. In this position they serve their purpose of giving the gate its proper rigidity in any position as well as if they were above, but greatly reduce the liability of pinching the passengers' fingers while the gate is being operated. If anything, it is claimed, the new gate is stronger than the ordinary straight gate, and the danger of passengers being thrown from the car by a sudden lurch or by crowding is reduced to a minimum.

As in the well-known surface-car folding gate, one of the principal features of merit is the small amount of space occupied by the gate when opening, and it is claimed for the new gate that it will save the room of three people on the platform, as in opening it doubles in half its reach. While more particularly intended for use on elevated roads the gate can be employed as well for surface-electric and steam cars, and is applicable to double doors and vestibule cars. It is simple in construction and manipulation, and its action is claimed to be absolutely positive, locking in and out both ways, so that whether open or closed there is no danger of its being thrown unintentionally.

The general features of the gate are shown in the illustration. The workmanship and material employed is of the best, all parts being thoroughly manufactured and fitted to the gate as assembled.



IMPROVED PLATFORM GATE

Instead of a bell crank on the handle a straight lever is used, hinged at the bottom, and connected to the actuating sleeve by a solid link. This gives the gateman a powerful leverage and enables the gate to be forced to with precision under the most trying conditions of crowding. The R. Bliss Manufacturing Company has had a great deal of experience in the manufacture of all kinds of car gates, and this latest production from their designing room contains the best features of safety, strength and durability that the company has developed.

Insulator for High-Voltage Transmission

With the rise in transmission line voltage insulation problems have been introduced of no mean proportions in long-distance power transmission engineering, and to meet these new conditions there has been worked out special types of pole-line insulators. An illustration of this class is shown herewith. It comprises the

HIGH-VOLTAGE TRANSMISSION INSULATOR

latest type of these insulators, and is placed alongside a standard glass telegraph insulator for the purpose of showing their relative size. The former is 14 ins. across the hood, 11½ ins. high and weighs 18 lbs. The manufacturer, Fred. M. Locke, of Victor, N. Y., says that the insulator is made of a special mixture of clay, and that it will withstand a test voltage of 160,000 and a working voltage of 80,000.

Sale of Omaha Street Railway.

A syndicate of New York bankers, headed by J. & W. Seligman Company, has closed a deal for the purchase of the Omaha Street Railway. The purchasers secure all of the stock, and the purchase price is reported to have been $92 per share for stock of a par value of $100.

The property consists of the Omaha Street Railway, the Council Bluffs & Suburban Company, the Omaha & Council Bluffs Bridge & Motor Company, and a bridge over the Missouri between the two cities. It constitutes a monopoly of the street car traffic of the two cities.

Strike at New Haven

Under what are said to have been the most extraordinary conditions surrounding any conflict between capital and labor that has ever been waged in Connecticut, the Fair Haven & Westville Railroad was completely tied up from Aug. 6 until Aug. 10, through a strike of conductors and motormen. With the exception of the operation of mail cars, street railway service in New Haven was entirely tied up while the strike was in progress. Immediately after the strike had been declared, a committee representing the business interests of the city began an effort to bring about an amicable settlement of the differences between the company and its employees, and it was through the efforts of this committee that the strike was terminated. Following is the agreement under which the strike is settled, signed by the company, through H. S. Parmelee, president:

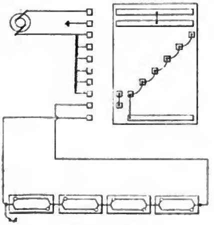
To the Motormen and Conductors of the Fair Haven & Westville Railroad Company: Your communication of this date is received. The Fair Haven & Westville Railroad Company will receive, at all reasonable times, a committee consisting of employees of the company only to receive and consider the grievances that may arise, and will use all reasonable effort to redress them fairly. Membership in the Amalgamated Association of Street Railroad Employees is not now and will not be in the future just cause for discharge from employment of said company. If desired, copies of all assurances made to the Business Men's Committee will be given, addressed to the motormen and conductors of the company, signed by the president, and, as stated to the committee of business men, if the strike be terminated speedily the twenty-one men recently discharged will be reinstated unconditionally.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED AUG. 5, 1902

706,020. Train Control System; F. E. Case, Schenectady, N. Y. App. filed Jan. 7, 1901. Means are provided for preventing the further operation of the master controller in case any of the sub-controllers fail to operate.



PATENT NO. 706,295

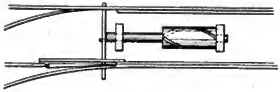
706,024. Switch Operating Mechanism; G. L. Cooper, Bridgeport, Conn. App. filed Dec. 6, 1901. The switchpoint is thrown and reset by devices on the car.

705,041. Car Fender; A. M. Ferguson, Ste. Cunégonde and J. A. U. Beaudry, Montreal, Can. App. filed Nov. 14, 1901. Details.

706,092. Trolley Pole Catch; J. A. Norton, Wilkesbarre, Pa. App. filed Nov. 19, 1901. In case the trolley pole strikes a cross wire and is thereby thrown violently downward, it is automatically caught and held by a latch.

706,106. Electric Railway; W. B. Potter, Schenectady, N. Y. App. filed Nov. 18, 1896. A third rail system which at stations or crossing is changed into a sectional normally dead system.

706,147. Brake-Shoe Lubricating Filler; R. D. Baldwin, Chicago, Ill. App. filed Oct. 26, 1901. The face of the shoe contains a lubricating composition insert.



PATENT NO 706,266

706,211. Trolley Wheel; R. H. Apelt, Boston, Mass. App. filed March 30, 1901. Structural details.

706,266. Switch; G. H. Smith, Boston, Mass. App. filed Sept. 25, 1901. A drum having a spiral groove is engaged by a pin carried by the car, and is rotated to throw the switch.

706,295. Starting Mechanism; J. B. Blood, Newburyport, Mass. App. filed Aug. 28, 1901. Pressure controlling devices located on each car have to be in coincident condition in order to send forward the starting signal.

706,338. Trolley Wire Finder; L. C. Nolan, St. Paul, Minn. App. filed April 11, 1902. A pivoted fork arranged to be thrown above the wheel.

PERSONAL MENTION

MR. FRANK MILLER, formerly superintendent and passenger agent of the Worcester & Webster Street Railway, Worcester, Mass., has accepted the position of salesman with C. J. Harrington, of New York, manufacturer of electric railroad and line material. Mr. Miller will cover the New England territory.

MR. WILLIAM E. DICKEY, who was recently connected with the United States Navy as past assistant engineer, has opened an office at 16 Murray Street, New York City, where he will represent The Goulds Manufacturing Company, of Seneca Falls, N. Y., and The West Point Boiler Works, of Pittsburgh, Pa.

MR. E. T. SELIG, late superintendent of the Citizens' Railway Company, of Fort Scott, Kan., has been appointed secretary and manager of the Mount Vernon Electric Railway Company and the Mount Vernon Electric Light Company, of Mount Vernon, Ohio, to succeed Mr. G. E. Johnson, who resigned on account of ill health.

MR. D. W. DOZIER resigned his position as chief mechanical engineer of the Metropolitan Street Railway Company, of Kansas City, Mo., on Aug. 1. Mr. Dozier installed the first engines for the cable line of the Grand Avenue Railway Company, and upon the completion of the plant was retained in the service of the company. He has ever since been identified with the Kansas City street railways.

MR. CLARENCE FROST HORTON died at San Fernando, P. I., from brain fever on July 31. He was born in Peekskill, N. Y., thirty years ago, and was educated at the public schools, the Peekskill Military Academy and Columbia School of Mines. He was graduated in 1894 and then was appointed to a responsible place on the engineering staff of the Rapid Transit Commission in New York. Later he did private work in surveying and engineering. Then he accepted a place in the United States Geodetic Survey. A year ago last month he was sent to the Philippines and was soon made a provincial supervisor with headquarters at San Fernando. He leaves a young wife, formerly Miss Bertha Carrick, of Delmar, Albany County, whom he married in December, 1900, and who accompanied him to the East. He is survived also by three brothers and two sisters.

FINANCIAL INTELLIGENCE

THE MARKETS

WALL STREET, Aug. 13, 1902.

The Money Market

Notwithstanding the influx of currency from the interior, and the continued heavy disbursements by the National Treasury on account of pension payments, a decidedly firmer tone prevails in the money market. This is due principally to a further demand in the local bank reserves of over $4,000,000, and an increased demand from borrowers made necessary by the larger transactions in stocks and bonds. Money on call rose from 2¼ to 4 per cent, while time contracts are hard to obtain under 5 per cent. The supply of lendable funds appears to be much smaller than a week ago, and indications point to a continued firmer market for an indefinite period. The movement of money to facilitate the handling of the crops has already begun in the West, and it is only a question of a comparatively short time when the local institutions will be called upon to furnish funds for this purpose. Preparations are now making to that end, and as the crops promise to be extremely large, the movement from this centre will probably be sufficient to keep rates at the present level. Shipments of gold to Europe have been arrested by the sharp advance in sterling rates at Paris, and it is not considered likely that this movement will be resumed during the present season, as bills against grain and cotton shipments are expected shortly in sufficient quantities to keep the rates of exchange below the gold export point. Aside from a temporary advance in the discount rate at Berlin, the condition at the principal European centres are about unchanged. Call loans are made freely in the open market at from 3½ to 4 per cent, while time contracts are made at 5 per cent for from three to six months on good mixed collateral.

The Stock Market

While there has not been any great activity in the market, the trend of values is to a higher level. The upward movement, however, is kept on a legitimate basis by frequent reactions. The market is now absolutely in the control of the speculative forces as represented by the so-called Western contingent, better known as the Gates interest, whose operations are on a large scale. The one strong feature of the speculative situation is the concentrated manner in which securities are held. While the high prices have brought out a considerable amount of stocks from strong boxes, these have readily been absorbed, and the floating supply is too small to admit of any aggressive operations for the bear account. The Gould stocks have been and may continue conspicuous, and with an outlet to the seaboard for the Wabash through the Western Maryland, at Baltimore, the Gould system of roads probably will receive more attention. The anthracite coal strike is on its last legs, and it will be only a short time before operations are resumed at several of the important mines. Interest centres in the action that will be taken on the Reading dividend, but it is pretty certain that the dividend on the first preferred will be declared as usual, and that the voting trust will be terminated. This accounts for the strength of the coal shares. The very favorable crop report, and the prospects of a yield of 2,600,000,000 bushels of corn, and an average crop of wheat, will impart a healthy tone to general trade, and with an active commercial business the railroads will earn more money than ever before in their history. The industrial stocks are growing in favor, as a result of the determined stand taken by the United States Steel Corporation in fighting all attacks. The opinion is widely held that this class of securities and the lower-priced railroad shares will be the centre of activity during the next two months.

The local traction group have been quiet. Interest centered in Manhattan by reason of the strike agitation. When the possibility of the engineers striking first developed, the professional traders made haste to sell the stock. The floating supply was too small for the successful carrying out of an aggressive bear campaign, and when a compromise between the men and the company was arrived at, the stock rallied sharply. The Street inclines steadfastly to the belief that the acquisition of the elevated system by New York Central interests is only a matter of time. This in addition to the expected increase in business to follow the installation of electricity on all the Manhattan lines, precludes heavy selling of the shares. The other traction stocks have been dull and featureless, without noteworthy change in quotations.

Chicago

There is not much to be said about the week's trading in Chicago traction stocks. The whole volume of transactions probably did not exceed 2000 shares, and no one issue came into any particular prominence. Metropolitan Elevated bonds were well bought around 101 on the excellent earnings of the company which are attracting a good deal of comment. We published the fact last week that the increase for July amounted to 23 per cent over the gross receipts of a year ago. It is expected that the August comparison will be equally good. Metropolitan shares have been in fair demand, with small sales of the common at 39. The activity in Northwestern Elevated, remarked a week ago, has completely subsided. Lake Street recovered a half point or more, and was steady around 10¼. South Side sold at 110. Scarcely anything at all has been done in the surface line stocks. City Railway changed hands at 215, but Union Traction was neglected. West Chicago selling ex-dividends, declined from 95⅝ to 95.

Philadelphia

Interest in the Philadelphia traction properties during the week has been taken up mainly with the plans and rumors of plans of the syndicate behind the Rapid Transit deal. Union Traction reached a new high record of 47½, but Philadelphia Rapid Transit did not reach again the previous high figure of 13⅞. Both issues during the last few days have reflected heavy profit-taking by speculators who benefited by the rise. On the other hand, Fairmount Park Transportation, which had begun to advance a week ago, was bid up very sharply to 30¼—a gain of 10 points in a fortnight. The movement was based entirely upon the story that the Rapid Transit people were seeking control of the road, and that they had offered 30 for a controlling interest. This report was denied from official sources, but the denial did not have much effect upon speculation in the stock. Philadelphia Traction, on moderate trading, held very steady at 99¾. American Railways was stronger and more active than in some time past, selling up to 48¼. A few sales were reported in Rochester Railway common at 66½ and in Indianapolis Street Railway, which also touched a new high record—89.

Other Traction Securities

Practically nothing has been done in the Boston stocks during the week. Massachusetts Electric continues to reflect some pressure, the common selling down to 40 and the preferred to 97½. Sales of a few odd lots were reported in Boston Elevated at 162 and West End common at 96. In Baltimore it has also been a very dull week. Nashville Railway maintains strength on pool support, the 5 per cent certificates selling up to 74¾ from 73¼, and the stock holding stiff around 6. United Railway incomes are a shade lower at 70¼, and the 4s at 97¼. Other sales include Newport News and Old Point 5s at 109½, City & Suburban (Baltimore) 5s at 114¾ and Baltimore Traction 5s at 117¾. Accumulation of North Jersey Railway securities in the local markets continues, the stock getting up above 35 and the 4 per cent bonds selling at 83¾. No further information is obtainable, however, concerning the much-talked-of consolidation in that territory. The New York curb sales for the week include New Orleans Railways 4½ per cent bonds at 89 and 89¼, Toledo Railway at 33½, San Francisco common at 22½, and the preferred at 63⅛ down to 61⅞.

Sales of traction stocks on the Cleveland Stock Exchange last week numbered only 2482 shares, as compared with almost 10,000 for the week before. Cincinnati, Dayton & Toledo again held the center of the stage, total sales being 1417 shares, opening at 25¾ and closing at 26¾. Northern Ohio Traction preferred went to 90 on sales of 300 shares. The common was steady at 45; 100 shares selling. Toledo Railways & Light was steady at 33; 175 shares selling. Cleveland Electric Railway advanced to 80¼ for 150 shares. Lake Shore Electric advanced to 19¼; 150 shares selling. The speculation in this stock is rather surprising, in view of the fact that the details of the financing plan for reorganizing the company have not yet been perfected, and there is possibility of immediate assessments. C. D. & T. 5 per cent bonds brought 84 on par value of $6000, and Western Ohio 5s par value $15,000 sold up from 83 to 83¾. Monday, $31,000 C. D. & T. 5s sold at 84¾ and 85, and $10,000 Western Ohio 5s went at the same mark. Seven hundred shares of Cincinnati, Dayton & Toledo sold at from 26⅝ to 27, the latter the closing figure. A small lot of Lake Shore Electric common went at 18½.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Aug. 5	Closing Bid Aug. 12
American Railways Company	47	50
Boston Elevated	164	161½
Brooklyn R. T.	69	67⅝
Chicago City	215	210
Chicago Union Tr. (common)	15½	15¼
Chicago Union Tr. (preferred)	50	48
Cleveland Electric	86¼	86
Columbus (common)	62	64
Columbus (preferred)	107¼	107
Consolidated Traction of N. J.	69½	71¼
Consolidated Traction of N. J. 5s	110½	111
Detroit United	85⅝	85⅝
Electric People's Traction (Philadelphia) 4s	99½	99¾
Elgin, Aurora & Southern	43	40
Indianapolis Street Railway 4s	87¾	—
Lake Street Elevated	9½	10⅝
Manhattan Railway	126¼	134
Massachusetts Elec. Cos. (common)	41	41
Massachusetts Elec. Cos. (preferred)	97¾	97¾
Metropolitan Elevated, Chicago (common)	39	39½
Metropolitan Elevated, Chicago	91½	91½
Metropolitan Street	149	148½
North American	123½	123
Northern Ohio Traction (common)	44½	41½
Northern Ohio Traction (preferred)	89	90
North Jersey	30½	35½
Northwestern Elevated, Chicago (common)	37	36½
Northwestern Elevated, Chicago (preferred)	84	—
Philadelphia Rapid Transit	13¾	14
Philadelphia Traction	99⅝	99¾
St. Louis Transit Co. (common)	31¼	31⅝
South Side Elevated (Chicago)	110	112
Southern Ohio Traction	72	77½
Syracuse Rapid Transit	27¾	30
Syracuse Rapid Transit (preferred)	76	74
Third Avenue	132	130
Toledo Railway & Light	30	32½
Twin City, Minneapolis (common)	123½	126
United Railways, St. Louis (preferred)	83½	*85
United Railways, St. Louis, 4s	87¼	87¼
Union Traction (Philadelphia)	47	47⅛
Western Ohio Railway	25¼	25¼
New Orleans Railways (common)	16	—
New Orleans Railways (preferred)	56¼	57½

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

The condition of the iron and steel market continues to be about the same as described last week; that is, the demand continues to run far ahead of the production in the leading branches of the trade, and fancy premiums have to be paid for prompt delivery. In the meantime there are reports of the arrival of large lots of foreign pig and billets. Many of the companies report orders for delivery extending far into next year. The quotations are as follows: $21.75 to $22, for Bessemer pig, $32 for steel billets and $28 for steel rails.

Metal

The quotations for the leading metals are as follows: Copper, 11.60 cents; tin, 28.50 cents; lead, 4⅛ cents; spelter, 5⅜ cents.

CHICAGO, ILL.—The Metropolitan Elevated Railroad Company has declared a semi-annual preferred dividend of 1½ per cent, payable Aug. 30; books close Aug. 16 and reopen Aug. 30.

CHICAGO, ILL.—It is said that the plan for the reorganization of the Lake Street Elevated Railroad will be announced about Sept. 1.

WORCESTER, MASS.—The Railroad Commissioners have authorized the Worcester Consolidated Street Railway Company to issue 3500 shares of new stock at $116 a share, to purchase real estate, rolling stock and equipment and for building extensions.

NORTH ADAMS, MASS.—The Railroad Commissioners have authorized the Hoosac Valley Street Railway Company to issue 300 new shares of stock at $105 per share for extensions and additions to the railway property.

ST. LOUIS, MO.—July was a record-breaking month in earnings of the St. Louis Transit Company. The monthly statement, issued Aug. 6, shows gross earnings of $575,173, as against $505,723 in July, 1901, a total gain of $69,450. This is the largest gain made during a single month in the history of the company. Officials of the company say that all the roads are on a better earning basis now than at any time since they were merged. Indications are that the deficit of last year, amounting to $525,630, will be wiped out by the next annual meeting, and that a substantial balance will be shown.

ST. LOUIS, MO.—The stockholders of the St. Louis & Suburban Railway and the St. Louis & Meramec River Railway Company, a constituent of the former, have been requested to meet on Sept. 24, to pass upon certain important propositions. The trustees, who are reorganizing these roads, propose to increase the present capital of the Suburban from $2,500,000 to $7,500,000, and the capital of the St. Louis & Meramec River Railway Company from $2,000,000 to $3,000,000. The bonded indebtedness of the Suburban, now $2,585,000, will be increased to $7,500,000, the old bonds being retired. In the case of the second road the bonded indebtedness of $1,000,000 is to be increased to $2,000,000, and the old indebtedness retired.

NEW YORK, N. Y.—The shareholders of the Interborough Rapid Transit Company will vote, Aug. 26, upon a proposition to increase the capital stock of the company from $25,000,000 to $35,000,000.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

June	1902	1901
Gross receipts	$1,165,287	$1,181,023
Expenses, including taxes	732,152	732,740
Net receipts	$433,135	$448,282
For twelve months ending June 30		
Gross receipts	$12,789,704	$12,101,197
Expenses, including taxes	8,952,214	7,970,634
Net receipts	$3,837,490	$4,130,563

ROCHESTER, N. Y.—A certificate of consolidation of the Rochester & Sodus Bay Railway and the Irondequoit Park Railroad Company has been filed with the Secretary of State. The new corporation is to be known as the Rochester & Sodus Bay Railroad Company, and its capital stock is $1,850,000. The directors are: T. J. Nicholl, G. G. Morehouse, Rochester; Benjamin Strong, F. K. Trask, C. A. Burbank, Joseph E. Beckley, New York; D. W. Gibbs, Montclair, N. J.; John L. Lockwood, Jr., Rosland, N. J.; Arthur C. Vaughn, Garden City, N. Y.

NEW YORK, N. Y.—The committee on stock list of the New York Stock Exchange has granted the application of the Metropolitan Street Railway to list $12,780,000 of its 4 per cent refunding one hundred-year gold mortgage bonds. The mortgage securing the bonds is a refunding mortgage to secure an issue of not exceeding $65,000,000 of bonds bearing interest at a rate not exceeding 4 per cent per annum, which by the terms of the mortgage are subject to issue as follows: $48,196,000 is reserved to retire existing funded obligations of the Metropolitan Street Railway Company and various subsidiary companies aggregating said amount, and $11,000,000 is subject to issue upon the order of the board of directors. The remainder, $5,801,000, is reserved, subject to the terms of the mortgage, for refunding purposes, until Jan. 1, 1920, after which date any balance not required for refunding purposes may be issued upon the order of the board of directors.

DOLGEVILLE, N. Y.—The Little Falls & Dolgeville Railway was disposed of at public auction on mortgage foreclosure a few days ago. The property was bid in for $260,000 for a committee of first mortgage bondholders, Judge Robert Earl, of Herkimer; Dumont Clark, of New York, and George R. Smit., of Little Falls. It is said that the road will be equipped with electricity.

COLUMBUS, OHIO.—The Central Market Street Railway Company has increased its capital stock from $500,000 to $1,500,000; three-fourths of the amount of increase is in preferred stock. S. B. Hartman is president, and F. W. Merrick secretary of the company, which was formed to operate the city portion of the interurban lines by the Appleyard syndicate.

COLUMBUS, OHIO.—The Everett-Moore holdings in the Scioto Valley Traction Company, amounting to 60 per cent of the capital stock, have been sold. The road is being built from Columbus to Circleville, and from Columbus to Lancaster. A reorganization of the company has been effected. Col. J. C. Hooven, of Hamilton, was elected chairman of the pool entered into by those who purchased the Everett-Moore holdings. Edwin R. Sharp, of Columbus, was chosen president; Frank H. Davis, treasurer; William Burdell, vice-president. The office of president, which was vacated by Barney Mahler, of Cleveland, will be filled later. Columbus people now own 70 per cent of the stock of the company, and the balance is held in Cincinnati.

CINCINNATI, OHIO.—Stockholders of the Mill Creek Valley Street Railway Company and the Hamilton, Glendale & Cincinnati Traction Company will meet on Aug. 27 to vote on the proposition of leasing the lines to the Elkins-Widener Syndicate. The two companies are practically identical, and cars operate over their line from Cincinnati through to Hamilton. The deal has been held up for some months on account of litigation, which has been keeping the line out of the center of Hamilton. This difficulty, however, has now been settled. The Mill Creek Company is capitalized at $1,750,000, of which $750,000 is 5 per cent preferred stock. The Hamilton, Glendale & Cincinnati has $250,000 capital stock, all of which is 5 per cent preferred. The proposition made by the leasing is to guarantee the 5 per cent interest on $1,100,000 preferred stock and a gradoated scale of interest starting at ½ per cent and scaling to 4½ per cent in seven years, on $1,000,000 common stock. The proposition increases the preferred stock $100,000. The officers of both companies are: H. H. Hoffman, president; Bayard Kilgour, vice-president; Henry Burkhold, secretary-treasurer. The lease will probably mean the entrance into Cincinnati of the large interurban traffic, which heretofore has been kept out of the city.

PHILADELPHIA, PA.—President Parsons, of the Philadelphia Rapid Transit Company, is quoted by the Philadelphia News Bureau as saying that negotiations for the purchase of the Fairmount Park Transportation Company are not now, nor never have been, in progress. "We have not the slightest idea of acquiring the property, and the matter has never been formally discussed by our directors," President Parsons is quoted as saying.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., June '02	67,681	36,540	31,041	14,121	17,021
	1 " " '01	58,191	32,186	26,009	13,066	15,946
	6 " " '02	318,987	166,852	152,575	77,056	66,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,165	136,162	130,004
	12 " " '00	513,722	* 317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., July '02	140,209	89,013	51,197	23,865	27,331
	1 " " '01	134,870	79,638	54,232	......	......
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,076	......	......
	1 " " '01	15,678	9,341	6,337	......	......
	10 " " '02	197,668	108,986	88,672	......	......
	10 " " '01	169,756	94,355	75,401	......	......
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,969,496	7,836,597	3,532,899	2,896,350	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,516,287	4,650,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., June '02	1,165,298	* 732,152	433,146	......	......
	1 " " '01	1,181,083	* 732,740	448,343	......	......
	12 " " '02	12,749,716	*8862214	3,887,490	......	......
	12 " " '01	12,101,198	*7970635	4,130,563	......	......
BUFFALO, N. Y.						
International Tr. Co.	1 m., May '02	264,184	146,787	117,396	97,330	20,066
	1 " " '01	291,666	161,077	130,589	92,030	38,560
CHARLESTON, S. C.	1 " " '00	209,309	115,487	93,822	78,250	15,572
Charleston Consol'ted Ry. Gas & El. Co.	6 m., May '02	309,572	208,325	191,248	75,826	115,422
	6 " " '01	245,745	150,495	95,250	75,714	9,607
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., July '02	23,591	7,556	16,035	......	......
	1 " " '01	23,459	7,680	15,770	......	......
	7 " " '02	102,641	45,638	56,993	......	......
	7 " " '01	88,920	42,091	46,829	......	......
Lake Street Elevated	12 m., Dec. '01	786,462	398,799	387,663	......	......
	12 " " '00	757,964	378,661	379,298	......	......
Union Traction Co.	12 m., June '02	7,942,468	4,570,719	3,371,749	3,819,277	† 947,398
	12 " " '01	8,158,800	3,942,194	4,216,615	4,058,040	158,575
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	......	......
	1 " " '01	3,435	3,016	† 581	......	......
	12 " Dec. '01	47,976	* 32,002	15,974	13,023	2,951
	12 " " '00	49,646	* 33,772	16,874	13,294	3,080
Cleveland & Eastern	1 m., Feb '02	4,916	3,616	1,300	......	......
	1 " " '01	3,535	4,047	† 512	......	......
	12 " Dec. '01	90,390	52,022	38,368	43,678	† 4,310
	12 " " '00	82,898	56,672	26,221	36,148	† 9,927
Cleveland El. Ry. Co.	1 m., May '02	217,663	......	......	......	......
	1 " " '01	187,049	......	......	......	......
	5 " " '02	982,800	......	......	......	......
	5 " " '01	854,504	......	......	......	......
	12 " Dec. '01	2,396,808	1,365,953	1,030,945	344,231	780,714
	12 " " '00	2,061,508	1,121,037	940,467	258,493	681,964
Cleveland, Elyria & Western	1 m., June '02	25,198	13,026	12,172	......	......
	1 " " '01	22,236	9,736	12,501	......	......
	6 " " '02	128,392	77,728	50,664	......	......
	6 " " '01	107,027	64,259	42,768	......	......
	12 " Dec. '01	249,290	136,886	112,394	57,023	55,371
	12 " " '00	179,698	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., June '02	17,747	9,520	8,227	......	......
	1 " " '01	15,749	8,035	7,714	......	......
	6 " " '02	79,537	44,670	34,857	......	......
	6 " " '01	65,449	36,228	29,221	......	......
	12 " Dec. '01	161,971	* 87,102	77,869	72,500	5,369
	12 " " '00	141,112	* 69,582	71,530	72,500	† 980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., June '02	77,548	* 42,671	34,875	15,614	19,261
	1 " " '01	72,201	* 42,147	30,054	15,746	14,308
	6 " " '02	422,150	*247,877	174,273	93,085	81,248
	6 " " '01	384,686	*235,858	148,786	94,105	54,681
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,516	66,533	57,983	32,863	26,119
	1 " " '01	116,367	62,866	53,490	31,304	22,186
	4 " " '02	481,348	261,118	220,230	131,258	88,972
	4 " " '01	435,297	236,915	198,382	125,622	73,759
	12 " Dec. '01	1,507,298	818,521	688,965	383,180	305,785
	12 " " '00	1,302,384	722,458	579,830	274,291	305,548
DETROIT, MICH.						
Detroit United Ry.	1 m., June '02	291,470	* 159,333	132,137	......	......
	1 " " '01	260,109	* 139,412	120,697	......	......
	6 " " '02	1,600,675	* 917,044	683,631	395,789	297,892
	6 " " '01	1,384,181	* 775,347	608,834	345,119	263,715
	12 " Dec. '01	2,919,171	*1596785	1,322,046	652,277	670,129
	12 " " '00	2,575,275	*1439056	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " '01	28,877	18,062	10,816	9,606	1,194
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., June '02	48,497	22,136	26,361	9,653	16,708
	1 " " '01	39,265	20,076	19,189	9,188	10,001
	6 " " '02	245,400	142,413	112,992	57,844	55,148
	6 " " '01	208,339	119,603	88,736	54,766	33,970
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., July '02	40,472	21,197	19,275	8,333	10,941
	1 " " '01	36,454	16,218	20,236	8,330	11,905
	7 " " '02	236,929	136,728	90,206	58,330	31,874
	7 " " '01	204,100	119,142	84,960	58,338	26,667
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., June '02	20,714	9,909	10,805	......	......
	1 " " '01	16,257	8,990	7,368	......	......
	6 " " '02	111,978	60,844	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,869	7,800	5,069
	1 " " '01	23,590	14,465	9,125	7,800	1,325
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT.						
London St. Ry. Co.	1 m., June '02	13,640	8,558	5,084	2,287	2,797
	1 " " '01	13,917	7,997	5,920	2,046	3,874
	6 " " '02	65,064	43,167	21,897	13,593	8,304
	6 " " '01	60,112	39,951	20,161	11,962	8,239
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., June '02	222,450	107,193	115,257	66,015	49,242
	1 " " '01	202,416	94,450	107,966	62,760	45,207
	6 " " '02	1,274,629	612,304	662,325	389,554	272,771
	6 " " '01	1,123,765	566,463	557,302	365,328	171,978
	12 " Dec. '01	2,442,344	1,185,534	1,256,808	755,139	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	884,665	206,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., May '02	296,991	136,964	160,028	58,723	101,304
	1 " " '01	251,946	114,340	137,606	56,635	80,971
	5 " " '02	1,356,554	649,006	707,552	292,800	414,752
	5 " " '01	1,178,257	563,664	614,593	273,092	341,498
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., June '02	187,668	80,655	107,007	19,391	87,615
	1 " " '01	160,926	97,782	83,144	14,272	68,871
	9 " " '02	1,445,190	846,862	598,367	144,299	453,969
	9 " " '01	1,355,066	841,409	573,557	90,298	483,259
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,088,465	1,404,971	1,633,465	733,135	890,329
	3 " " '00	2,728,594	1,340,696	1,387,904	749,857	638,045
	12 " Sept. '01	10,455,872	5,308,649	5,187,223	2,882,122	2,444,091
	12 " " '00	9,950,720	5,196,312	4,754,408	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786,090	1,690,649	2,096,381	1,138,467	947,914
	12 " June '02	15,466,641	7,846,993	8,480,758	4,813,421	3,066,337
	12 " " '01	14,720,767	6,755,181	7,965,586	4,584,066	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	12 m., June '02	56,065	29,118	26,947	16,318	10,619
	12 " " '01	54,018	26,228	25,790	16,755	9,035
PHILADELPHIA, PA.						
American Railways	1 m., July '02	119,870	......	......	......	......
	1 " " '01	99 65	......	......	......	......
	12 " June '02	1,000,500	......	......	......	......
	12 " " '01	844,298	......	......	......	......
ROCHESTER, N. Y.						
Rochester Ry.	1 m., June '02	89,236	46,809	42,436	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	507,748	298,006	239,737	148,604	91,180
	6 " " '01	495,266	306,966	188,259	147,157	41,102
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., June '02	60,863	34,780	26,064	19,085	7,089
	1 " " '01	56,952	30,942	26,010	18,947	7,063
	12 " " '02	603,281	294,255	309,019	228,246	80,773
	12 " " '01	621,299	340,890	280,409	223,918	56,580
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., June '02	122,692	65,148	57,539	37,854	19,685
	1 " " '01	112,900	58,928	58,978	24,271	34,707
	6 " " '02	671,264	352,352	318,912	227,053	91,859
	6 " " '01	598,928	303,402	295,535	145,635	149,901
	12 " Dec. '01	1,311,084	* 636,407	674,677	415,168	259,509
	12 " " '00	1,162,517	* 616,945	565,572	409,051	156,521
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	† 3,986
	3 " " '01	56,936	35,600	22,336	25,000	† 2,663

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The Advantages of Consolidation

Whatever may be the opinion of political economists as to the desirability to the public of the suppression of trusts, there can hardly be any question, we believe, as to the benefits to be derived from the consolidations of natural monopolies. The street railways of a city fall under the category of natural monopolies, and the tendency during the last ten years toward the unification of all the systems in one city has been very marked. In fact, it is difficult to cite more than a very few cities where the entire system is not in the hands of one company, and in these exceptions the separate companies are few in number and each serves exclusively a very large territory, so that they are not real exceptions to the rule. In other words, competition in local transportation in the cities of this country is practically past, and the public is better served as a whole, has better cars and can ride longer distances for a single fare than ever before in the history of the country.

One of the large cities of the United States in which the plan of many competing companies was maintained for a longer period than in almost any other, but in which the systems have finally become consolidated during the past few months, is New Orleans, and steps are now being taken which were impossible before to give improved transit facilities in that city. Like most American cities, there was one principal business street, Canal Street, and each competing company in former days considered it necessary to run cars and to have its principal terminal on this street. Fortunately, the street was a wide one, and as a result there were five separate tracks extending practically its entire length, with unavoidable congestion of street traffic. The consolidated company now proposes to remove most of these tracks by changing the different routes so that most or all of the lines will cross Canal Street, but will give transfers to and from a single line of cars, running practically its entire length, by which the traffic on that street will be cared for. The details of this plan, as well as a striking view of the present condition of the thoroughfare, are published elsewhere in this issue, and the proposition is now under consideration by the city authorities.

Suburban Traffic

The question of caring for the suburban traffic on steam lines has forced itself upon the management of many roads, and others are being confronted with the same problem every day. Few of them seem to be ready to meet it in a practical manner, and not one, to our knowledge, has provided in advance against the invasion of the trolley in the suburban field. This lack of foresight on the part of the steam railway managers has occasioned much comment and some criticism, but thus far there has been no reasonable explanation on the part of the steam roads. Apparently the railroads are "quite well satisfied with the situation," as stated by the "Railway Review," which goes on to say that except in rare instances suburban passenger traffic does not pay, and most roads are only too glad to find an excuse for abandoning it. Such a suburban service as that of the Illinois Central, in Chicago, undoubtedly is profitable, our contemporary admits, but nowhere near to the extent that is popularly supposed. But the Illinois Central is in an exceptional position, it declares, as this road possesses exceptional facilities, and its suburban service is as separate and distinct from its regular traffic as if it belonged to an entirely separate company. It has separate tracks, cars, engines, stations and all other paraphernalia necessary for conducting the business, an advantage which is not commonly possessed, but this is just the point which we have contended all along, namely, that the big steam railway systems are in position to furnish this service and should provide the electrical equipment and organization. The "Review" declares that the legitimate business of railroading does not seem to be within the realm of a 5 or 10-cent suburban fare, and to allow that kind of traffic to interfere in any way with the larger and more important business of the road is beginning to be regarded as a mistake. This is a

question that the steam road managers will have to find for themselves, but it seems to us that such a statement amounts simply to an admission that they are not able to handle this business. Many of the big roads have spent considerable money in developing this traffic, but they cannot hope to retain it unless they supply better accommodations, and this can only be done successfully by adopting electrical equipment.

Air Blast Railway Motors

Transformers are almost doubled in permissible output by the simple application of an air blast to carry away the heat that would otherwise be imprisoned in the casing. Why cannot the principle be applied with advantage to railway motors, especially those intended for heavy traction? The large increase in motor capacity obtained by leaving the cases opened, a device permissible in elevated work, is well known. Why not carry the matter a little farther and force the air through with a blower? This device would at once change the load limit from a temperature limit to one of commutation, efficiency and similar considerations, and would possibly have the effect of making the present hour rating a continuous one, which in interurban work is a consummation devoutly to be wished. The increased life of the windings and the absolutely tight casing also offer advantages which in themselves quite counteract the disadvantage of maintaining the little motor and blower which would be necessary. A further consideration, with reference to the device, is rather radical, but nevertheless attractive. Taking a 200-hp equipment, a fair interurban figure, working at a net efficiency of 60 per cent, counting the use of resistances in control, it is safe to say that of the 40 per cent losses one-half could be absorbed by the air of the blower system. Twenty per cent of 200 hp is 29.84 kws, or about the energy absorbed by five ordinary sets of car heaters. It looks as if the heaters would pay for the motor, blower and piping. To keep the motors and resistance cool, the passengers warm, and save the entire heater current by the process, sounds too good to be true. Of course motors do not always run at full load, and these figures require shaving, but they can withstand the process.

As to the energy for the blower motor every particle of it will appear as heat in the car atmosphere. The energy consumed in arc headlight resistance is not only ample but available for such a motor. An electric car is rather a wasteful combination after all.

The Excursion Business

In some respects the moderate summer which the country has enjoyed this season has been detrimental to the excursion business of electric railway companies, as the need of outings has not been felt to the usual extent by the general public. At the same time the cool weather has had an opposite effect in keeping many people in the cities, as the doleful tales of lack of patronage from the managers of seaside hotels and other summer resorts indicate. The people who have not left the city for the country have contented themselves with trips nearer home, and it is the general verdict that the excursion business of the average city railway during the present season has been up to that of past years, if not somewhat greater. This is a branch of the business which can be developed by systematic effort, as has been proven on many occasions. The maintenance of street railway parks and pleasure resorts of various kinds is entirely in this line in that they tend to create traffic. We believe, however, that many of the railways of the country have reached a size now when they could afford to maintain a regular passenger department, and that such a course would prove of great benefit. The general passenger agent of the average steam railroad devotes himself entirely to the development of traffic, to preparing the literature published by the company and seeing that the road is properly advertised. A field has been found here which does not conflict in any respect with the duties of the general manager or superintendent. We do not mean to say that the general passenger agent of an electric railway company need have so large a staff as that of the same officer on many of the steam railroads, or that the department need be anywhere near so expensive. But the possibilities in the way of educating people to ride in one way and another are so extensive that this work should not, on a large system, be thrown exclusively on the shoulders of the general manager, although the general passenger agent would necessarily have to consult with him and report to him on any plans which he may develop. This method of establishing a special branch of the operating division to care for this work, under the title of a "general passenger department," or "outing department," as it is called in Cleveland, has been followed on a few of our large systems with very satisfactory results, and it is certainly worth the consideration of the managers of any system on which the excursion traffic is a large feature of the business.

Omnibuses vs. Trolley Cars

A striking example of the difference in the eyes of the law, certainly English law, between an omnibus and a street car was given during "coronation week," last month, by the omnibus companies in London. A street railway company is supposed, through the privilege granted it of laying rails in the streets, to have entered into a contract with the city authorities by which it guarantees to carry passengers for a certain rate of fare. Omnibus companies, however, are on the same footing as the owners of private vehicles, can carry passengers or not as they choose, and can charge any rate of fare which pleases them. In fact, the only municipal regulation governing the rates of fare of the omnibus in London is that these rates should be conspicuously posted in some part of the omnibus, and that the fares charged should correspond to those so posted. There is no law to prevent the posting of a different set of rates every day, or even oftener, if the company desires. The result of this was that the omnibus companies took advantage of the fact that London was crowded at the coronation time and that transportation facilities were at a premium, to double and treble their rates, and in some cases increase them in a still greater ratio. For instance, the rates between Ludgate Circus and Charing Cross, which are about a mile apart, was increased from 1 penny to 6 pence. The following are a few of the rates charged during that week (that ending June 28) by a number of the principal omnibus lines in the city:

Liverpool Street to Ludgate Circus	2d.
Chancery Lane to Charing Cross	3d.
Ludgate Circus to Charing Cross	6d.
Bank to Piccadilly Circus	8d.
Charing Cross to Piccadilly Circus	3d.
Charing Cross to Victoria	4d.
Bank to Victoria	8d.

On the line between Piccadilly Circus and Liverpool Street, a distance of not more than 3 miles, the fare outside was 8 pence and inside 6 pence, and there were no intermediate fares. Even the ha'penny 'buses over the bridges charged penny fares.

In this respect of increasing their rates the omnibus companies followed the practice of the cab companies, the hotels, the restaurants, and in fact of nearly all concerns outside of the steam railroad companies, who catered to public requirements in London. It seems somewhat of an anomaly that a company which supplies its own roadway, as a street railway company does, should be treated less generously than one which wears out the public highway and gives at the same time a slower and more noisy transportation service. Nevertheless, in the eyes of the English law the omnibuses are on the same footing as the owners of any other public conveyance, as a cab. We do not know what would be the exact difference in status in this country, nor is it very important, as omnibus lines could not do the business here accomplished by our street railway systems, but it is somewhat curious that our English cousins in giving such latitude to the old-fashioned vehicle, and while restricting the improved motive power so closely, have in this way perpetuated an institution which the city of London, with its long distances and vast commercial interests, has long ago outgrown.

Schedules for Trolley Lines

The necessity for observing the schedule is generally recognized by transportation companies in cities and between important business centers, but the trolley lines in many rural districts, and especially those serving pleasure resorts, are not run on any fixed plan. Most of the latter have schedules printed in their advertisements, and the unwary stranger who depends upon them for making connections is often grievously disappointed. This is a serious mistake, and soon brings the management into disrepute, for there is nothing which the average pleasure seeker resents so much as a disarrangement of his plans. It matters not that he may make the trip the next day or on any other of the ten or dozen days which he has at his disposal. He is sorely disappointed, and usually he communicates his feelings to everybody about the hotel in which he is stopping. Thus the trolley line gets a bad name. In the case of one line which recently came under our personal observation the employees did not know that they were expected to make the schedule; it had not been observed early in the season, as traffic was light, and it became customary to run cars only when enough passengers had been secured to make it profitable. As a result the patronage of the road did not increase as the season advanced, and soon the schedule was entirely lost sight of, excepting by disappointed patrons.

Special Conditions in Franchises

Builders of new railways and street railway companies that are extending existing properties are very often confronted, when applying for franchises, by some clause, or set of clauses, which the authorities of the municipality through which their lines are to run wish inserted in the franchises. In some cases these requests are, of course, exorbitant and cannot be granted with safety to the financial condition of the property, but in many other cases the clauses are comparatively unobjectionable, and many arguments are marshalled in their favor by the public authorities and local newspapers. Where the company interested is operating in a large city and practically all of its lines are included within the boundaries of that city, a certain amount of latitude in granting demands of this kind can be exercised without very much future inconvenience, but the case is entirely different with an interurban railway company or, in fact, any company which has a number of municipalities to deal with. We believe that in cases of this kind it is much better, not only for the railway company but for the public as well, that the company should not be tied down by one set of restrictions and clauses in one town and another set in another town, or ever a uniform set of conditions, where these conditions are not absolutely necessary for the protection of the community against the company. In deciding what conditions are necessary for its protection the city authorities should remember that all railway companies are created by the State, and that the State laws, as a rule, provide against all abuses possible on the part of these companies. These State statutes are the result of a long experience with corporate enterprise, and will, in general, be found equitable in their application, while those restrictions which are not provided for in the State laws are often inadvisable and have not been made the subject of legislation for this very reason. Before indicating the advantages to both railway company and the general public by the exclusion of "unnecessary" clauses in the franchise, we will cite an example bearing directly on the point under consideration.

A certain railway company applied for a franchise in a city in the eastern part of New York State, but found that the community, while anxious to secure the construction of the new railway, thought that the interests of the city would not be entirely safeguarded unless the company agreed, in its franchise, to three conditions, viz.: (1) That the road should be in operation within five years; (2) that the fares should not be more than certain amounts, and (3) that the expense of making the crossings above and below the grades of the existing highways (the road being on its own right of way without grade crossings) should be paid entirely by the railroad corporation.

It so happened that none of these provisions was individually objectionable to the owners of the road, that is, they expected to have the line in operation long before the time set; the fares proposed by the city were those which they had planned to charge, and the State law under which the road was chartered required the construction of the crossings by the railway company. Nevertheless, the company properly took the ground that it was not advisable to have these conditions in its franchise, because the latter clause was unnecessary, having already been provided for, and because the two former, while they would be complied with, might act as an impedient in raising capital and also in future operation.

As a result, the president of the company, by appointment, met the official representatives of the city and leading citizens at a general town meeting, and went over the subject carefully with them. Taking up the first point, that of the time in which the construction should be completed, he pointed out the fact that a section of the Railroad Law of the State of New York explicitly states that the construction of a road must be begun and 10 per cent of the amount of its capital expended within five years, and furthermore, that if the road is not in operation within ten years from the time of filing its certificate of incorporation, its corporate powers cease; also that another section of the Railroad Law provides that if, at the end of two years from the time the company receives its certificate from the Board of Railroad Commissioners authorizing the construction of the road, such construction is not commenced, the board may inquire into the reasons of such failure and may revoke such certificate if it shall appear to be in the public interest to do so.

Taking up the second point, that of fares, he pointed out that the Railroad Law of the State, under which the company was incorporated, fully covers, also, the question of fares to be charged, by stating that the maximum rate may be 3 cents a mile, with a minimum fare of 5 cents, but that the Legislature can at any time reduce the mileage rate below that mentioned, provided that in doing so it shall not, without the consent of the company, reduce the net earnings to less than 10 per cent per annum on the capital actually expended. The fact was then pointed out that as these laws applied to all companies organized within the State, under the general railroad law, the interests of the community were fully protected. On the other hand, if any special contracts were made by the company, even if they coincided exactly with the State law as then in force, this fact alone might, and probably would, prejudice the company in the eyes of financiers, and might result either in the failure of the entire undertaking or else in the selection of a route outside of the boundaries of the particular city which insisted upon such a franchise. In other words, the company stood squarely up to the position of not being willing to waive from any of its statutory rights, and showed that in taking this stand it did so, not with the desire to impose on the city, but to assure the completion of the project which all those present admitted was as important to the city as to the company.

The sequel of this particular episode was that the town meeting voted unanimously in favor of giving the franchises without any restrictions whatever, and the incident was closed.

We realize that the temptation to any railway company, situated as this was, is often very great to quietly accept conditions of this kind, which appear harmless, and which, as a matter of fact, might never create any trouble. But those who have had much experience with railway operation realize that very often a limiting condition, such as the completion of a line by a certain time, which originally appeared entirely innocuous, will, through some unforeseen contingency, such as a financial crisis, cause a great deal of trouble. The consequence is that Wall Street looks upon all special conditions of this kind with a great deal of suspicion, and their inclusion in any franchise often jeopardizes the success of the entire property from a financial point of view

The Pacific Electric Railway Equipment

The new power house, car houses and shops of the Pacific Electric Railway Company, of Los Angeles, Cal., which have recently been completed, comprise the largest electric railway equipment of this character on the Coast. The present company was incorporated on Nov. 14, 1901, but the work of construction on the new power plant and shops was well under way at that time. At present the company is operating 95 miles of single track in the cities of Los Angeles and Passadena, and the system extends to Mt. Lowe, Long Beach, Alhambra, San Gabriel, Monrovia, Santa Ana and other points. Ninety-eight motors and 16 trailers are now in service.

POWER STATION, SHOWING SITE OF NEW EXTENSION

The present power station equipment comprises two 250-kw, two 200-kw and one 125-kw direct-current generators in the Passadena plant. The Los Angeles station, which is now being erected, will contain one 1050-kw direct-current generator, and two 1500-kw three-phase generators, three 600-kw and five 200-kw motor-generator sets. One 650-hp Ball & Wood cross-compound condensing engine, one 450-hp and one 250-hp machines of the same type are now employed, and an additional equipment is being installed, comprising one 2000-hp and two 2500-hp McIntosh & Seymour cross-compound condensing engines. Steam is furnished by four 250-hp Stirling boilers at the present time, and an addition of eight 400-hp Babcock & Wilcox boilers is being made.

Interest is centered at present in the big shops at Seventh and Alameda Streets and Central Avenue, in Los Angeles, which are now being equipped with machinery and machine tools. All machinery, except the steam hammers, is to be driven from electric motors. Work on this plant was begun on Oct. 28, and has so far progressed as to make it possible to turn out considerable work in several departments. It is proposed that all of the repair work of the Pacific Electric Railway Company and the Los Angeles Railway Company will be done in these shops, together with the building of cars and other mechanical work for the operation of the railway systems in Los Angeles and the suburbs.

There are five departments in the shops, and in addition the largest car house in the West is under construction and nearly completed and ready to receive the cars of the Pacific Electric Railway Company. The car house is at the west end of the large tract of land purchased by H. E. Huntington, fronting on Central Avenue and occupying almost the entire space of a block. The shops are primarily for repair work on cars of the two electric railway systems, and new cars will also be built.

The new shops are at present contained in six new buildings, namely, the machine and blacksmith shop, store and carpenter shop, paint shop, car repair shop and winding room, pattern shop and lumber store house and an oil house, to which will soon be added a brass and iron foundry.

In the construction of the buildings 3,000,000 ft. of lumber, 3,000,000 brick and 8000 barrels of Portland cement were used. The shops contain about 10,000 lineal feet of track for the reception of cars under construction or repair, and the car house contains about 5200 lineal feet of track for the storage and inspection of cars.

INTERIOR OF CARPENTER SHOP

The first floor area in the shops is over 3¾ acres, and in the car house over 1½ acres. There are 59 doors, 16 ft. high and 12 ft. wide, for the admission of cars to the shops. The pitch of all roofs is 30 degs. The roof trusses are combination wood and iron. All the buildings are of brick, with trussed roofs, no purlins or jack rafters being used. The roof planks, which are 2 ins. x 12 ins. tongue and groove Oregon pine, are spiked directly to the trusses. The brick walls extend directly up to this planking, and hence there are no pockets or draft runs for the spread of fire.

INTERIOR OF PAINT SHOP

The inside of all the shops and car house is coated with white magnite, thereby diffusing light, and also intended to make spread of fire more difficult.

The building containing the machine and blacksmith shop is 276 ft. long, 100 ft. wide, and 22 ft. high in the clear. Of this a space 200 ft. in length is occupied by the machine shop and 76 ft. by the blacksmith shop. Three tracks, fitted for either broad or narrow gage cars, extend across the machine shop near one end. They have cement-lined pits, 4 ft. 6 ins. deep beneath them, to facilitate work on car trucks. The machine shop has a to-

ton traveling crane spanning its 35-ft. central bay, and traveling the length of the shop. This shop is newly fitted up with modern machinery for the making and repairing of cars. The blacksmith shop has swinging cranes, and besides the usual forges and fires has a double-frame 3000-lb. steam hammer in its list.

The building containing the store and the carpenter shop is 380 ft. long, 100 ft. wide, and 22 ft. high in the clear. Through the store, which occupies a space 100 ft. sq., there is provided a broad and narrow gage track for the receipt or shipment of supplies, and this department is fully fitted up with special places for the numerous articles to be found therein. The carpenter shop has ten tracks, for either broad or narrow gage cars, under three of which cement-lined pits, 2 ft. 5 ins. deep, are provided, to enable the men to work under cars. In one end of the carpenter shop the mill machinery is located, and is complete for the manufacture or repair of cars.

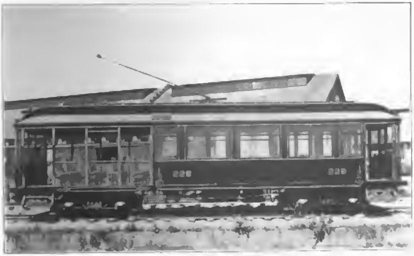
The two buildings just mentioned stand in line with one another, which from end to end is 711 ft. long. Parallel to this line, and at a distance of about 100 ft., are first, the paint shop, which is 300 ft. long, 100 ft. wide and 22 ft. high, and contains twenty tracks for the reception of either broad or narrow gage cars; next, the car repair shop and winding room building, which is 360 ft long, 100 ft. wide, and 22 ft. high in the clear; 80 ft. is partitioned off at one end for the winding room, and through this room a track for either broad or narrow gage cars is provided. In the car repair department there are eighteen tracks, for either broad or narrow gage cars, and all the tracks are over cement-lined pits for better access to the trucks. All the pits throughout the shops are connected to sewers for the disposal of wash water.

Between the two rows of shops mentioned there is a transfer table 60 ft. long, capable of transporting a fully-loaded broad-gage freight car, containing supplies, and aggregating 160,000 lbs., and its travel is 866 ft. long. This table is novel, in that it has only four wheels, traveling on two rails, and is driven by an electric motor with overhead trolley.

ONE OF THE NEW COMBINATION CARS

MACHINE AND CARPENTER SHOPS

REPAIR AND PAINT SHOP



CAR BUILT FOR PASADENA SERVICE

The fifth building contains an 80-hp boiler for the steam hammers and dry kilns, and also contains on the lower floor the hardwood lumber storage, while the second floor is devoted to a fully equipped pattern shop. This building is 200 ft. long, 60 ft. wide, and two stories high.

The sixth building is the oil house, 40 ft. long, 34 ft. wide, with basement 10 ft. high. The building is one story high. The oil is handled either by gravity or compressed air, as may be most convenient. Oil is used for the ordinary purposes, and also for firing the boiler when the mill refuse is not sufficient and for all blacksmith shop fires.

The seventh building, soon to be in readiness, is a brass and iron foundry, 200 ft. long, 100 ft. wide, and 30 ft. high, provided with all the tools and appliances for such work in connection with the manufacture and repair of cars.

There has also been constructed a car house 263 ft. long, 264 ft. wide, and 18 ft. high in the clear. There are twenty tracks in this building, each 257 ft. long, for the storage and inspection of cars, and inspection pits are provided under all the tracks.

The shops are provided with full fire service hydrants and hose. Each department throughout has its own wash rooms and waterclosets, convenient to the inspection of the several foremen.

The officers of the company are: President, H. E. Huntington; vice-president, Epes Randolph; secretary, E. E. Bacon; treasurer, I. W. Hellman. F. Van Vranken is superintendent of the Los Angeles plant, and W. H. Smith superintendent of the Pasadena

NEW CAR HOUSE UNDER CONSTRUCTION

station. G. E. Pillsbury is chief engineer and S. H. Anderson, chief electrician. C. E. Donnatin is superintendent of the mechanical department.

Chicago Elevated Traffic for First Half 1902

The reports from three of the elevated railroads of Chicago for the first half of 1902 show passengers carried as follows:

SOUTH SIDE ELEVATED

Month	1902	1901	Increase	Per Cent
January	79,154	71,137	8,017	11.2
February	79,386	74,525	4,861	6.5
March	80,313	76,269	4,044	5.3
April	81,009	77,772	3,237	4.2
May	76,063	74,206	1,858	2.5
June	76,449	69,645	6,804	9.7
July	70,767	63,763	7,004	10.9

METROPOLITAN ELEVATED

Month	1902	1901	Increase	Per Cent
January	98,029	89,699	8,330	9.3
February	100,466	97,659	2,807	2.8
March	105,512	98,339	7,173	7.2
April	109,246	97,018	12,228	12.6
May	105,799	92,579	13,227	14.2
June	101,743	86,179	15,564	18.0
July	97,929	79,308	18,621	23.4

NORTHWESTERN ELEVATED

Month	1902	1901	Increase	Per Cent
January	62,010	52,022	9,988	19.5
February	64,760	55,256	9,504	17.2
March	65,362	57,193	8,169	14.3
April	65,430	58,623	6,807	11.6
May	63,199	56,399	6,800	10.8
June	60,813	53,587	7,226	13.4
July	56,110	48,559	7,551	15.5

Advertising Trolley Excursions in Cleveland

The Cleveland Electric Railway Company has given especial attention during the past season to the development of the excursion business on its system, and as the lines of the company reach a large number of popular parks and pleasure resorts, as well as the five principal cemeteries in the city, the work of working up the business has been an extensive one. To obtain the best results from this business a special department has been established, called the Outing Department, and has been placed in charge of J. W. Butler.

One of Mr. Butler's methods has been that of printing a large number of attractive flyers, giving the points of interest which can be reached from any point in the city by means of a 5-cent fare. This is called "Nickel Outings to Cleveland's Public Parks, Boulevards, Pleasure Resorts and Points of Interest," and the flyer mentions the route to take and as well describes any principal attraction, such as a band concert, which may be given at any particular park.

Another plan was to make an arrangement with the daily papers by which each one printed a "return coupon," good as passage on the cars in returning from a certain park which the company wished particularly to advertise. The result of this policy has been to develop greatly the excursion business of the company.

Proposed Changes in New Orleans Railways

The New Orleans Railways Company has submitted to the Mayor and City Council a general plan for the reorganization of the transportation system of the city. The management has given the problem its undivided attention since acquiring the properties, and it is believed that the plan proposed will relieve the present congestion of traffic on Canal Street and greatly improve the service throughout the entire city. The company is convinced that the adoption of the plan, which will enable it to make minor connections at intersecting streets, between existing tracks, short excursion routes, and changes in the system of operating cars, will bring about at once greater rapidity in transit, greater convenience and less expense to patrons and increased saity to pedestrians. Cross-overs on Canal Street, the merging of Napoleon Avenue line into New Lake Road, and the extension of Claiborne line to Poland Street are the main features of the plan proposed.

It is a well-known fact that Canal Street in New Orleans presents one of the most difficult problems in street railway operation that has yet been encountered, and it is rapidly becoming worse in proportion to the growth of the city and extension of the street railway lines. The trouble arises from the fact that all lines lead to Canal Street—an admirable feature in the days when few lines were operated—and these were owned by independent interests, but under existing conditions there is, of course, no valid reason for continuing the plan and every reason for abolishing it. In the first place the city has outgrown the idea that all business must be centralized in one particular spot in the town, and that all cars must therefore lead to that district. Moreover, the company now proposes a transfer system that will not only enable all passengers to reach Canal Street, but will give them facilities for reaching other parts of the town for a single fare, when at present two or three fares would be charged for making the same trip. By changing the routes somewhat the present congestion of traffic on Canal Street could be avoided, or at least materially lessened, so as to make unnecessary the delays and blockades of that thoroughfare, which are now unavoidable. An idea of the condition of this street may be gained by examining the accompanying reproduction of a photograph, which fairly represents ordinary conditions on that route. There are six tracks on the street, and their capacity is constantly taxed. It is largely for the purpose of affording relief upon this thoroughfare that the company proposes the following plan, which is now under consideration:

Tchoupitoulas line, Levee and Barracks line: The privilege to connect, by tracks across Canal Street, the tracks of the Tchoupitoulas line, on Tchoupitoulas and South Peters Streets, with the tracks of the Levee and Barracks line, on North Peters Street, and to make the terminus of the Levee and Barracks line on Poland Street, Dauphine, instead of Rampart Street.

Annunciation and Erato line, City Park line of Orleans Railroad Company: The privilege to connect by a curve track, the down track of the Annunciation and Erato line with the down track of the City Park line of the Orleans Railroad Company, at Canal and St. Charles Streets, to connect by a curve track the up track of the Annunciation and Erato line with the City Park line of the Orleans Railroad Company at Canal and Carondelet Streets, and the privilege to change the direction of the running of cars on Laurel and Constance Streets between Louisiana Avenue and Valmont Street.

Magazine line, Camp and Prytania lines: The privilege to connect by a curve track the down track of the Magazine line with the up track of the Camp and Prytania line at Canal and Camp Streets.

Henry Clay Avenue line, Coliseum line, Camp and Prytania line, Broad Street line of Orleans Railroad Company: The privilege to connect by a track across Louisiana Avenue the up track (to be used as a down track) of the Henry Clay Avenue line on Camp Street (to be used as a down track) with the down track of the Coliseum line on Camp Street, to connect the up track of Coliseum line on Chestnut Street by a track on the neutral ground of Louisiana Avenue, with the down track (to be used as an up track) of the Henry Clay Avenue line on Coliseum Street, to operate cars down Camp Street from Calliope to Canal Streets, and to connect the down track of the Camp and Prytania line with the down track of the Broad Street line of the Orleans Railroad Company, at Canal and Camp Streets, and the up track of the Broad Street line of the Orleans Railroad Company with the up track of the Coliseum line at Canal and Carondelet Streets.

Peters Avenue line, Henry Clay Avenue line, Rampart and Dauphine line: The privilege to connect by a track on Peters Avenue, from Magazine Street to Constance Street, and a track across Louisiana Avenue at Dryades Street, the up track (to be used as a down track) of the Peters Avenue line, and the down track of the Henry Clay Avenue line, and by a track across Louisiana

at Baronne Street, the up track of the Henry Clay Avenue line with the down track (to be used as an up track) of the Peters Avenue line, and to connect the down track of the Henry Clay Avenue line with the down track of the Rampart and Dauphine line at Canal and St. Charles Streets, and the up track of the Rampart and Dauphine line with the up track of the Henry Clay Avenue line at Canal and Carondelet Streets.

Louisiana Avenue line: The privilege to connect, by short pieces of straight track, existing tracks on the neutral ground of Louisiana Avenue, and to operate the cars of the Peters Avenue line thereon out Louisiana Avenue, between Freret Street and Tchoupitoulas Street, and to connect the down track of the Peters Avenue line on Dryades, at Canal Street, with the up track of Peters Avenue line on Canal Street.

Villere Street line, Canal and Lake line: The privileges to extend the tracks of the Villere Street line down Villere Street, from Lafayette Avenue to Port Street, to connect (for emergency purposes) the track on Villere Street with the tracks of the Rampart and Dauphine line on Rampart Street and Dauphine Street by a track on Port Street, and to discontinue the operation of cars of the Villere Street line on Lafayette Avenue, from Villere Street to St. Claude Street. Lafayette Avenue, between Villere Street and St. Claude Street, will be well served by cars of the Claiborne Street line, to which free transfers will be furnished under the general transfer system hereinafter proposed.

Esplanade and French Market line: To discontinue the operation of the cars of the French Market line on North Peters Street, from Esplanade to Canal Street, and to operate this line on Esplanade Avenue, between Villere Street and North Peters Street.

Bayou St. John line, French Market line of the Orleans Railroad Company, South Peters line: The privilege to discontinue the operation of the cars of the Bayou St. John line, and French Market line of the Orleans Railroad Company and the South Peters line.

Although at the time this proposition was prepared the New Orleans Railways Company had not acquired possession and administration of the franchises of the New Orleans and Carrollton Railroad, it was understood that the franchises referred to would pass into its hands, and the management therefore further asked the following:

St. Charles Avenue Belt line, Tulane Belt line: The privilege to connect by curve tracks the tracks of the Tulane Belt line on the neutral ground of Canal Street and the tracks of the St. Charles Avenue Belt line on Baronne Street by curve tracks at Canal and Baronne Streets.

Jackson Avenue line, Claiborne Avenue line: The privilege of operating the cars of the Jackson Avenue line over the tracks of the Claiborne Avenue line.

Napoleon Avenue line: The privilege to connect by tracks across St. Charles Avenue the tracks of the Napoleon Avenue line with the tracks to be constructed by the New Orleans and Pontchartrain Railroad on Napoleon Avenue, to operate the cars of the Napoleon Avenue line and the cars of the New Orleans and Pontchartrain Railroad Company as a combined passenger system, and to discontinue the operation of the cars of the Napoleon Avenue line on St. Charles Avenue, Baronne and Canal Streets.

The company also asks the privilege for all cars to take on and let off passengers at near side crossings on Canal Street, so as to avoid the loss of time resulting from two stops.

In return for these concessions the company agrees to establish immediately and always maintain a general transfer system, providing one transfer for one fare on any line to any other line which is crossed.

To establish immediately and always maintain properly graded, grassed and trimmed neutral grounds on Metairie Road, from Canal Street to Bayou St. John, and on Dryades Street, from St. Andrew to Howard Avenues.

To pay (without, however, any admission of liability therefor)

VIEW OF CANAL STREET, NEW ORLEANS, SHOWING PRESENT CONGESTION OF STREET RAILWAY TRAFFIC

the entire cost to the city of New Orleans of the work heretofore done in raising the tracks on Prytania Street, from Philip Street to Louisiana Avenue.

To furnish orchestra music at Audubon Park and City Park on Sundays, commencing the first Sunday in May and ending the last Sunday in August each year.

To extend the Claiborne tracks down St. Claude Street to Poland Street, and to operate the cars of that line over the extension, and otherwise to improve and extend the service.

The accompanying engraving shows what the condition of affairs is now and the desirability of the relief possible by continuing the lines across town. At certain periods of the year most of the processions and displays take place on Canal Street, and the crowd increases to such an extent that the Mayor of the city has been forced to induce the various street railway companies to discontinue operating on Canal Street during the periods of these processions. The effect of granting the permission requested by the New Orleans Railways Company would be to relieve this congestion and give as good service as it was before. The illustration was taken at 9 o'clock in the morning, and illustrates a number of tracks and cars on the street, the latter being sufficient in number at times to almost cause an interruption in crossing the street from one side to the other. The merchants on either side hail this application with a great deal of satisfaction, and its introduction by the New Orleans Railways Company, who is progressive in its movement, will give to the shoppers the opportunity of crossing the street without fear of danger.

In a circular letter, under date of July 17, the New Orleans Railways Company announces the following officers for the management of the several departments, as well as the executive staff: General officers—H. H. Pearson, Jr., president; Charles H. Ledlie, first vice-president; Joseph H. De Grange, second vice-president. Departments—Captain John G. Woods, general manager railway department; Bankson Taylor, general manager gas department; Alexander Black, chief engineer and electrical department; E. B. McKinney, superintendent power houses; H. A. Ferrandou, auditor of the City & Orleans railroad companies; E. J. Morris, master mechanic; John R. McGivney, purchasing agent, and W. H. Renand, claim agent. These gentlemen will organize their departments, reporting to the president for instructions. Other department appointments will be named later, and for the present the old officials and employees will continue in their respective positions.

Street Car Brakes*

BY M. POETZ,

Chief Engineer of the "Strassen-Eisenbahn-Gesellschaft," of Hamburg

From circular letters sent by the writer to members of the union asking for information on the subject of brakes, only twenty replied, viz: The Aachener Kleinbahn-Gesellschaft, Elektrische Strassenbahn Barmen-Elberfeld, Grosse Berliner Strassenbahn, Strassen-Eisenbahn-Gesellschaft in Braunschweig, Tramways Bruxellois, Société d'Entreprise Générale de Travaux, Frederiksberg Sporvejs-og Elektricitets Aktieselskab, Strassenbahn Hannover, Kristiania Sporveisselskab, Grosse Leipziger Strassenbahn-Gesellschaft, Leipziger Elektrische Strassenbahn, Tramways Liégeois, Magdeburger Strassen-Eisenbahn-Gesellschaft, Munchener Trambahn, Nurnberg-Fürther Strassenbahn-Gesellschaft, Stettiner Strassen-Eisenbahn-Gesellschaft, Strassburger Strassenbahn-Gesellschaft, Société Nationale des Chemins de fer vicinaux de Bruxelles, Stadtische Strassenbahn Zürich, and Strassen-Eisenbahn-Gesellschaft Hamburg.

All the companies named, with the exception of the Strassburger Strassenbahn-Gesellschaft, and the Société Nationale des Chemins de fer Vicinaux possess electric traction, while those two companies employ on their line traction partly by steam locomotives and partly by electricity. Steam traction is used principally on the suburban lines of the chemins de fer vicinaux, and electric traction on its urban lines.

In only a few instances have precise local statutes been passed on the subject of braking. We have received the following communications on this subject:

Aachener Kleinbahn-Gesellschaft.—It must be proved to the authorities that the power of the brake is sufficient to stop the train within a distance which does not exceed the length of the portion of the line illuminated by the headlight of the train.

Grosse Berliner Strassenbahn.—Continuous brakes are prescribed. At first electromagnetic brakes were specified, but at the present, compressed air brakes are also permitted, and a great number of cars are already equipped with them.

Strassenbahn Hannover.—The rules require a continuous brake, which can be worked from the front platform.

Kristiania Sporveisselskab.—Where the brake cannot be worked from both platforms, or where a continuous brake does not exist, each trailer car must be attended not only by a conductor, but also by a brakeman.

Grosse Leipziger Strassenbahn and Elektrische Strassenbahn, Leipzig.—The rules prescribe a brakeman on each car, or else, a continuous brake.

Nürnberg-Fürther Strassenbahn.—The compressed air brakes, with which a certain number of cars are furnished, are prescribed by the authorities.

Stettiner Strassen-Eisenbahn-Gesellschaft.—The rules only prescribe a brake without specifying the system.

In most cases the authorities have left the choice of the system of brakes to be adopted, entirely to the tramway companies, and have limited themselves to approving the system employed.

The companies have expressed themselves as follows in regard to the brakes they are using:

1. Hand Brakes.—Aachener Kleinbahn-Gesellschaft.—Screw brakes are sufficient when they work properly, to stop rapidly a motor car. The screw brakes which were first used on the cars have been replaced by simple chain brakes with sprocket wheels, because with this latter system the conductor has greater control over his brake, and can apply it in shorter time. Besides, dust and wear are destructive to the screw brake.

Strassenbahn Hannover.—The hand brake works well and surely. It presents, however, inconvenience that it acts only on the motor car, and that its quick working depends too much on the promptness of its application.

Kristiania Sporveisselskab.—Chain brakes are not adapted to all the climatic conditions. At times the cars slide over the rails with the wheels skidding, while again braking becomes impossible in spite of the efforts of the conductor, on account of the snow which gets between the shoes and the wheels. Under these conditions the use of costly air brakes would hardly improve our conditions. These inconveniences are less with the electric systems.

Tramways Liégeois.—Chain brakes are sufficient on lines with few grades, provided that the chains are carefully inspected.

Magdeburger Strassen-Eisenbahn-Gesellschaft.—Hand brakes have the disadvantage of increasing the working expenses on account of wear, but they have the advantage of facilitating operations.

2. Electric Brakes.—Grosse Berliner Strassenbahn.—An inconvenience of the magnetic brake consists in the continual strain put on the field coils and commutators by which they get overheated. There is also great wear on the discs, and frequent breaking of the connections, which entails great expense.

Frederiksberg Sporveis-og Elektricitets Aktieselskab.—Short-circuit brakes employed simultaneously with hand brakes give excellent results.

Strassenbahn Hannover.—The short-circuit break often acts too quickly, and causes the wheels to skid. This system of braking has also the disadvantage that it brakes only one axle when the car possess only a single motor. The reverse-current brake has the same disadvantages, and entails a certain expense, because the current is taken from the overhead conduit.

Kristiania Sporveisselskab.—Electric brakes are less affected by snow than hand brakes and air brakes (see hand brakes). An objection against it is the impossibility of stopping the car completely by the electric brake, on account of which it is always necessary to have recourse to another brake, which we consider inconvenient. It is well to add that the motors are subjected to great strain, without periods of rest, which is undesirable, especially in summer.

Magdeburger Strassenbahn-Gesellschaft. — The short-circuit brakes are expensive, on account of the repairs which it entails to the armature, coils, etc. Electromagnetic brakes wear out fewer discs, and enable the driver to stop the train, it may be said, instantaneously.

Nürnberg-Further Strassenbahn-Gesellschaft.—We consider a good hand brake used simultaneously with a short-circuit brake as emergency brake, or vice-versa, as being the best braking device. If there are free axles without motors, they must be braked electromagnetically. This system presents the advantage that on all the down grades the two brakes must be always employed, which guarantees their constant working; besides this arrangement offers the least hindrance to the progress of the vehicle.

Stadtische Strassenbahn Zürich.—We consider that the two brakes (hand brake and electric brake) are absolutely indispensa-

* Abstract of paper read at the meeting of the International Tramways Union, London, July 3, 1902.

ble for a city tramway. Frequent use of the electric brake causes more rapid wear of the pieces on which it works, above all if it is put in force quickly when running at great speed.

3. Pneumatic Brakes.—Aachener Kleinbahn Gesellschaft.—We have discontinued the use of compressed air and similar brakes, chiefly for want of space, and also because of the difficulty of maintaining the pressure of the air and the freezing in winter which weakened the reliability of the working of the brake. The necessity of constant and minute examination by an experienced staff raises the cost of the maintenance of the brakes, etc., and finally the increase in the weight of the cars constitutes a serious inconvenience.

Grosse Berliner Strassenbahn.—The compressed air brake has not as yet manifested any disadvantages, and it has the advantage over the magnetic brake in the smallness of the repairs it requires.

Tramways Bruxellois.—The Westinghouse brake has the advantage of working surely and efficaciously. It necessitates a certain upkeep, and some expense, which is, however, much less than the wages of the brakemen, with which it dispenses.

Strassenbahn Hannover.—The Carpenter brake consumes some power for the compression of the air, but on the other hand, it works quickly and forcibly, stopping the whole train at once.

Grosse Leipziger Strassenbahn.—The experience which we have acquired with this brake (compressed air brake of the Standard Air Brake Company) during a working period of five years, has been entirely satisfactory and its upkeep is so simple and inexpensive that we have resolved on keeping to the same system when ordering all our new cars.

Münchener Trambahn.—We have adopted, on our own initiative, the air brake, and it works in a perfect manner, only, in winter, when it is very cold, the brake valves are sometimes frozen, and it becomes necessary to replace the car. However, the car can be put again in operation at the end of five minutes.

Nürnberg-Fürther Strassenbahn-Gesellschaft. — We consider that the electromagnetic brakes and air brakes stand about equal in point of merit, if we omit the question of first cost and maintenance charges (the air compressors consume a considerable amount of electrical energy).

4. Friction Brakes.—Leipziger Elektrische Strassenbahn.—This brake presents the advantage that it is actuated by means of the handle by a slight movement and without any effort, and that the inertia of the car itself is used for the braking. This brake is notable for its low cost.

The conclusions reached by the writer from the foregoing letters, and from his own experience, are as follows:

1. Hand Brake.—With chain brakes, the gearing ratio generally adopted between the handle and the shoes is as 1 : 80 or 1 : 100. Experimental tests have shown that, when light double axle cars are operated, running at the maximum permissible speed in the interior of towns (which is not very high), these brakes are sufficient under ordinary conditions, it being understood that no trailers are handled. In northern countries the efficiency of the brake is liable to be reduced by the fact of the snow getting between the shoes and the wheels. Otherwise this brake answers to the general requirements.

This brake is easily inspected and regulated. It is likewise easy to remove the worn parts; and the maintenance cost is low.

With the screw brake the gearing ratio can be carried to above 1 : 100, but a great inconvenience results therefrom, from the fact that it is brought so much the less quickly into operation. This cannot be permitted, considering the risks inherent to tramway operation. Another serious drawback is the wear caused by the street mud and dust upon the screw; this reduces the efficiency of the brake. Consequently, this brake cannot be relied upon as a regular service brake, and ought only to be considered as a safety brake.

2. Electric Brakes.—So far as ordinary service is concerned, the short circuit and electromagnetic brakes worked by the current set up by the motion of the cars, can only be considered. The reverse-current and electromagnetic devices which are actuated by the line current are mere emergency brakes. As the short circuit and electromagnetic brakes worked by the current set up by the car's motion, cannot bring the car or train to a perfect stop, it will be of advantage, especially on grades, to work them together with the hand brake. In such a case, a very small effort is required from the motorman to set the hand brakes. When the car must be stopped by the electric brakes alone, the current must be derived directly from the line.

It is of the utmost importance that all the axles of a train should be braked whenever quick stops are a condition of safe operation. Experience has shown that short-circuit brakes are capable of exciting a very strong braking action. When the motor cars run single and all axles are driven, the short-circuit brake will, as a general rule, answer every purpose of a reliable service brake; it being understood that the hand brake is also available. Under special easy and favorable conditions, the short-circuit brake can still be relied upon if only one axle is driven. When trailers are used, all their axles must be braked whenever stopping within short distances is required.

The electric brake, when compared with the ordinary brake, requires no effort, and, consequently, does not exhaust the motorman. This point is of importance, especially when high speeds are reached and when the street traffic is congested; as a physically exhausted motorman is liable to be inattentive and lose that presence of mind which is, above all, necessary to him.

The brake being actuated by a short motion of the handle, the action is very quick, which is of importance in cases of emergency. Provided a good regulation of the resistances is devised and the motorman has some practice, the stoppage is very smooth. The simultaneous working of the hand brake with the electric brake is also of advantage, as it keeps both systems in proper working condition.

As to the other advantages claimed by the electric brakes, the opinions widely differ. A number of companies consider that the brake is hard on the motors and entails heavy repairs for armature coils. As for the electromagnetic brake, the Grosse Berliner Strassenbahn states that the wear on the discs and the frequent breakings of the electromagnet leads cause very great repair expenses. It is to be regretted that no statistics concerning these changes are given. The experience which the Hamburg Strassen-Eisenbahn-Gesellschaft has had with the simultaneous use of short-circuit and electromagnetic brakes, as ordinary service brakes, on all its cars, is highly satisfactory. This company has not experienced any increase in the repairs to motors, switches, gear wheels, etc.; moreover, no magnet lead of the electromagnetic brake has as yet been broken. The faults found with these systems seem more likely to be due to want of sound construction or of the proper proportioning of the resistances.

3. Pneumatic Brakes.—The compressed air brake has the advantage over the electric brake that any number of trailer cars can be added to a train and braked without inconvenience. On the other hand, the following drawbacks can be cited against them: higher cost of installation, necessity of a special controlling handle, increase in the working expenses caused by the compression of the air, necessity of a minute inspection of the compressors and valves, etc., the freezing of the pipes, and the reduction in the braking efficiency when the snow gets between the shoes and wheels.

All the companies which use air brakes, however, express themselves as satisfied with their working. A particularly interesting statement is that made by the Nürnberg-Fürth Tramways who, it is remembered, make use of both the electromagnetic and the compressed air brakes. We will once more produce its statement here: "We believe that the electromagnetic and compressed air brakes stand about equal in point of merit, if we omit first cost and maintenance charges."

4. Friction Brake of the Elektrische Strassenbahn Leipzig.—I have nothing particular to mention here with regards to this system.

Taking all the evidence at our disposal into consideration we conclude that the mechanical efficiency of the air and electric is equal when the motor car hauls but one or two not too heavy trailers. When the number of trailers is greater than this number, preference must, by all means, be given to the compressed air brake, because the short-circuit current set up in the car would not, under such conditions, be sufficient to brake the train. So far as reliability is concerned, it must be admitted that the electric brake, owing to its greater simplicity, will be less frequently disabled than the air brake which is far more complicated and is composed of various parts, some of which are very delicate. The freezing of the pipes and valves is a great inconvenience of the air brake. It is also more natural that an electric car should be braked directly by electricity instead of actuating air compressors by electricity first and then using this compressed air for the braking.

We do not possess any certain statistics on the financial part of the question by which the advantage of one system over the other can be stated. The air brakes are likely to entail greater first and maintenance cost than the electric brakes. It is of a general interest to get full information on this matter.

A bad accident occurred Aug. 19 on the Jerome Avenue line of the Union Railway Company, of New York, when a large open car left the track near the foot of the Jerome Avenue hill and fell into a ditch. Several persons were injured. It is thought that recent rains covered the track with sand, and this derailed the car.

Systems of Mechanical Traction for Street Railways*

BY E. A. ZIFFER, of Vienna

Reports on this subject were presented by the writer at the meetings for this Union held at Cologne, 1894; Stockholm, 1896; and Geneva, 1898; and the systems in use at that time were fully described. Although a number of improvements have been made since that time, only a few companies have replied to the circular letter sent by the reporter, asking for information. The small nnmber of these replies was undoubtedly due to the fact that most of the companies in the Union employ the trolley svstem, and hence had made no experiments with any other method. A general summary of the different systems in most common use, outside the trolley, follows:

ELECTRIC CONDUIT SYSTEM

The first application of this system took place in 1885, when Walter H. Knight installed a short line in Cleveland and H. M. Smith one in Blackpool. The commercial history of the system, however, really dates from the installation in Budapest, by Siemens & Halske, which has been in continnons service for fourteen years, and where there are now 60 km of track. The conductors in this system have been modified from the original form, so that they are now T-irons with a flat, vertical rubbing surface. The cost of construction per km is 109,000 francs. The same firm has also built lines in Berlin and Vienna, the latter having been put in operation during the last twelve months. There are, in Vienna, 23.3 km of track and they are working very satisfactorily. The Union Elektricitats-Gesellschaft, of Berlin, has also built a line, in that city, 876 m in length. The Metropolitan Railway Company, of Washington, and the Metropolitan Street Railway Company, of New York, also have conduit systems in which the conduit is placed in the middle of the track instead of under one rail, as in the European systems. This method is more expensive than the European system, which requires less excavation, and with which there is less iron in the street, and switching is more easy. On the other hand, the side conduit requires a slot of greater diameter. In Washington, the installation of the conduit system cost 178,000 fr. per km of single track, and in England 164,000 fr. The Brussels Tramway is now installing the conduit system on a considerable length of its track, and has had two lines in operation since 1897. According to this company, the cost of installation is estimated at 100,000 fr. per km, not inclnding the cost of repaving or of moving underground pipes. These latter figures depend upon local conditions, and in the case of the Brussels Tramway amounted to 60,000 fr. per car in service. The maintenance of the conduit in Brussels, which has 10 km of double track; that is, 20 km of single track, including the inspection of insulators, cables, etc., requires eleven men per day. The Brussels Tramways Company gives the following as the cost of operation in francs per car km for traction:

	Conduit Lines. Francs.	Trolley Lines. Francs.
a. Cost of current	0.0400 (1)	0.0570 (1)
b. Maintenanee of track, exclnding paving	0.0147	0.0174
c. Maintenanee of rolling stock	0.0703	0.0516
d. Miscellaneous (including maintenance of paving)	0.0172	0.0023
Total	0.1422	0.1383

This table shows that there is very little difference between the cost of operation of the two systems. The insulation of the conductors varies greatly with the climatic conditions. Accidents are more frequent with the conduit system, on account of the liability of trouble to the plow, which costs, complete, about 50 fr. These troubles, however, have been rare in Brussels.

According to information furnished by the Compagnie Générale Parisienne de Tramways, it has applied the conduit to three lines within the city of Paris. These lines have a length of 10.5 km of double track and were built with a side conduit by the Compagnie Française Thomson-Honston in 1900. The cost of these lines averaged 265,000 fr. per km of single track. In this sum are included the cost of paving, which amounted to 60,000 fr. per km, the conduit with its accessories, the cost of removal of water pipes, etc. Based on the nnmber of cars in service, the cost of installation amounted to 85,700 fr. per car. The cars run are single-deck cars with fonr-wheel trucks, and are equipped with two 40-hp motors. The difference in power consumption between this system and the trolley system is practically insignificant. The cost of maintenance is also practically the same as that for the trolley system, except the expense of cleaning the conduit, which amounted to about 2100 fr. per km of single track per year. The plow can be raised or lowered from the car by means of a winch placed on the side of the car. The conduit is under one of the rails, except at switches, where it is placed in the center of the track. Experience with the construction of the Bastille-Chareton line indicated that the cost of construction amounted to about 230,000 fr. per km of single track, and that the cost per car km was between 0.36 fr. and 0.59 fr.

The first conduit line in Budapest was put in operation Jnly 30, 1889 and cost between 64,000 fr. and 106,000 fr. per km of single track, not counting crossings or changes in locations. In 1901 the trolley and conduit lines in that city comprised a total of 70.623 km, with 142 four-wheeled cars and 22 eight-wheeled motor cars. The cost of the cars varied between 14,800 fr. and 21,000 fr., and they required from 500 to 1000 watt-hours per car km. The cost of operation of the trolley and conduit lines is not kept separately. The company ran, during 1901, 6,386,832 car km at a cost of 0.2431 fr. per car km.

According to Siemens & Halske, who are operating the Vienna tramway system, the length of conduit lines in that city is 12.5 km of double track, or 23.3 km of conduit. During the present year, 2.7 km of trolley will be transformed into conduit. The condnit is located under one of the rails, so that the cars have to be fitted with two plows, one on each side, so that either one can be used. The cost of installation has not yet been determined. Both double and single-truck cars are employed.

According to a recent report presented to the city of Sheffield by a committee appointed to examine into the conduit system in eighteen cities, the cost of installation in the different cities per km was as follows:

Berlin	102,000 francs
Blackpool	111,000 francs
Budapest	71,000 to 110,000 francs
Dresden	103,000 francs

SURFACE CONTACT SYSTEMS

The Mnnich tramways installed the Schnckert conduit system in 1897 on an experimental section 300 m in length. The company reports that the system is considerably more expensive and less reliable than the trolley and mentions among its other objections that of danger of short circuit, in case the car is derailed or the contacts remain alive. Improvements were made by the Schuckert Company, however, in the system, and cars were run regularly over it between November, 1899, and October, 1901. During this time no accident was reported. The first cost of the installation of this system amonnted to about 45,000 marks per km, while the cost of operation is practically the same as that of the trolley. The skate is the only part of the apparatus which shows much wear; it will last about 10,000 km and costs only 20 marks to replace. Other surface contact systems almost without number have been devised, but the writer will refer briefly to only a few of them.

The Claret-Vuilleumier was installed for the first time in Lyons in 1894 in a section 3.2 km in length, and was afterward installed on the Paris-Romainville line. The cost in the latter case amounted to 21,547 fr. per km of single track. The General Electric Company has installed a short system at Monaeo 4.5 km in length and having a gage of 1 m.

The Diatto system is used quite extensively in France, and about 130 km of track have been equipped with it. It was first pnt in operation in Tours in April, 1898, and has been adopted in Paris by the Compagnie des Tramways de l'Est on 54 km of track, and by the Compagnie Electrique des Tramways de la Rive gauche on 17 km of track. The cost of installation is abont 30,000 fr. per km of single track. The system, however, does not seem to give complete satisfaction, and several horses have been injured by it.

The Lorain Steel Company has installed the Brown system at Wolverhampton. The experience in that city has not yet been great enongh to determine the actual value of it, and although the service seems to be satisfactory, the traffic is not as large as it would be in a larger city. It should be mentioned here, however, that at Tours, where the traffie is not large, the Diatto system seems to give much better results than in Paris. The difficulties in Paris are aggravated not only by the large traffic, bnt also by the dampness of the soil in certain quarters of the city.

CONCLUSIONS

A careful examination of the status of the different systems at present and four years ago at the time of the Geneva convention will show that there is very little change to record during the last four years in the status of the condnit or surface contact systems, although the former has been adopted to a considerable extent

* Abstract of paper read at the meeting of the International Tramways Union, London, July 8.

(1) Owing to differences in grades and power of motors.

in some of the largest cities. The side conduit seems preferable to the center conduit as used in America, one great reason for the adoption of the center conduit in America being that that was the style of conduit used with the cable roads. During the last four years some improvements have been made in surface contact systems, but there has been no great increase in the number of roads of this kind, except in the case of the Diatto system in France, where it has not been very satisfactory. The other systems are hardly out of the experimental state; it is, nevertheless, a fact that if such a system could be devised which would be satisfactory, it would supply a real demand for a system which will be more certain and less costly than the conduit.

The writer will say in conclusion that the conduit system at the present state of development is certainly to be preferred to any surface contact system, as the latter cannot be relied upon for continued operation.

London Letter

(From Our Regular Correspondent.)

It seems that, after all, there are to be no embankment tramways, the House of Lords, about the end of last month, having refused to pass the bill already approved by the House of Commons. The Lords seem to imagine that it would be *desecration* to put tramways on the embankment which, as one of the noble lords characteristically put it, is "the finest boulevard in Europe." Lord Newton stated that he considered that a much more practical and sensible way of joining up the tramways of the north and south of the Thames would be by constructing a subway under the river. In spite of all the efforts, therefore, of the London County Council no tramways will be seen on the embankment for some time. There is no doubt, in our opinion, that a tramway on the embankment would greatly relieve the congestion on the Strand, and would thus be of great benefit to London. The work on the Tooting lines of the County Council continues apace, however, and the large section will soon be completed.

The extension of the City & South London Railway from Moorgate to the Angel, Islington, has evidently proved a good paying investment for this company, which was the first tube railway in London. At a recent meeting this company declared a dividend of 3 per cent against 1¾ per cent declared a year ago, and has carried forward a sum this year of £1750 against £732 last year, besides placing a sum of £2000 toward renewals. It is quite clear, therefore, that a tube system can be made to pay, if facilities are granted by Parliament for extensions in the proper directions. This railway would, undoubtedly, have been even more valuable had it been able to get its proposed extension from the Angel to Euston passed, as it would, undoubtedly, have filled a tremendous want, there being very poor communication between the large northern railway stations on the Euston Road and the city and southern portions of London.

The battle of the tubes has been energetically fought during the past month. Practically all the schemes referred to in past issues have passed the second reading. Without going into details again, as most of our readers must now be very familiar with the situation, all of the schemes of the Yerkes group have passed the second reading and practically all the schemes of the Morgan group have also passed the second reading. This will bring those two groups into distinct competition along Piccadilly, the Yerkes group having a bill called the Brompton and Piccadilly Circus Bill, and the Morgan group having a scheme for a tube from Hammersmith by way of Piccadilly and connecting with the northeastern systems. Both of these bills have passed the second reading, though it looks as if some confusion would arise by two tube railways being permitted on the same route. The final decision of these bills will be awaited with great interest.

It has now been abundantly proved that the recent movement of the Metropolitan District Railway Company to considerably reduce its fares was a good move, and it would seem that this should have been done long ago. The gross receipts for a recent week showed a gain of no less than £1556, which would go to show that there is much life in the old railway yet, if the management would wake up and devise substantial means of meeting competition. The rates on this line and on the Metropolitan have been, for the past year or two, absurdly high; now they have been practically cut in two, and the results show a largely increased traffic. It should be an object lesson to other railways in the city with suburban traffic, and it seems to us that even though the City & South London, about which we referred in another note, has succeeded in paying 3 per cent for the past year, that the company would largely increase its business if it would also make substantial reductions, or else adopt a uniform fare. Instead of cars running with only a few passengers, owing to the competition of 'buses and cars the company could easily reduce its prices and have its cars comparatively full at all times, and, as the operating expenses would remain constant, the result would be an increase in the net receipts.

A curious case recently came before the Dudley Police Court when the Dudley & Stourbridge District Electric Traction Company were fined for carrying passengers on the top of a car in defiance of the Light Railway Act to safeguard the public from possible danger from an electrically-charged standard or pole. This will bring up an interesting point, as, if it is proved that it is against the law for passengers to sit on the top of the car in close proximity to a trolley pole, it will result in wholesale changes being necessary. It is not, of course, to be thought for a moment that the decision of the Dudley Police Court will be taken as a guide, and higher authority will be sought in the near future.

An analysis of the atmosphere in the Two-penny Tube has shown that in certain places the air contained 27½ volumes of carbonic acid gas per 10,000 volumes of atmosphere. In a car a sample showed 13 volumes for 10,000, while samples at one of the stations averaged about 13 volumes per 10,000. It should be stated, however, that the sample containing 27 volumes was taken at the top end of a crowded car, which would, undoubtedly, be one of the places most seriously affected. In order to make comparisons, it should be stated that fresh country air contains 3.4 volumes per 10,000, while London streets ordinarily contain about 4.4, while the clause in the factory act states that not more than 9 volumes of carbonic acid gas per 10,000 volumes of air are permitted in factories. This shows that while the ventilation is not as good as it might be, still the danger is not serious. The Central London Railway Company is, however, making every preparation for improving the atmosphere, and are introducing a system by which it is hoped much better ventilation will be accomplished.

A system of electric tramways is being constructed at Peterborough by the British Electric Traction Company. The lines will extend from the cathedral gateway to the northern suburbs of Walton, Dogsthorpe, and Newark, and will cover 5½ miles. The contractors for laying the rails are J. G. White & Co., of London, and about 100 men are at work on the streets of the city.

A novel feature of the new municipal electric tramways at Yarmouth, which has just commenced running their first full daily service, is a telephone line carried upon the street standards, by means of which, in case of accident or breakdown, the driver or conductor can, with a portable telephone carried on the cars, at once get into communication with the tramway headquarters.

At the offices of the Board of Trade, a conference took place recently between Sir F. Hopwood (the secretary of the department), and Sir Herbert Jekyll (secretary of the railway department), and the representatives of various London and provincial bodies, in reference to the boards of trade regulations regarding the speed of electric tramways. Among the bodies represented were the corporations of Glasgow, Liverpool, Manchester, Leeds, Sheffield, Nottingham, Cardiff, Bradford, Newcastle-on-Tyne, Salford, Bolton, Oldham, Brighton, Halifax, and Hull. As to speed indicators, it was urged that no other carriages were required to carry them, and that they would do little or nothing toward the safe working of the cars. It was further asked that local authorities should be permitted to make regulations as regards speed, that the speeds allowed by the Board be from eight miles to sixteen miles an hour, according to the local traffic and conditions, and not fixed at a maximum of ten miles. Sir Francis Hopwood said the Board was not in favor of hard-and-fast rules. Exceptions had already been made in some cases, where a maximum speed of more than ten miles an hour was allowed. He was disposed to advise the department that no general maximum speed should be fixed, but that the rate should be left to be settled by the inspectors in each case upon its merits. It is believed that the regulations prepared by the department will now be modified in several important particulars.

At a recent meeting of the Tramway Committee of the Aberdeen Town Council, it was decided not to introduce half-penny fares over the system, and to discontinue, forthwith, the half-penny fare hitherto in existence on the Woodside route. It was pointed out that half-penny fares do not pay the corporation.

The new length of tramway lines recently laid down by the Liverpool Corporation from the former Old Swan terminus to the city boundary at Knotty Ash has just been put in service, thus opening up connection with the Prescot Light Railway, which runs from the boundary through Prescot, Rainhill, and Eccleston Park to St. Helens, and then on to Haydock. Mr. C. R. Bellamy (tramway manager) and Mr. C. W. Mallins (traffic superintendent) were present to witness the initial car run to the new terminus. In the meantime Liverpool is exercised over the question of whether they should send a deputation to the United States or not.

A. C. S.

Plotting Speed-Time Curves—V

BY C. O. MAILLOUX

APPENDIX A.

(ANALYTICAL DEFINITIONS.)

TIME-FUNCTION CURVES OF RECTILINEAR MOTION.

Motion and Velocity.—The phenomenon of motion being the natural starting point in the analytical study of the speed-time curve, we may begin by noting some of its characteristics.

According to the definition given by the late Professor S. W. Holman, in his able work on "Matter, Energy, Force and Work" (page 12), "Motion is change of relative position." It is symbolized by distance and may be estimated and measured by reference either to its amount or to its rate.

The amount of motion of a body is equal to the length of the line (called "path") along which the motion takes place.

The rate of motion of a body is the proportional amount of its motion estimated by reference to some basis or unit of comparison. Time being the most convenient and practicable basis of comparison or proportion, the rate of motion, when estimated with reference to time, is equal to the change in amount of motion (or the variation of distance, or space) occurring in a definite interval of time, and it is then called the time rate of motion or the time rate of speed variation. Thus, when distance is expressed in miles, and time values in hours, the rate of motion will be equal to the quotient of the distance divided by the time consumed in moving over the given distance. In this case the quotient would be "miles per hour," which is the numerical measure of speed or velocity. Hence, velocity is equal to the time rate of motion, or

$$v = \frac{ds}{dt} \qquad (a)$$

whose value would be:

$$v = \text{miles} \div \text{hours} = \text{miles per hour}$$

where v = instantaneous velocity or speed (m.p.h.)
s = distance (space)
t = time (seconds)

If, in Fig. 15, the ordinates be used to represent amounts of motion or distances, expressed, say, in feet, and if the abscissæ be used to represent time values, say, in seconds, then the curve O A B C D will represent the relation between any distance and the time required to pass over it by a moving body.

The amount of motion which has taken place between any two points, as A and B, on the curve, will be measured by the vertical distance dy ($= y' - y$) between these two points. This amount of motion has taken place in the space of time dx ($= x' - x$), comprised between the two time intervals x and x'. Hence the amount of motion in unit time (*i. e.*, the time-rate of motion), or the velocity, will be

$$\frac{y' - y}{x' - x} = \frac{dy}{dx} = \text{feet per second.}$$

Let the (dotted) line, x° - - - z, be drawn tangent to the middle point of the portion of the curve comprised between the points A and B. Then, by similar triangles, we have

$$\frac{dy}{dx} = \frac{Bx'}{x^\circ x'} = \frac{y'}{(x' - x^\circ)} = \tan B\, x^\circ\, x'$$

A similar relation would obtain in the case of a line drawn tangent to any other point whatever of the curve. Hence, the differential coefficient $dy \,/\, dx$, or the tangent, at any point of the curve, is numerically equal to the time-rate of motion, or the velocity, at that point.

The precise numerical value of the differential coefficient, for any point of the curve, will depend upon the angularity of the tangent line (analogous to the line x° - - - z) at that point. For an angle of 90°, corresponding to any portion of the curve having an exactly vertical direction, we have $dx = 0$, while dy = a finite quantity, and consequently, the value of the tangent being infinity (as is well known from trigonometry) we will have

$$\frac{dy}{dx} = \frac{dy}{0} = \tan 90^\circ = v = \text{infinity,}$$

that is to say, the velocity will be infinite. For an angle of 0°, corresponding to any portion (D) of the curve which is exactly horizontal, we have $dy = 0$, while dx = a finite quantity, and, consequently, we will have

$$\frac{dy}{dx} = \frac{0}{dx} = \tan 0^\circ = v = \text{zero}$$

that is to say, zero velocity, *i. e.*, absolute rest.

A curve such as shown in Fig. 15 is, in reality, a "distance-time" curve, but is usually called simply a distance curve. From the preceding analysis it will be readily seen that the slope of the curve or the angle which it makes with the axis of x, is an indication and a measure of the velocity of the moving body. It is also an indication of the direction of motion, for, as will be seen, the elemental motion (dy) taking place in the time (dx) is upward, since the space increment (dy) when measured on the scale of ordinates represents the progression from the point y to the point y'.

In Fig. 16 we have a distance-time curve having a general downward slope. In this case, the elemental motion (dy) taking place in the time (dx) is downward, since it represents the progression from the upper ordinate y' to the lower ordinate y. In such a case the space increment (dy) would have a negative sign, and,

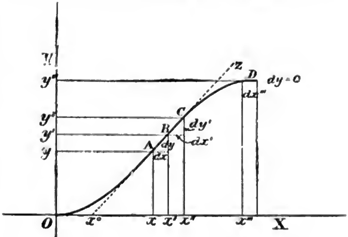


FIG. 15

consequently, the differential coefficient $\dfrac{dy}{dx}$ would have the negative sign.

It follows, therefore, that in any distance-time curve, when the differential coefficient has a positive sign, it indicates motion upward, and when it has a negative sign, it indicates motion downward.

The distance-time curve is related in an interesting manner to the speed-time curve, which we now proceed to consider analytically.

In a speed-time curve (Figs. 1, 2, 3) the ordinate values (y) represent instantaneous values of speed or velocity, as previously stated. We, therefore, have (from equation a)

$$y = \frac{ds}{dt} = v \qquad (b)$$

It follows that the ordinates of a speed-time curve are porportional to the differential coefficients, or the tangents, of a corresponding distance-time curve. Reciprocally, since integration is the reverse of differentiation—any distance-time curve may be regarded as the integral curve of a corresponding speed-time curve. This is a very important and useful relation, which may also be established in another manner.

The area (da) enclosed by any small portion of a speed-time curve corresponding to the time-element dt is

$$da = y\, dt$$

Substituting for y, according to equation (b), we have

$$da = \frac{ds\, dt}{dt} = ds \qquad (c)$$

or the elemental area of a speed-time curve is the equivalent of an elemental distance (ds). This elemental distance is equal to the difference in the ordinate values of a corresponding distance-time curve taken between the same time points.

The equivalent of ds, by equation (b), is

$$ds = v\, dt \qquad (d)$$

The integration of the speed-time curve between any two time points such as t° and t', will give

$$A = \int_{t^\circ}^{t'} v\, dt = s \qquad (e)$$

NOTE.—The first instalment of this paper appeared in the STREET RAILWAY JOURNAL July 5; the second part July 26, and contained Figs. 1 to 10; the third part, Aug. 9, and contained Figs. 11 to 13, and the fourth part, Aug. 16, and contained Fig. 14.

in which

A = the area of the portion of the speed-time curve comprised between the time values t° and t',

and

s = the distance traversed in the interval of time t° t'.

By reversing the process, or differentiating, we return readily from equation (e) to equation (d), and thence to equation (b), which was our starting point.

The above relationship between the distance-time and the speed-time curves is utilized to advantage in plotting the "run" curves.

[This relationship was mentioned as early as 1885 by M. Bruno Abdank-Abakanowicz, in one of his serial articles on the "Integraph," published in "La Lumière Electrique" (Vol. XVIII, pp. 538-539), and reprinted in his work, "Les Intégraphes," 1886, pp. 117-119.]

Variable Velocity and Acceleration.—Velocity, like motion itself, may be estimated by reference either to its amount or to its rate.

I. Amount of Velocity.—The amount of velocity (or the amount of speed) of a moving body, is the difference between

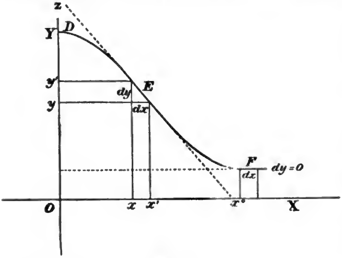


FIG. 16

two definite given velocities of said body. The two velocities by reference to which amount of velocity is determined, are sometimes called the "initial" and "final" states "of motion," or "velocities" of the body.

Equation (a) suggests at once the following analytic definition: Amount of velocity is the difference between two given time-rates of motion of a body. In symbols we have, for the amount of velocity,

$$v'' = v' - v^\circ = \frac{d\,s^\circ}{dt} - \frac{ds'}{dt} \qquad (f)$$

where

v'' = amount of velocity
v° = initial velocity
v' = final velocity

When the initial velocity v° = zero, we have

$$v'' = v' \qquad (g)$$

In this case the amount of velocity is the total velocity. This is the quantity generally meant when we speak of a speed of so many miles or kilometers per hour, or so many feet or meters per second.

When the initial velocity is lower than the final velocity, equation (f) gives a positive value for v'', and we have a gain or increase in velocity, which is acceleration. The motion taking place under these conditions is called accelerated motion.

The following statements should be carefully noted:

Acceleration is increase in velocity.

It is measured in miles per hour, like velocity.

This is not the usual acceptation of the term acceleration, which, as we shall see later, is used, ordinarily, in a figurative sense, instead of "time-rate of acceleration."

When the initial velocity is higher than the final velocity, then equation (f) gives a negative value for v'', and we then have a loss or decrease in velocity, which is retardation. The motion so conditioned is called retarded motion.

Retardation is decrease of velocity, and is measured in miles per hour, like velocity.

Since a loss or decrease is a negative gain or increase it follows that retardation is, analytically, the same as negative acceleration; and it is in practice often designated by that term.

If the initial and final states of motion are exactly the same, equation (f) gives v'' = o, and we have "constant" speed or velocity.

In the speed-time curve in Fig. 1, the points A, B, C correspond, respectively, to speeds of 55, 60 and 65 m. p. h. These figures represent the total velocity at the corresponding points. Reckoning from rest or zero velocity there has been an increase in velocity, or an acceleration of 55 m. p. h. at the point A, of 60 m. p. h. at the point B and of 65 m. p. h. at the point C. The gain in velocity or the acceleration between one point and the next is equal to 5 m. p. h.

In Fig. 2 the points A, B, C, D correspond to speeds which are respectively 60, 50, 40 and 30 m. p. h. These figures represent the total velocity as before, but in this case the total velocity decreases from one point to the next, there being a loss of velocity or retardation of 10 m. p. h. between any one point and the next.

It will be noted that the time required to bring about the same acceleration or retardation is not the same between A and B, as between B and C. This shows that acceleration (using the term in the sense hereinabove defined) and retardation are independent of time.

Between the points D and E, in Fig. 1, there is no gain or loss in velocity, or, in other words, there is no acceleration or retardation, the speed line being perfectly horizontal, thereby indicating constant or uniform velocity.

II. Rate of Velocity.—The rate of velocity which is most suitable for practical use is the time-rate of velocity, which is

$$\frac{dv}{dt}$$

where

v = velocity

and t = time

We at once recognize this as being also the expression for the differential coefficients of a speed-time curve at any point.

Since, according to equation (b), the ordinate of a speed-time curve is already equal to a time-rate of motion, its differential coefficient, or the time rate of variation, at any point of the curve, will be equivalent to the second differential coefficient of a corresponding distance-time curve, or

$$\frac{dv}{dt} = \frac{d\left(\frac{ds}{dt}\right)}{dt} = \frac{d_2 s}{dt} \qquad (g)$$

We see at once that while the differential coefficient of the distance-time curve $\frac{ds}{dt}$ — indicated amount of velocity, the differential coefficient of the speed-time curve indicates time-rate of velocity. Since time-rate of velocity is equal to change in amount of speed (or acceleration) per unit time, it follows that it is equal to time-rate of acceleration. We therefore have

$$\frac{dv}{dt} = \frac{d_2 s}{dt^2} = \text{time rate of acceleration.} \qquad (h)$$

for which the term "acceleration" is usually employed. The term "rate of acceleration" or "acceleration rate" would be more proper. The writer has sometimes used the term "acceleration coefficient."

When acceleration is measured in miles per hour, as is usual in this country, we have

$$\frac{dv}{dt} = \frac{\text{Acceleration}}{\text{time}} = \frac{\text{miles per hour}}{\text{seconds}} = \text{miles per hour per second}$$

When $\frac{dv}{dt}$ = o, we have a horizontal speed line indicating zero acceleration.

When $\frac{dv}{dt}$ = a positive quantity, we have an upward slope in the curve, indicating increase in acceleration.

When $\frac{dv}{dt}$ = a negative quantity, we have a downward slope in the curve, indicating negative acceleration or retardation.

APPENDIX B.

TRAIN ACCELERATION

DERIVATION OF FUNDAMENTAL FORMULÆ

The fundamental formulæ relating to train acceleration are derived directly from the formulæ for mechanical energy and mechanical work.

The mechanical work done by a source of energy in moving a body over a given distance is a measure of the mechanical energy usefully expended in doing this work, and it is equal to the product of the propelling force acting against the body by the distance over which the body has traveled, or

$$E = Fs \tag{1}$$

from which we have

$$F = \frac{E}{s} \tag{1a}$$

where

E = Energy (or work)
F = Force exerted (in causing pressure, push or pull)
s = Distance traveled

The above (1) is the equation of potential energy. When considering the changes of energy in a moving body, especially where the force exerted does not remain constant, the equation may be modified so as to estimate separately the energy for each small element (ds) of the distance traveled, thus:

$$d\,E = F\,ds \tag{2}$$

the total energy corresponding to the whole distance being, in that case,

$$E = \int_0^s F\,ds$$

The distance factor of the energy developed may be expressed in terms of the velocity of the body at each instant of time. Velocity being, itself, a time-rate of space variation, we have

$$v = \frac{ds}{dt} \tag{3}$$

whence

$$v\,dt = ds \tag{3a}$$

where

v = velocity
t = time

Substituting this value of ds in equation (2) we have

$$d\,E = F\,v\,dt$$

which expresses the change in the mechanical energy imparted to a moving body at each instant of time. We also have

$$\frac{d\,E}{dt} = F\,v \tag{4}$$

or, "the time-rate of variation of energy is equal to the product of force by velocity."

The kinetic energy of a moving body, according to the well-known formula, is

$$E = \frac{M\,v^2}{2} \tag{5}$$

in which M = the mass of the moving body.

Differentiating with respect to v, we have

$$d\,E = M\,v\,dv$$

which expresses the change in the mechanical energy imparted to a moving body at each change of speed. Dividing by dt, we have

$$\frac{d\,E}{dt} = M\,v\,\frac{dv}{dt} \tag{6}$$

which is another expression for the time-rate of variation of energy.

Equating (4) and (6) we have

$$F\,v = M\,v\,\frac{dv}{dt}$$

whence

$$F = M\,\frac{dv}{dt} \tag{7}$$

but $dv\,/\,dt$ is the time-rate of change of velocity, which is rate of acceleration. (This can be readily seen from equation (3); by differentiating v with respect to s and dividing by dt, we have

$$\frac{dv}{dt} = \frac{d_2s}{dt^2}$$

which is the same as equations (g) and (h), in Appendix A.

Hence, if we designate this time-rate by the symbol A, we obtain the well-known fundamental equation

$$F = M\,A \tag{8}$$

which state that "force is equal to the product of mass by acceleration;" from which we derive

$$A = \frac{F}{M} \tag{9}$$

This equation, which expresses the relation between the acceleration produced in a given mass and the force acting upon it, is the fundamental equation for acceleration. The formula requires modification in order to make it convenient for practical use. The mass (M) should be expressed in terms of weight. The acceleration (A) should be based on increments of velocity, stated in miles per hour, and the force (F) should be expressed as a pull in pounds per ton.

The force of acceleration is usually estimated in "gravity-measure," that is to say, by reference to the acceleration produced in a falling body by the action of gravity.

The distance traveled by a falling body is

$$s = \frac{g t^2}{2} \tag{10}$$

where

g = the acceleration constant due to gravity
t = time (in seconds)
s = distance traveled (in feet)

The velocity of the falling body is

$$\frac{ds}{dt} = g t = v \tag{11}$$

and its acceleration is

$$\frac{d_2s}{dt^2} = g = \frac{dv}{dt} \tag{12}$$

The force exerted by gravity is, by equation (8),

$$F = M\,A = \tag{12a}$$

When a body falls and reaches the end of its fall, its potential energy is all converted into kinetic energy. The equation (1) for potential energy may be written

$$E = s\,w = \text{ft. lbs.}$$

when the force w is expressed in pounds, and the distance s is expressed in feet.

Using equation (5) for the kinetic energy, and equating the two, we have

$$E = \frac{M\,v}{2} = w\,s \tag{13}$$

Substituting for s its value as given in equation (10) the preceding equation becomes

$$\frac{M\,v^2}{2} = \frac{w\,g\,t^2}{2} \tag{14}$$

whence

$$M\,v^2 = w\,g\,t^2$$

Taking the value of v ($= g\,t$) and substituting for v its value as given in equation (11), the above equation becomes

$$M\,g^2\,t^2 = w\,g\,t^2$$

which reduces to

$$M\,g = w \tag{15}$$

whence we have

$$M = \frac{w}{g} \tag{16}$$

The value of g may be taken as

$$g = 32.2$$

so that mass expressed in gravity measure is equivalent to weight in pounds, divided by 32.2, or, we have

$$M = \frac{w}{g} = \frac{w}{32.2} \tag{17}$$

when w is expressed in pounds.

If we substitute this value for M in the fundamental equation (9) for acceleration, we have

$$A = \frac{F}{\frac{w}{32.2}} \tag{18}$$

or

$$A = \frac{32.2\,F}{w} \tag{18a}$$

F being, according to equation (1a), the ratio of the energy to

the distance traveled, that is, the pulling force exerted over said distance. This pulling force is expressed in pounds and speeds are expressed in feet per second, when energy (E) is expressed in foot-pounds and distance (s) is expressed in feet. The above formula (18a), therefore, expresses acceleration as a gain or loss in speed measured in feet per second, obtained during one second, that is to say, the increase or decrease in velocity in feet per second per second. In dealing practically with train acceleration, the speeds are usually estimated in miles per hour, and the gain in speed per second is, as a rule, expressed as the increase or decrease in miles per hour, per second. The formula (18a), therefore, requires to be modified by a conversion factor expressing the relation between an acceleration of a foot per second per second and a mile per hour per second. Since a mile is equal to 5280 ft., and an hour is equal to $60 \times 60 = 3600$ seconds, it follows that a velocity of 1 mile per hour $= \frac{5280}{3600} = 1.467$ ft. per second. Using the letter "A" to indicate acceleration in feet per second per second (as in formula 18), and the letter a to indicate acceleration in miles per hour per second, we have the following equation:

$$A = 1.467a$$

whence

$$a = \frac{A}{1.467}$$

or

$$a = .682A \qquad (19)$$

which means that an acceleration of 1 ft. per second per second is equal to an acceleration of .682 mile per hour per second.

Therefore, substituting the value of A, as given in equation (18), we have

$$a = .682 \times 32.2 \times \frac{F}{w} \qquad (20)$$

in which the numerical value of a is equal to the gain or loss of speed (in miles per hour) per second. If the weight (w) is to be expressed in tons of 2000 lbs., as is the general practice in this country, we must substitute its value such that

$$w = 2000\,W$$

where

$$W = \text{tons (of 2000 lbs.)}$$

and where

$$w = \text{pounds (lbs.)}$$

This means, simply, that the symbol (W) representing weights in tons must be multiplied by 2000 to give the equivalent weight in pounds. Substituting for w its value, in terms of W, the equation for acceleration (20) becomes

$$a = \frac{ds}{dt^2} = \frac{(0.682 \times 32.2)\ F}{2000\,W} =$$

$$= \frac{21.96\,F}{2000\,W} = \qquad (21)$$

$$= \frac{.01098\,F}{W} \qquad (21a)$$

Solving for F, we have

$$F = \frac{W\ a}{.01098}$$

$$= 91.1\ W\ (a) \qquad (22)$$

If we are considering the force (F) corresponding to unit weight ($W = 1$ ton), and unit acceleration ($a = 1$ mile per hour per second), the preceding equation reduces to

$$F = 91.1$$

This means that an effort or pull of 91.1 lbs. is required for each ton of train weight for maintaining acceleration at the rate of one mile per hour per second.

Solving for W, we have

$$W = \frac{.01098\,F}{a} \qquad (23)$$

These three equations (21), (22), (23), give the value of each of the three quantities a, F and W, when the other two are known or assumed. They are the formulæ usually employed in discussing problems in train acceleration. The term F, it should be carefully noted, does not symbolize the total force applied to, or absorbed by, the train, but only that part of it which is expended in producing acceleration. It is one of the two factors of that portion of the total energy applied to the train which is really stored in the train in the form of kinetic energy of momentum; the other factor being (according to the fundamental formula of work, hereinabove,) the distance traversed while the force is operating. If the force remain constant in value throughout the entire distance, we have

$E = F\ s$, which is the same as equation (1).

If the force varies at different points, we have

$E = \int F\ ds$, which is the same as equation (2).

In any case where there are other forces besides that which is expended in, and represented by, the production of acceleration, these other forces may also be expressed in terms of acceleration, and using the letters F' F'' F''' to represent these forces, the total force P, would be:

$$P = F \pm F' \pm F'' \pm F''' \pm \text{etc.} \qquad (24)$$

the sign ($\pm$) being taken to mean that the forces in question may be either such as to produce acceleration, or such as to prevent it. The acceleration (a) which each of these forces would produce by itself, is to be determined by reference to equation (21a) same as the acceleration corresponding to stored energy.

Using the symbols a', a'', a''' to indicate these accelerations, and substituting their value, as given by equation (21a) in equation (24), we have

$$P = 91.1\ W\ a \pm 91.1\ W\ a' \pm 91.1\ W\ a'' \pm 91.1\ W\ a''' \pm \quad \text{etc.} \qquad (25)$$

Since 91.1. W is common to all these terms, we may write this equation as follows:

$$P = 91.1\ W\ (a \pm a' \pm a'' \pm a''' \pm \text{etc.}) \qquad (25a)$$

From this equation we have

$$\frac{P}{91.1\ W} = a \pm a' \pm a'' \pm a''' \quad \text{etc.} \qquad (26)$$

But P being the total force, according to equation (25), and the quantity, 91.1 W, being the "converted" measure of mass, the quotient of these two quantities represents, according to equation (9) an acceleration which might be called the total acceleration. Using the symbol A' to designate this total acceleration, we have

$$A' = \frac{P}{W} = a \pm a' \pm a'' \pm a''' \pm \text{etc.} \qquad (27)$$

or the effective acceleration, in any concrete case, is equal to the algebraical sum of the accelerations which would be produced by each of the forces acting independently and alone.

This is a most important deduction which is of great utility and convenience in simplifying the analysis and the plotting of speed-time curves.

Equation (27) may be put in more practical form. The symbols "a" used in this equation in reality represent time-rate of acceleration, as is fully explained in Appendix A; consequently, each one is equal to a time-rate of velocity (dv / dt). The equation may, therefore, be written

$$A' = \frac{dv}{dt} = \frac{dv'}{dt} \pm \frac{dv''}{dt} \pm \frac{dv'''}{dt} \quad \text{etc.} \qquad (28)$$

The analytical statement of the deduction previously noted is, therefore, as follows:

The differential coefficient of an acceleration curve is equal to the algebraical sum of the individual differential coefficients corresponding to the various forces concerned and operating in producing the acceleration, each of these differential coefficients being determined separately, just as if it were alone concerned in the result.

Using the letter "k" (as is done in Appendix C), as a symbol to designate a time-rate of velocity, the above equation becomes:

$$A' = k \pm k' \pm k'' \quad \text{etc.} \qquad (29)$$

where k, k', k'', etc., represent the values of the differential coefficient, corresponding to the accelerations a, a', a'', etc., in equation (27).

(To be Continued.)

Chicago's Mayor Will Veto All Traction Franchises

It is said that Mayor Harrison, of Chicago, has returned from his vacation apparently stronger in his purpose not to sign any traction franchise extension ordinance until the State Legislature gives the city the undisputed right to own the traction lines. It is even said that he will veto any proposition providing for municipal ownership as a possibility at the expiration of ten years. Mayor Harrison is quoted as saying:

"I will veto any such proposition unless the people vote for it at the coming election. I can't see why I should have to say again and again what I have said 100 times—that I shall not sign an ordinance until municipal ownership is made possible. If this question of franchise is not passed upon by the people this fall I shall oppose any Council measure that may be offered until there is legislation at Springfield by which we may attain municipal ownership."

An Outing of New York Street Railway Men

As is well known, President H. H. Vreeland, of the Interurban Street Railway Company, of New York, extends an invitation once a year to the heads of the departments of his company to visit his country home in Brewster, to participate in a clam bake and to have a generally good time among the attractive surroundings which Brewster enjoys. The fourth annual entertainment of this kind occurred Aug. 16. The guests were invited to meet at the Grand Central Station and go by special car, attached to the 9:09 a. m. train, via the Harlem Railroad, to Brewster. There is a large attendance, including practically all of the officers and staff of the Interurban Street Railway Company, as well as the following invited guests, among others:

F. S. Pearson, consulting engineer; Edw. A. Maher, president Union Railway Company; Thos. W. Olcott, secretary and treasurer, Union Railway Company; Henry Sanderson, president, New York Transportation Company; G. Tracy Rogers, president, Binghamton Railway Company and of the New York Street Railway Association; Hon. A. W. Cole, New York State Railroad Commissioner; W. W. Wheatly, of the Brooklyn Heights Railroad Company; A. M. Waitt, of the New York Central & Hudson River Railroad Company; W. F. Potter, of the Long Island Railroad Company; W. B. Yereance, of the Brooklyn Heights Railroad Company; G. W. West, of the New York, Ontario & Western Railway Company; D. M. Brady, of the Brady Brass Company; George G. Haven, Jr., and Pierre Jay, of the Second Avenue Railway Company.

Four carryalls met the train at the station, and the guests were at once driven to Lake Tonetta. The clam bake was held at the Tonetta Outing Club at high noon, at which time the guests collected from the various sports in which they amused themselves in the way of boating, fishing, ball, etc. "Two bells" were sounded and everybody was asked to "step lively" and partake of the luscious bivalves which composed the baking pyramid of clams. The day was perfect for an outing of this kind, and Mr. Vreeland's well-known hospitality was enjoyed by a larger number than ever before.

After an impromptu vaudeville performance, which followed the repast, the entire party was driven to Mr. Vreeland's summer home, Rest-A-While, where all the guests were received by Mrs. Vreeland. The house and its extensive grounds gave ample opportunity for a most enjoyable time, and the ping-pong tables, pool table, croquet and other outdoor sports proved very attractive, and a number of exciting games were soon in progress. In these athletic exercises many of the guests displayed a skill which was a revelation to most of their associates, who were acquainted with their intimate knowledge of street railway conditions, but who did not know that they were experts in other branches of study.

After a band concert in the evening the guests reluctantly took their departure, after one of the most enjoyable occasions in which they had ever participated, and all, except those who reside in Brewster, were whirled by special train on the Harlem Division of the New York Central Railroad back to the city.

The John Fritz Medal

The treasurer of the John Fritz medal fund, to which reference has been made in this paper, reports that enough subscriptions have been received to insure the success of the plan, but that a little more money would be desirable, and it has been decided to keep the subscription lists open for a short time longer, to enable any others who have not as yet sent in their subscriptions to do so. This medal, it will be remembered, is being founded to celebrate the eightieth birthday of John Fritz, the well-known engineer, and it was decided by the committee organized to institute the medal, to limit all subscriptions to $10, no more and no less, and to award the medal every year "to the originator of the most useful scientific or industrial achievements, in perpetual honor of John Fritz and to the glory of engineering." The medal is to be awarded by a perpetual committee of sixteen, to be appointed or chosen in equal numbers from the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, and the American Institute of Electrical Engineers.

The public celebration of Mr. Fritz's eightieth birthday and the foundation of this memorial will be held in New York City, Oct. 31. It will take the form of a dinner, in which the subscribers to the fund will have the first opportunity to participate. Further information can be obtained by those who desire it from John Thompson, treasurer, 253 Broadway, New York; or T. C. Martin, member of the committee for the American Institute of Electrical Engineers, 114 Liberty Street, New York.

CORRESPONDENCE

Brick for Car House Floors

NEW YORK, N. Y., Aug. 20, 1902.

EDITORS STREET RAILWAY JOURNAL:

I have noticed a number of articles in your valued paper on the subject of car house construction, but have never seen any particular discussion in your columns as to the relative advantages of different materials to be used for flooring. Of course, in the old style car house and in the cheaper car houses of to-day, wood is the ordinary material used for this purpose. It is inexpensive but possesses so many manifest disadvantages, including that of inflammability, that I do not think that its use can be defended in any case except where first cost is the prime consideration with a railway company.

In the more modern car houses, so far as I have been able to learn, concrete is considered the most desirable material, and it is used almost exclusively for this purpose. Concrete is no doubt an ideal material in many ways, and it does not have many of the disadvantages which are possessed by a wooden flooring. Its appearance also is very attractive at first, but this statement cannot be made even after a few months of use. The concrete very soon becomes badly spotted by the oil and grease from the cars, and there does not seem to be any way of removing these stains.

The ideal material, it seems to me, for a flooring of this kind is a porous brick, which ought not to be any more expensive than concrete, if as costly, which dries quickly and which would not show oil stains. I understand that some of the railway companies abroad are using a brick of this kind which does not show oil spots. Whether this is so or not the ordinary red brick would be fairly satisfactory, I think, in this respect, as the discoloration would not be so conspicuous on it as on the lighter colored concrete. Moreover, brick would have the added advantages that it dries quickly, that it will not chip or crack so readily as concrete, and that any portion of the surface which does become worn can easily be renewed. I am not interested in any brick yard and offer this suggestion for what it is worth.

R. P. GORMAN

The Training of Motormen

WILKINSBURG, PA., Aug. 17, 1902.

EDITORS STREET RAILWAY JOURNAL:

The prediction recently made by Mr. Edison that thirty years hence electricity will likely have replaced all steam locomotives, again impresses on my mind that railway managers who are at present converting their motor power from steam to electricity, are making a mistake in not requiring "motormen" to become equally familiar with electricity and the electric motor as they were with the steam locomotive, before being considered competent to handle same.

The experience or knowledge necessary to handle a trolley car can hardly be compared to that required of motormen in charge of a train of five or six cars, which the elevated railway systems operate.

I have had personal experience, in several instances, where lengthy delays to traffic and considerable damage to the apparatus could have been wholly avoided by the motorman or conductor, if they had even a crude knowledge of electricity.

Their instructions or requirements in most cases do not go beyond a knowledge of the movement of controller handles, and as some men are not very ambitious their knowledge does not increase, since their officers do not insist on it. In my mind, it would add greatly to the success of electricity in heavy traction work if motormen were expected to pass an examination, which would compare favorably to the standard required of locomotive engineers. The steam engineer that would permit the crown sheet of the fire-box to burn because the water supply ran out, would surely be considered incompetent. But in many cases, recently, motormen have been guilty of equally absurd failures to protect the balance of the apparatus when one part became inoperative.

M. B. LAMBERT.

The Doylestown Electric Company, of Doylestown, Pa., has recently contracted with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, for two kilowatt engine-type 2-phase alternators, with direct-connected exciters, complete with switchboard. The engineer for the work is Dr. W. A. Drysdale, of Philadelphia.

The Efforts of an Independent Company to Secure Entrance to Trenton, N. J.

The New Jersey & Pennsylvania Traction Company has asked the Common Council of Trenton, N. J., for franchises on Willow, West Hanover and Calhoun Streets, as well as through a part of the old city reservoir property. The company proposes extending its Princeton line from the present terminus, at Ingham Street, to the center of the city, a distance of one mile, and the Yardley line from the Upper Delaware Bridge to the center of the city. The Princeton line is now operated under a steam charter from its present terminus to the borough line of Princeton, but the Trenton, Lawrenceville & Princeton Railroad, as it is officially known, will terminate at the Trenton city line. The extensions will be constructed under the New Jersey & Pennsylvania Traction Company's charter. For 500 yards the road will run on private right of way, crossing several streets at grade, and entering Willow Street at its northern terminus. In order to reach Willow Street it is necessary to pass through a part of the old reservoir property (the new reservoir being a half mile away), and the company is seeking to purchase this from the city. The company offers to give the city, in return for the franchise, about $50,000 in property; also to do considerable street paving. The company has agreed to deed to the city a part of the valuable property at West State Street and Calhoun Street, just west of the State Capital, for which the company paid $45,000; also to deed other lands of the company in order that Calhoun Street may be made from 10 ft. to 15 ft. wider than at present. Wherever there is paving upon any street (Willow Street and West Hanover Street are paved with vitrified brick) the company agrees to pay for such portion as its tracks may occupy, between the same, and for a distance of 1 ft. upon each side. This money the company has agreed to pay as may be determined by a committee, appointed for that and other purposes in connection therewith by the Common Council. In addition it is agreed that the fares shall not be more than 3 cents within the city limits, with free transfers to the company's own and such other lines as may enter into traffic relations with it. Two cents extra will secure a transfer to Lawrenceville, 6 miles out; 2 cents extra to Morrisville, Pa., across the Delaware, and 7 cents extra to Princeton, which will be 13 miles from the center of Trenton, when the extensions are built. High-grade equipment is promised, and the minimum wages to be paid motormen and conductors will be 20 cents per hour.

No action was taken by Common Council at the meeting at which the petition and ordinance were presented, but President Hill was authorized to appoint a committee to investigate as to what could be done with the old reservoir property, and also to ascertain what the chances would be for damage to the city's water mains, which run through Calhoun Street. This committee will soon be appointed. As a whole the citizens of the city seem to be in favor of granting the franchise without loss of time, but there is a movement on foot among some of the city officials to ask the company to give to the city the Calhoun Street Bridge across the Delaware River in addition to the concessions it has offered. The company paid more than $200,000 for this bridge, which is about 1100 ft. long, and collects tolls (as has always been done) for teams and pedestrians. Under the present offer of the company the city will receive about $27,000 per mile for the franchises, and to give the bridge, too, would make the franchises cost the company about $127,000 per mile. Another drawback to deeding the bridge to the city, aside from the amount of money involved, would be that it would afford other companies the right to cross, by permission of the city. This bridge was purchased by the New Jersey & Pennsylvania Traction Company for a figure which was considered prohibitive by all the other companies that had sought its purchase, and the demands that it be deeded to the city certainly is very unreasonable.

A peculiar situation is now presented by this latest move of the New Jersey & Pennsylvania Traction Company. Up to Dec., 1901, no foreign company had ever asked permission to enter the city, and previous to April, 1901, no other company had reached the city line. In Dec., 1901, the Camden & Trenton Railway Company asked for a number of franchises to bring its line from Camden into this city, and they were speedily granted, but they are yet tied up in the State Courts, through action brought by the Trenton Street Railway Company to prevent the company from entering the city. The Yardley, Morrisville & Trenton Street Railway, now owned by the New Jersey & Pennsylvania Traction Company, came into the city limits last August, but it was upon the Calhoun Street Bridge, and no franchises were necessary. The New Jersey & Pennsylvania Traction Company now seeks permission to bring two lines in, from the west and north. The Trenton & New Brunswick Railroad, nearly completed under a steam charter, touches the city line on the east, and will doubtless soon be asking admission under a traction charter, and the Delaware Valley Traction Company, incorporated last fall, has maps filed covering every available outlet from the city except those already covered. This company is also securing rights of way for several of the routes.

There is so much public feeling concerning the franchises of the New Jersey & Pennsylvania Traction Company, as well as the other new roads, that an effort is said to be on foot among the city officials to stave off action until after the fall elections, but this will be difficult. It is quite possible that Trenton may be treated to scenes such as have been witnessed in Cleveland, where efforts have been made to secure a low-fare franchise by an independent company. Mayor Katzenbach, of Trenton, is counsel for the New Jersey & Pennsylvania Traction Company, and the company is controlled by the Johnson syndicate. The Mayor is a Democrat, but the Council is Republican.

The New Jersey & Pennsylvania Traction Company now transfers its passengers from the Ingham Street terminus of the Princeton line to the center of the city by means of 'buses, which are a great expense and cause considerable delay. The passengers from the Yardley line have to use the local road or walk. The Princeton line has been put in such fine shape for the entire 12 miles from the Trenton city line to the Princeton borough line that a car can be run at full speed the entire distance, not a single slow-down being necessary.

The Aldermanic Investigation of New York and Boston

An account was given, in a recent issue, of the trip of the committee on local transportation of the Chicago City Council to New York and Boston to investigate the subways in those cities, and other subjects connected with rapid transit facilities. The Aldermen, who were accompanied by Alderman Frank I. Bennett, chairman of the committee, and Bion J. Arnold, electrical expert, spent two days in Boston after leaving New York, and then returned to Chicago. Interviews with a number of the gentlemen composing the committee indicate that the investigation carried out by them was very successful in the direction of securing information sought. The question of a subway, which was one of the principal objects of the trip, received especial attention, and the members seemed unanimous in their opinion of the desirability of a subway for Chicago. An abstract of some of the interviews published in the Chicago papers with different members of the committee follows:

M. J. Foreman stated that the investigation, in his judgment, demonstrates "that no arrangement or duplication of surface tracks, terminals, or routes can be devised for Chicago that will supply adequate and rapid street car service.

"That a system of subways for street cars, at least in the congested districts, is an essential if Chicago is to have good, comfortable and rapid transportation.

"That the best service is achieved where all passenger-carrying lines in a city, whether on the surface, in the air, or under ground, are operated by one company as one line or system.

"That if such consolidation cannot be had at once in Chicago at least co-ordination should be required of companies as one of the conditions for franchise extension."

The Boston subway, he believes, passes through substantially the character of places as would be found in Chicago, but that one difficulty which was encountered in Boston, that is, sudden and steep changes of grade, would be unknown in the former city. The Brooklyn condition, Mr. Foreman continues, "resembles ours in a great many ways. The traction companies carry their passengers a long distance, several miles from the center. Relief there must be secured from a system of subways which should connect or be part of the New York subway and thereby bring passengers from any point in New York to any point in Brooklyn. New York or Brooklyn present conditions that Chicago cannot have or improve upon."

Frank I. Bennett refers to the immense traffic in New York, and while he acknowledges that the New York problem of transportation is probably the most difficult in the world, refers to its rapid and comfortable transportation service, which apparently gives satisfaction to the public. "The system of transfers," he says, "is a little puzzling to the stranger, but enables the citizen who is posted to reach any part of the island without an additional fare. The companies, in short, reserve the right to route the passenger in order, it is claimed, to prevent the congestion of all traffic on any one main line, and thereby render service unsatisfactory, and, owing to the conditions, I am not prepared to say that this regulation is not the best here."

Mr. Bennett says the service in Boston is almost ideal, and refers particularly to the subway and the new subway under the Boston Bay. He concludes, "the city officials and railway men of New York, Brooklyn and Boston have afforded the committee every facility, and have shown us every courtesy, and the com-

mittee on local transportation will return to Chicago with a fund of information gathered from personal observation which will enable it to recommend a system not only equal, but superior, to the best in these places."

W. J. Raymer says: "My judgment is that consolidation of the street railways in both Boston and New York has resulted in giving the people many advantages not obtainable in the operation of separate companies. Chicago can have an ideal service by the construction of a subway, and the new franchises should provide for this improvement. There are a number of features of a minor nature which Chicago should benefit from which would be provided for by the city controlling the street car situation as the city of Boston does."

William Mavor says: "The fact that one company operates all the lines, surface and elevated, in Boston, gives that city the best transportation system and the people the most complete service in the country. In New York all the surface lines are operated by one company, so that New York, having unification of service to that extent, is also much better prepared to give its people good service."

New York State Electrical Laboratory Commission

An outline of the proposed establishment in New York State of a State Electrical Laboratory Commission has already been noticed in these columns. The bill appointing these commissioners was passed at the recent session of the State Legislature, and defined the purpose of the Commission as follows:

For investigating as to the necessity for the establishment of a State Electrical Laboratory to provide independent, authoritative information on questions of electrical science, and an official standardizing laboratory for electrical measuring instruments, apparatus and standards for the protection of municipalities and the general public in the use of electrical energy and of the producers of electrical energy. Said commission is hereby directed to report to the Legislature at the opening of the session of 1903, and if, in their judgment the establishment of said electrical laboratory is necessary, to prepare and submit in connection with their report, detailed plans and specifications for the construction and equipment of such laboratory, accompanying said plans with a specific and detailed statement of the cost thereof.

Under this law a commission consisting of three members, viz.: Edward A. Bond, of Albany, chairman; Charles P. Steinmetz, of Schenectady, and Harold W. Buck, of Niagara Falls, has been appointed.

In the establishment of a New York State Electrical Laboratory (which could serve as a precedent for similar institutions in other States) it is proposed to organize an institution of the highest efficiency and widest scope, which shall be capable of dealing in an authoritative manner with all problems which may arise in the mutual interests of the people of the State; to have its equipment such that all phenomena in question can be reproduced on a large scale and results under various conditions demonstrated; to have a complete set of standards for the calibration of all types of electrical meters; to have an electrochemical laboratory for demonstrations and analysis; to have the location of the institution such as to be central in the State and near to some large source of power from which several thousand horse-power can be drawn at times for experimental purposes by a special transmission line; and, last, to have the institution presided over by a man of high standing and ability, assisted by a corps of competent assistants, who can carry out the work which will be called for by the people of the State, for merely its cost.

It is not the intention to have this State laboratory conflict with the Natural Bureau of Electrical Standards at Washington, but to have it co-operate with it and attend only to such local matters in the State which can more properly and conveniently be handled within the limits of the State.

An idea of the importance and extent of the interests involved can be obtained from the following statement of the capitalization of corporations in New York State engaged in business involving the use of electricity:

(a) Electric railroads, electric light and power stations, telegraph and telephone companies	$1,462,615,595
(b) Companies engaged in the manufacture of electrical apparatus	217,974,695
Total	$1,680,590,290

In the present status of the distribution of electrical energy disputes arise, among other causes, from the following:

1) From mutual induction, static or magnetic, between independent circuits, especially between circuits carrying large currents or high potentials and circuits used for the transmission of intelligence, such as telephone, telegraph, fire alarm, railway block signals, etc.

(2) Accidents to life resulting from conditions frequently not clearly understood at the time of accident, such as crossing of circuits, failure of insulation, etc.; also from insufficient warning notices on circuits of dangerous potential.

(3) Between producers of electrical energy and public consumers, such as municipalities in street lighting contracts, involving the quantity of light supplied, the trouble arising from lack of officially standardized photometric methods.

(4) Between producers of electrical energy and public and private consumers on the quantity of current or energy supplied, resulting from inaccuracy of meters or methods of measurement.

(5) From electrolysis in railway and other grounded systems.

(6) From risk and damage to property from fire caused by defective insulation of circuits.

(7) Between producers and consumers of electrical energy and fire insurance underwriters on methods of installation.

(8) Between independent interests having adjacent distributing circuits under ground from damage caused by heat in short circuits in conduits and subways.

(9) From damage caused by explosions in subways and conduits.

10) Between manufacturers of electrical apparatus and purchasers on guarantees for electrical performance.

(11) Between producers of electrical energy and municipalities on the subject of transmission voltage of overhead circuits.

(12) Between the producers of electrical energy and the general public in cases of rights of way for very high voltage transmission lines where danger to life and property is claimed.

(13) Between the general public and manufacturers of electrochemical products where destructive fumes and gases are claimed to be set free in the process of manufacture.

(14) Many other cases which will undoubtedly arise as the art advances, such as interference in wireless messages.

At present all such disputes, when brought to issue, are settled by the courts, the decisions being based largely upon expert testimony given by those who may or may not state with accuracy the facts involved. For such expert testimony large fees are required, which add greatly to the cost of settlement, and this obtains even in cases of the most simple and obvious decision. No authority exists which can be recognized by the courts as official, nor any institution where the points involved in such disputes could in many cases be made the subjects of actual demonstration by experiment.

The commissioners, whose names are given above, are now, under the authority of the act quoted, engaged in organizing the department, and have issued a general invitation to all interested for their opinion upon the proposed institution, as to its scope, organization, equipment or location. Communications can be addressed to the State Electrical Laboratory Commission, State Engineer's office, Albany, N. Y., or personally by letter or interview with one of the commissioners.

Converting Steam Road to Electric System

The Tennis Company, of Cincinnati, has undertaken the work of converting the Cincinnati, Georgetown & Portsmouth Railway into an electric system. This road is at present a narrow gage steam railway, and has been operated as such for about twenty years, and extends from Carrel Street, Cincinnati, where it connects with the Pennsylvania Railroad Company, to Georgetown, the county seat of Brown County, a distance of 42 miles, including a branch of about 1 mile from a point near Cincinnati to California, where the new city water works are being constructed. This branch line has recently been extended to Coney Island, a distance of about 1½ miles, and in connection with that part of the main line, between the junction point and Carrel Street, has been electrified and is now being operated as an electric railway by means of an extra rail laid, so that one of the narrow gage rails and this extra rail constitutes the track for the electric cars.

The power house is located at Olive Branch, a point 15 miles from Carrel Street, and is being equipped with six 250-hp Cahall boilers, two 600-kw Westinghouse alternating generators, direct-connected to two 915-hp Hamilton-Corliss engines. The plant will be compound condensing. Three sub-stations will be located on the line in addition to one at the main power station. The road has been and will continue to do freight as well as passenger business, operating when completed as a standard gage electric line instead of a narrow gage steam line.

The main line will be equipped with ten 50-ft. passenger cars in addition to those operated on the Coney Island line, which are 40 ft. in length. The latter cars will run direct to the center of Cincinnati over the Cincinnati Traction Company's line. The company has also decided to build several branches.

Financial Report of the Glasgow Corporation Tramways

The report for the year ending May 31, 1902, of the Glasgow Tramways, the largest municipal tramway system in Great Britain, is meeting with considerable adverse comment in that country, and it is claimed that the results secured are not so successful as some of the advocates of municipal enterprise would have the public believe. The Glasgow Herald, for example, states that while the report apparently shows a large profit for the enterprise, these "profits," if analyzed, will be found entirely imaginary. The reasoning upon which this deduction is based follows:

The revenue for the year ending May 31 last, according to the accounts, was £614,413 4s. 11d., the working expenses were £405,103 0s. 7d., and the "gross balance" is £209,310 4s. 4d. This is the first year of operation entirely by electric traction, or practically so, for only £30,680 was earned by the few horse cars kept running, and the working expenses of the horse traction were £754 in excess of the receipts. In the year ending May 31, 1901, the revenue from both horse and electric traction was £489,469 8s. 7d., the working expenses were £401,839 14s. 8d., and the "gross balance" was £87,629 13s. 11d. From this year's "gross balance" certain deductions are made in the report, viz.: £5057 3s. 10d. for the use of the Govan tramways, £54,282 17s. 10d. for interest, £36,974 15s. 9d. for sinking fund, and £12,500 for payment to the Common Good by way of street rental. When these deductions are made there remains a sum of £100,495 6s. 11d., which is transferred to the General Reserve Fund, and which, therefore, the public will believe to be net profit. It is nothing of the sort, as shall presently be shown.

The payment to the Commissioners of Govan of £5057 is for the use of 4¼ miles of track, equal to £1,1190 per mile, while that to the Common Good for the use of 41 miles of street within the municipal boundaries is only £12,500, or £300 per mile. If the same rate had been paid for this track as in Govan, and this would have been required of a private corporation, the amount would have been £48,790 instead of £12,500. Accepting, however, the report as it is, we will take up the General Reserve Fund, which, the criticism of the report claims, has been applied in liquidation of payments that ought to have appeared in the general balance sheet. The General Reserve Fund at May 31, 1901, stood at £183,428 6s. 10d., and, augmented by the transfer of the above £100,495 6s. 11d., it would be £283,923 13s. 9d But, first of all, from it is taken £190,000 to transfer to Permanent Way Renewal Fund, from which the expenditure during the past three years has been £240,560 2s. 5d., and in which a balance now remains of only £85,344. In the report it is stated that this sum is all that is considered necessary by way of provision for the renewal of the track. But it is doubtful whether, in view of the heavy double-deck cars used in Glasgow and the large amount of special work, an expenditure of £450 per mile of single track per annum will be sufficient for upkeep. To come back to the Reserve Fund, however. After allocation of the £190,000 for payment of part renewals of the track, there was nominally at the credit of the fund a sum of £93,923 13s. 9d. But this is only a book entry for depreciation—cost of alteration of buildings to suit electric traction, the loss on last dispersal sales of horses, and so forth, are taken out of this fund instead of out of the reputed "gross balance." These debits absorb £93,539 15s. 9d. and leave only £383 18s. at the credit of the General Reserve Fund. A recast of the balance sheet without the cross-entries through Reserve account would then read as follows:

RECEIPTS		
Gross per statement	£614,412 4 11	
Less working expenses	405,103 0 7	
		£209,310 4 4
EXPENDITURE		
Govan Tramways	£5,067 2 10	
Interest on capital	54,282 17 10	
Sinking fund	36,974 15 9	
Common Good	12,500 0 0	
Depreciation, &c., per reserve fund account	93,539 15 9	
		202,354 13 2
Net balance		£6,955 11 2

Instead, therefore, of a profit of £200,000 from the tramways, there is less than £7000 out of which shareholders could have got any dividend after payment of debenture charges. Had the Department to pay rental, such as a company would have to do, instead of a trifle of £12,500 to the Common Good, there would have been a dead loss of over £40,000. This is assuming that enough has been written off for depreciation in every direction, which, however, is assuming too much. The track depreciation has already been referred to. The depreciation written off for cars is £22,541 on a total value of £296,355, while that on electric equipment is £14,690 on a total capital outlay of £466,596, both manifestly too small. This showing is in face of the fact that no private corporation could raise money on bonds or debentures as cheaply as the Tramways Department can borrow of the City and there is no Board of Directors to pay, whose services would perhaps be more valuable than those of an unpaid, however zealous, committee of the Town Council, but whose fees, at any rate, should be placed in the balance when weighing the comparative advantages of private and municipal enterprise. In conclusion, the Herald states that the citizens of Glasgow must disabuse their minds of the idea that the corporation tramways are a highly remunerative undertaking.

New Franchise in Kansas City

The new franchise ordinance of the Metropolitan Street Railway Company, of Kansas City, Mo., passed by the City Council on July 25, has been signed by the Mayor, and its acceptance by the company has been filed with the city authorities. The ordinance provides that the company and its subsidary organizations shall, beginning June 1, 1902, and so long as they operate under existing franchises, set aside each year 8 per cent of the gross car and track earnings, and, having paid therefrom all State, county and city, school and municipal taxes and licenses, shall turn over any balance of said 8 per cent to the city. This provision, it is believed in Kansas City, will increase immediately the amount to be paid to the city by $100,000 yearly. For the concessions of the company the city grants franchises covering substantially all of the city not now covered by the street railway company. The company agrees to equip with electricity its remaining cable lines and to make various specified extension within a given time. Provision is also made for universal transfers, but there is a clause which provides against "looping" transfers.

Changes in Dick, Kerr & Co., Ltd., of London

According to late English advices, Dick, Kerr & Co., of London, who have for some time been sole selling agents for and large shareholders in the English Electric Manufacturing Company, Ltd., of Preston, have now taken over the whole of the shares of that concern. The business of Dick, Kerr & Co. has been conducted as a private limited company so far, its shares being held almost entirely by members of the firm. The amalgamation has been effected by Messrs. Dick, Kerr & Co. exchanging £100,000 ordinary shares for the £200,000 in the English Electric Manufacturing Company, and they have exchanged £145,000 out of the £185,000 preference shares in the latter company. The debentures have not yet been dealt with, but it is intended to convert the Dick, Kerr & Co. 4 per cent debentures to 4½ per cent, the same as those of the other company, and to raise the preference dividend to 6 per cent all round. The capital of Dick, Kerr & Co. now figures at £840,000, and its profits for the last three years have averaged over £60,000, which is sufficient to pay the increased interest on the preference stock and debentures in the two concerns, and also give a 10 per cent dividend on the ordinary. For the current financial year the profits are estimated to be considerably in excess of previous years. The English Electric Manufacturing Company has also been earning substantial profits. It is stated that during the last eighteen months these have been £67,000.

Kincaid, Waller, Manville & Dawson

The announcement has just been made that Mr. Philip Dawson, the well-known British electric traction engineer, has joined the old-established firm of Messrs. Kincaid, Waller & Manville, consulting engineers. The new title of this firm will be Kincaid, Waller, Manville & Dawson, their address being as before, 29 Great George Street, Westminster. Mr. Manville, one of the members of the firm, is almost as well known in America as he is in England, having been connected with several electrical undertakings, among which we may mention the Massena Power Transmission in New York State, and the Buenos Ayres Tramways in South America, which was recently described in our columns. Mr. Dawson has also made several visits to America, and has made a special study of American methods. He is also widely known as a writer on technical subjects and as the editor of "Dawson's Engineering and Electric Traction Pocket Book." He will bring to the company a ripe experience in traction matters and power transmission, of which two particular branches of the electrical profession he has made a special study.

The Improved Automotoneer

The advantages of the proper manipulation of the controller handle in starting so as to prevent the enormous waste of power in the rheostats have been admitted for a long time, and a number of devices have been introduced to compel the motorman to move his handle at the proper speed only. Among them the one which is probably best known is the "Automotoneer," which was invented by George M. Knox, fomerly of the Chicago City Railway Company, and is now offered in a perfected form by the Garton-Daniels Company, of Keokuk, Ia. In the development of this device the Garton-Daniels Company has spent the past three years bringing out, at a great expense, several models, that, while they would do the work, were not all that could be desired from an operating standpoint. The present model, however, has been in use in different parts of the country for the past seven months, and the manufacturers state that there is yet to be received a single complaint about it.

FIG. 1.—WHEEL AND REGULATOR

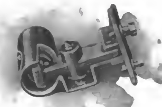


FIG 2.—BOTTOM VIEW OF REGULATOR

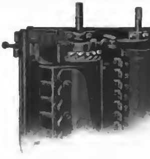


FIG. 3.—DEVICE APPLIED TO CONTROLLER

The device consists of the wheel and regulator shown in Fig. 1. The wheel has a zig-zag groove in its periphery, as shown, with suitable ratchet teeth for engaging the dog of the regulator, which rides in the grooves as shown. The regulator consists of the dog, or pawl, mounted on a pivoted lever, which is fastened to the back of the controller casting. The outer end of this lever engages a piston working in the cylinder of the dash-pot. This piston has a long bearing surface, and is provided with an adjusting-valve to regulate its movement, as well as a release-valve to permit easy operation.

When the controller is operated, the wheel, being attached to the shaft in place of the usual star wheel, rotates, and the inclined surface of the slot raises the pawl and lever which in turn raises the piston in the dash-pot. The pawl then strikes the ratchet stops which are far enough back of the vertical portions to allow the pawl to drop when the pressure is relieved upon the controller handle, to the bottom of the groove, so that the upper edge of the pawl clears the bottom of the ratchet stops, when another notch may be taken. The adjustment of the piston-valve determines the speed of the pawl in its downward movement, and regulates the operation of the controller.

The wear on the moving parts is reduced to a minimum. The piston has no strain on it, simply rising and falling in a vertical bearing. The pawl is case-hardened and shows practically no wear after continued use. It is held in the groove by a coiled spring, and its back edge beveled so that when the wheel is reversed, in order to throw off the current, the pawl slides back against the tension of the coil-spring, thus permitting a ready and sure return of the handle to the "off" position.

Fig. 2 shows a bottom view of the regulator, and it will be noted that the thrust against the pawl is taken up by the regulator casting, and does not bind or bring any strain on the dash-pot piston, which rides perfectly free on the outer end of the lever. The dash-pot is lubricated with dry powdered graphite only, and each device is sufficiently lubricated when sent out for at least one year's service.

In action the automotoneer requires the motorman to stop on each point of the controller for a predetermined time. This time element may be adjusted so that it is impossible to turn on the full power in less than five seconds, seven seconds, ten seconds, or as desired.

The ideal acceleration is as rapid as can be attained without the slipping of the car wheels, and considering this feature it has been found that on an average track a ten-second start is ideal.

Taking this as a basis and a four-second start as the average method employed by a careless motorman, it has been estimated that a saving of about 45 per cent of the power used in starting or 20 per cent of the total power can be secured on a line making many starts and stops. The correct and economical application of the current to the motor car not only works a large saving in the expense of the power but also lengthens the life of the motor in proportion to the reduction of the amount of work required of them, which in the course of a year will result in a large saving for motor repairs. The proper amount of current will reduce the risk of personal injury by the sudden starting and jerking of the car.

Fig. 3 shows a standard G.-E. type K-10 controller fitted with the automotoneer. The device is entirely concealed when the controller is closed. The same device may be used on types K-2, K-4, K-5, K-7, K-8, K-9, K-10, K-11 and K-12 controllers. Other types now being perfected.

Employees' Rooms at Rochester

The new quarters of the employees of the Rochester Railway Company were formally presented to the men on the afternoon of Aug. 4. In the evening there was an entertainment, attended by some 350 of the men and their families, and addresses were made by Rev. J. Lyon Caughey, Vice-President and General Manager T. J. Nicholl, of the company; Assistant Manager R. E. Danforth, of the company; John F. Dinkey, auditor and treasurer of the Buffalo, Rochester & Pittsburgh Railroad; J. M. Dudley, who is in charge of the association rooms of the employees of the Brooklyn Rapid Transit; William C. Montignani, who will supervise the work in Rocheste., and several others. As in Brooklyn, the local branch of the Young Men's Christian Association has become interested in the work of the street railway men, but it is not necessary to become a member of the Young Men's Christian Association in order to enjoy the advantages of the rooms. Additional privileges, however, are gained by becoming a member of the Young Men's Christian Association. Every convenience that is provided in the well-appointed club is to be had by the employees at their rooms. A three-months membership ticket was presented to all employees of the company. Mr. Montignani, who will have charge in Rochester, came from Montreal, where he was secretary of the Young Men's Christian Association railroad branch of the Grand Trunk system.

More Injunctions at Cleveland

The Supreme Court tied up the City Council of Cleveland on Aug. 15 by granting an injunction asked for by the attorneys of the Cleveland City Railway Company and the Cleveland Electric Railway Company.

The Council was some time ago about to pass a 3-cent fare franchise ordinance when an injunction stopped it. The Circuit Court dissolved the injunction, but the opposition carried it to the Supreme Court, and that body has continued the injunction until a full hearing can be given the matter. If the Supreme Court sees fit it can hold the case until next spring. This means that 3-cent fare in Cleveland is blocked, perhaps for a long time, as the Legislature in special session may remove franchise-granting powers from the present Council.

Progress on the Levis County Railway

The Levis County Railway Company, Levis, Can., has appointed the Morris Electric Company purchasing agent for all of its American supplies. Levis is a small town directly across the St. Lawrence River from Quebec, and the railway is the beginning of what promises to be an important system. The general manager of the Levis County Railway Company is G. U. G. Holman. Work has been carried on rapidly on the new system and inclined railway which will be operated in connection with it, and the line will probably be opened within a few weeks.

An Offer of Bonds

The United States Mortgage & Trust Company, of New York, is offering for sale an issue of $1,000,000 4 per cent 5-20 year first mortgage trust gold bonds. These bonds are specifically secured by a deposit with the Guaranty Trust Company, of New York, of $1,000,000 of first mortgages on improved real estate in the principal cities of the United States, valued at $2,648,969, having a gross income of $265,273, and a net income of $178,372, as against the 4 per cent charge on the above bonds of $40,000. In addition to this security these bonds, together with the company's deposits, are a direct obligation against all of the company's assets, amounting to over $32,000,000. The care with which the company's mortgage investments have been made is evidenced by the record of the past seven years, during which over $13,000,000 have been invested, and no real estate is now owned by the company.

Street Railway Patents

UNITED STATES PATENTS ISSUED AUG. 12, 1902.

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

705,619. Beam for Railroad Track Foundations; L. B. West, Cincinnati, Ohio. App. filed Dec. 14, 1901. A longitudinal track beam surrounding the sides and bottom of a rail and composed of asphalt, coal-tar or other bituminous products mixed with sand, crushed stone and like material.

PATENT NO. 706,672

706,668. Switch Throwing Device; T. J. Kent, Pittsburgh, Pa. App. filed March 4, 1902. Details of a switch mechanism operatable from the platform of a moving car.

706,672. Car Brake; R. E. Lockwood, Chicago, Ill. App. filed April 3, 1902. A friction mechanism which may be brought into contact with the periphery of the car wheel, sets the brake-shoe.

706,815. Hose Bridge; G. H. Frazier, J. W. Wagner and H. G. Iserberg, Dennison, Ohio. App. filed March 3, 1902. Details of an arc-shaped structure to be applied to car tracks, with an opening for the passage of fire hose.

706,824. Brake for Vehicles; W. F. Hitchcock, Rochester, N. Y. App. filed March 10, 1900. A brake mechanism in which the brake-shoe has an arc of movement eccentric to the circle of the rim of the wheel, so that the friction of the wheel when the brake is applied will drag the shoe into closer contact with the wheel.

PATENT NO. 706,824

706,950. Railway Switch; C. Johnston, Memphis, Tenn. App. filed Jan. 9, 1902. A fender operated by a foot lever and adapted when operated to cause a discharge of sand to the track, so that the application of the brakes will be more effective.

706,950. Railway Switch; C. Johnston, Memphis, Tenn. App. filed May 3, 1902. Details of a switch adapted to be operated from the front end of a car.

707,018. Convertible Car; H. Romunder, Newark, N. J. App. filed April 12, 1901. The car body is a metal skeleton frame which is provided with grooves for sliding sections, which may be raised and lowered.

PERSONAL MENTION

MR. J. Z. GEORGE has tendered his resignation as manager and purchasing agent of the Vicksburg Railroad, Power & Manufacturing Company, of Vicksburg, Miss. Mr. George has not announced his plans for the future.

MR. M. E. SATCHWELL has resigned as superintendent of the Main Street Railway and the Jacksonville Street Railway Company, of Jacksonville, Fla., and Mr. William Henry Tucker, connected with Stone & Webster, of Boston, has been appointed as successor to Mr. Satchwell.

MR. J. P. POTTER, formerly superintendent of the western division of the Oakland Transit Company, of Oakland, Cal., has been appointed superintendent of the entire system of the company. Mr. Potter has been connected with the street railways of Oakland since the cars were first placed in operation.

MR. F. J. GREEN, general manager of the Dayton, Springfield & Urbana Electric Railway, of Springfield, Ohio, has been succeeded by Richard Emery, who will be general manager of all the Appleyard syndicate properties radiating from Columbus. Mr. Green will take charge of the construction work for the syndicate.

MR. O. E. OLESON, chief engineer of the power house of the Toledo Traction Company, of Toledo, Ohio., who recently resigned from that company to accept a position with the Twin City Rapid Transit Company, of Minneapolis, was presented with a fine diamond Elks ring by employees of the company a few days ago. Mr. W. L. Long succeeds Mr. Oleson at Toledo.

MR. J. W. DUGGAN has been appointed to the position of superintendent of rolling stock of the Worcester & Webster Street Railway, the Webster & Dudley Street Railway, the Worcester & Connecticut Eastern Street Railway, and the People's Tramway Company, operating in Massachusetts and Connecticut. Mr. Duggan is a street railway man of seventeen years' experience, and formerly was superintendent of rolling stock of the Youngstown & Sharon Street Railway, of Youngstown, Ohio.

PROFESSOR GEORGE F. SEVER, adjunct professor of electrical engineering at Columbia University, has been appointed electrical engineer of the Department of Water Supply, Gas and Electricity of New York City. Professor Sever was last year superintendent of electrical exhibits at the Pan American Exposition, and combines a large amount of important outside work with his college duties. He is consulting engineer for Wendell & McDuffie, of New York, and has devoted considerable attention to the plans of the road which that well-known firm is constructing between Oneonta, Cooperstown and Richfield Springs, N. Y.

MR. CHARLES G. WINGATE, formerly superintendent of the Ridgewood Avenue Division of the Brooklyn Rapid Transit Company, has recently become connected with the New York office of the Crocker-Wheeler Company. Mr. Wingate, who is a son of General George W Wingate, formerly vice-president of the Brooklyn Elevated Railroad Company, has had charge of the construction of a number of electric railways, including the Ocean Electric Railway and the Rockaway Electric Railway divisions of the Long Island Railway Company, and the Branford Electric Railway, which runs between East Haven and Branford, Conn., and which is now operated under lease by the Fair Haven & Westville Railroad Company.

MR. J. W. PERRY, who has for a long time represented the H. W. Johns-Manville Company in Philadelphia, has recently been appointed head of the electrical department of that company, and will hereafter make his headquarters in New York. Mr. Perry is well known in the electrical and street railway field, particularly in the Middle States, and has invented and patented a number of improvements in electrical work. He was one of the Americans who attended the convention of the International Tramway Association in London last July, and he took the opportunity while in Europe of making a short trip on the Continent, where the Johns-Manville Company has filled a considerable number of orders. Mr. Perry reported the outlook for business in Europe as excellent.

MR. F. A. BOWTELLE, chief dispatcher and acting train master of the Susquehanna Division of the Delaware & Hudson Company, has been appointed superintendent of the Hudson Valley Railway, of Warrensburg, N. Y. Mr. Bowtelle has been a railroad man for many years, and he is well qualified for the position to which he has just been appointed. Mr. Bowtelle was in the employ of the Delaware & Hudson Company almost constantly since 1870. In 1878, when the Delaware & Hudson Company was interested in the Boston, Hoosac Tunnel & Western Railway, Mr. Bowtelle was transferred by the company to the last mentioned road, filling acceptably the position of train master while the relation of the two companies continued. During the period extending from 1872 to 1875 Mr. Bowtelle filled an important position in the office of the president of the Baltimore & Ohio Railway. Until a few years ago the Susquehanna Division was a single-track line of 196 miles on which one hundred engines and thousands of cars were operated with remarkable freedom from accident.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Aug 20, 1902.

Money rates, as had been fully expected, have worked decidedly closer during the week. The average rate for call loans has been 4½ per cent, with occasional advances to 6 per cent. Time loans, meanwhile, have been marked up to a stiff 5 per cent for all dates. The causes for this upward movement have lain on the surface for several weeks past, and ought not to need rehearsal in this column. With the large gold exports at the outset of the month and the steady expansion of loans, surplus reserves of the Clearing House banks have sunk rapidly, until they now stand at the scant total of $7,100,000. This, with one exception, is the lowest for any corresponding period in the last ten years. To all appearances out-of-town banks, which have been lending directly in the New York market, withdrew their funds in anticipation of the active autumn demand in their own localities. It is also quite likely that local trust companies did the same, with the idea of placing their loans to better advantage later on. The immediate result was, of course, to shift the full force of the borrowing demands upon the members of the Clearinghouse Association, and their loans have consequently expanded in face of heavy lending by foreign bankers in the local market. There is, to be sure, an obvious limit to this sort of movement, for when reserves of the New York banks are nearing exhaustion and money rates work higher, the outside institutions will again appear as lenders, and the substitution of their capital for that of the local banks will allow the latter to retrench their loans and correspondingly reduce their liabilities. At the same time the offerings of foreign credit, which have been such a feature during the past week, will probably continue. But it is still a matter of great doubt how far these factors will provide an offset to the heavy demands for currency, now close at hand from the interior cities. At all events money rates are pretty certain to rule higher than the present before many weeks have elapsed.

The Stock Market

Fears of unfavorable developments in the money market continue to restrict genuine business on the Stock Exchange. Professional traders, working for small profits, and speculative cliques of greater or less calibre, have kept on from time to time with their endeavors to bid up various individual stocks, and they have had a fair measure of success. But if their purpose is to lighten loads which have become uncomfortably heavy or to distribute holdings on which paper profits have accrued, it is more than doubtful whether they have done much toward attaining the desired end. The operations now being witnessed in the market consist very largely of manipulation in which speculative interests are pitted against one another in an effort to secure the most advantage from temporary fluctuations. This manipulation is directed toward a higher rather than a lower price level, because general conditions are more conducive to buying than to selling among actual investors. There is no change in the main aspects of the outside situation from what have been noted for several weeks past. With the exception of the problems awaiting solution in the money market, everything is calculated to inspire confidence among holders of securities. Nothing now can happen to seriously hurt the grain crops; we are unquestionably on the eve of one of the greatest harvests the country has ever known. What this means for future railroad earnings, for general business, and for corporation dividends, is something which may be left to the imagination of the average observer. Yet even in the midst of this brilliant prospect the question must constantly arise, how far the very high range of prices has discounted this prospective prosperity. Evidently apart from the uncertainty of the money position, and any adverse effects upon the speculation that it may have later on, the present market is one where careful discrimination must be exercised between stocks which are relatively high, and therefore are in the danger zone, and stocks which are relatively low, and have reasonable probabilities of further advance.

The local traction group has not been at all conspicuous in the week's general dealings. Metropolitan and Brooklyn Rapid Transit have been left pretty much to themselves, and have followed the usual course of neglected securities in a highly speculative market. On the other hand Manhattan seems to have been quietly but persistently bought ever since the troubles with the company's employees were amicably settled.

Philadelphia

All the securities interested in one way or another with the recent Philadelphia trolley combination have reached new high-record prices during the week. Union Traction sold up to 48¼, and Philadelphia Rapid Transit to 14⅞, while Fairmount Park Transportation, which rumor has associated with the "deal," went up to 34. A movement similar to that in Park Transportation was inaugurated in the securities of another outlying Philadelphia company, the Huntingdon & Broad Top, the common stock rising sharply from 28 to 32, and the preferred gaining 2 points to 59. How far there is any genuine basis for the advance in the suburban line shares is still very doubtful. Nothing but denials have so far issued from official sources, and it is natural, therefore, that suspicion should have been aroused lest the rise was simply a shrewd piece of speculation conducted on rumors which sound plausible. The one thing certain is that the earnings of the Park Transportation line would not justify a purchasing syndicate in paying anything above present quotations for the stock. Other sales of the week comprise American Railways at an advance to 50—the highest on record—Railways General bid up from 4¼ to 5⅜; Philadelphia Traction at 99⅞, Consolidated Traction, of New Jersey, at 69½; United Traction, of Pittsburgh, preferred, at 52, and Rochester Railway, common, at 67. In bonds, Electric People's Traction 4s advanced to 99⅞, Union Traction, of Indiana, 5s sold at 102⅛; Consolidated, of New Jersey, 5s at 111, Indianapolis Railway 4s at 87½, United Traction, of Pittsburgh, 5s at 117, and United Railways 4s at 87.

Chicago

Chicago securities have merely kept steady during the week, displaying no particular feature, and not footing up much of a total in actual transactions. Union Traction held firm on light trading around 16¼, and 50 shares of City Railway sold at 216. West Chicago was steady at 95. Metropolitan Elevated, preferred, selling ex-dividend rose a point from 89 to 90. Lake Street was firmer at 10¾ with a few sales at 11, and one or two small lots of South Side sold at 110. Nothing was done in the Northwestern Elevated stocks. Officials of the road now say that no new developments in the way of extensions will occur before the end of September. Metropolitan earnings for August, it is said, will show increase of 20 per cent over last year, and Northwestern earnings a gain of 15 per cent. The Metropolitan expects to derive considerable benefit from the new Aurora-Wheaton electric line, which was opened for business last week.

Other Traction Securities

It has been another featureless week in the Boston market. Boston Elevated, on scattered sales, declined to 159, which is the lowest of the year. West End was weak, in sympathy, at 94, and Massachusetts Electric, on light trading, held its own at 40½. In Baltimore the United Railway issues were strong, especially the general mortgage 4s, which went up to 98¼—the highest of the season. The incomes were dealt in moderately at 70¾, and the stock at 16. Nashville Railway certificates were comparatively inactive but strong, at an advance from 74¼ to 76. The stock rose sympathetically from 5⅜ to 5⅞. Among the other sales of the week in Baltimore may be noted Knoxville Railway 5s at 101, United Traction, of Pittsburgh, 5s at 116¼, Atlanta Railway 5s at 106¼, City Passenger 4½s at 104½, Norfolk Railway & Lighting 5s at 95 to 95½, and Charleston Consolidated Electric 5s at 94¼. No further change is recorded in North Jersey Traction, the common being quotably unchanged at 34½, and the bonds at 85. New Orleans securities have been active and strong in their local market, selling up to 18. Traction sales on the Cleveland Stock Exchange last week numbered 3107 shares, a gain of several hundred shares over the previous week. Cincinnati, Dayton & Toledo continues to hold the center of the stage, sales numbering 1060 shares, at prices ranging from 26⅝ to 27¼, last sale at the high figure. Northern Ohio Traction continues strong, the common at 45 for 515 shares and the preferred 620 shares at 90 and 91. Lake Shore Electric dropped from the week previous. The total sales were 430, at from 16 to 17½; last week the stock went as high as 19¼. Western Ohio sold for 250 shares at 24½ to 25¼. Only one sale was made in Detroit United, 100 shares at 86½, three-quarters below previous sales. Big Consolidated was strong, but there is little on the market. A small block was taken at 86¾. Monday Northern Ohio common took a remarkable jump, probably as the result of the report that the company is to be reorganized on a basis profitable to stockholders. The first sale was at 45, and it increased steadily to

51; sales were all in small lots, the total numbering only about 150 shares. The preferred was strong at 91, about 300 shares selling. A small block of Cleveland, Elyria & Western went at 70 which is considerably below last sales. Big Consolidated advanced to 87 for a small lot.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Aug. 12	Aug. 19
American Railways Company	50	49¾
Boston Elevated	161½	159½
Brooklyn R. T.	67⅝	67
Chicago City	210	210
Chicago Union Tr. (common)	15⅛	16
Chicago Union Tr. (preferred)	48	48
Cleveland Electric	86	88
Columbus (common)	51	57
Columbus (preferred)	107	108
Consolidated Traction of N. J.	71¼	69½
Consolidated Traction of N. J. 5s	111	111
Detroit United	85⅝	86
Electric People's Traction (Philadelphia) 4s	99¾	99¾
Elgin, Aurora & Southern	40	40¼
Indianapolis Street Railway 4s	..	87½
Lake Street Elevated	10⅝	10½
Manhattan Railway	134	135⅛
Massachusetts Elec. Cos. (common)	41	40
Massachusetts Elec. Cos. (preferred)	97⅝	97½
Metropolitan Elevated, Chicago (common)	39½	38½
Metropolitan Elevated, Chicago	91½	*89½
Metropolitan Street	148½	147½
North American	123	122¼
Northern Ohio Traction (common)	41½	51
Northern Ohio Traction (preferred)	90	91½
North Jersey	35½	36
Northwestern Elevated, Chicago (common)	36½	..
Philadelphia Rapid Transit	14	14
Philadelphia Traction	99¾	99⅞
St. Louis Transit Co. (common)	31⅜	31⅜
South Side Elevated (Chicago)	112	110
Southern Ohio Traction	77⅛	75
Syracuse Rapid Transit	30	27
Syracuse Rapid Transit (preferred)	74	70
Third Avenue	130	130
Toledo Railway & Light	32½	33⅝
Twin City, Minneapolis (common)	125	127¼
United Railways, St. Louis (preferred)	*85	84
United Railways, St. Louis, 4s	87¼	87
Union Traction (Philadelphia)	47⅛	48
Western Ohio Railway	25⅛	24½
New Orleans Railways (common)	..	17⅞
New Orleans Railways (preferred)	57½	56⅞

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

According to the usual monthly figures compiled by the Iron Age, the average weekly output of blast furnaces was 336,465 tons on Aug. 1, as against 350,890 tons on July 1. This decrease is wholly due to the troubles in Pennsylvania and the South with the coal miners, which have necessitated the shut-down of a number of furnaces. Such curtailment of production is not necessary to insure the soundness of the present iron market, but coming accidentally it affords an additional safeguard to the situation. Imports are on the increase in the steel trade, and there is talk of some being made in the structural branch of the industry. Quotations are unchanged from last week at $21.75 for Bessemer pig, $33 for steel billets and $28 for steel rails.

Metal

Quotations for the leading metals are as follows: Copper, 17½ to 17¾ cents; lead, 4⅜ cents; tin, 28 cents; spelter, 4.45 cents.

WASHINGTON, D. C.—The Capital Traction Company recently sold to the Government a parcel of land, and part of the proceeds of the sale will be distributed among stockholders in the form of an extra dividend of 4 per cent, which will be payable Aug. 20 to stockholders of record Aug. 4. The remainder will be invested in the 4 per cent bonds of the company.

SPRINGFIELD, ILL.—The entire issue of $125,000 first mortgage bonds, made in 1890 by the Springfield Consolidated Railway, has been called, and will be paid on Sept. 1, at 106 and interest by the Mercantile Trust Company, of New York.

MICHIGAN CITY, IND.—Judge Baker, on application of the trustee for the bondholders, has appointed A. L. Boyd as receiver of the Lake Cities Electric Railway Company, to succeed I. I. Spiro.

BALTIMORE, MD.—A mortgage has been filed for $2,000,000 by the Baltimore, Washington & Annapolis Electric Railway Company in favor of the Federal Trust Company, of Cleveland, Ohio. The mortgage is to guarantee an issue of bonds for the completion of the company's road, which will connect Baltimore with the National Capital.

DETROIT, MICH.—It is said here that plans are being matured for consolidating the Detroit, Ypsilanti, Ann Arbor & Jackson Railway and the Grand Rapids, Grand Haven & Muskegon Railway. It is even said that several other lines will be brought under one management, and the consolidation of the lines with the Detroit United Railway is hinted at.

WORCESTER, MASS.—The Railroad Commissioners will give a hearing Sept. 8 on the petition of the Worcester & Connecticut Eastern Railway Company for the right to lease the Webster & Dudley Street Railway. The Webster & Dudley Company now operates the Worcester & Webster Street Railway, so that the lease asked for is to give control to the Worcester & Connecticut Eastern of the line between Worcester and Danielson, Conn.

BOSTON, MASS.—The West End Street Railway Company has applied to the Railroad Commisisoners for authority to issue $3,559,000 4 per cent thirty-year bonds, dated Aug. 1, 1902. The purpose of the company is to use $3,000,000 of the new bonds to refund a like amount of bonds due Nov. 1, 1902, and $559,000 for additional improvements made on the property of the Boston Elevated Railway Company.

BUFFALO, N. Y.—The International Railway Company has been granted the approval of the State Railroad Commission for an increase of its capital stock from $10,200,000 to $17,000,000.

BUFFALO, N. Y.—In accordance with an agreement reached by the creditors and bondholders of the Buffalo, Hamborg & Aurora Railway, Justice Kenefick, at Buffalo, has ordered that Robert W. Day shall be appointed receiver of the company; that the road shall be sold; that the $300,000 bonds shall be declared valid, and that the other creditors shall be paid 60 cents on the dollar from the proceeds of the sale before anything can be paid on the bonds. It is said that the receiver will be permitted to operate the road long enough to determine its earning capacity before it is offered for sale.

SYRACUSE, N. Y.—The Syracuse Rapid Transit Railroad Company reports earnings as follows:

Year ending June 30	1902	1901
Gross earnings	$687,196	$615,162
Operating expenses	384,265	340,830
Earnings from operation	$302,930	$274,332
Other income	6,089	6,137
Total income	$309,019	$280,469
Fixed charges	228,246	223,918
Net earnings	$80,773	$56,551
Total surplus June 30	99,918	92,925
Betterments for year	118,796	61,591

STATEN ISLAND, N. Y.—The Staten Island Railway reports earnings as follows:

Quarter ending June 30	1902	1901
Gross receipts	$46,554	$40,983
Operating expenses	32,365	34,576
Earnings from operation	$14,189	$6,407
Other income	6,063	6,029
Total income	$20,252	$12,436
Charges	8,782	8,473
Surplus	$11,470	$3,963

CLEVELAND, OHIO.—The stockholders of the Securities Company, of Cleveland, which suspended operations at the time of the Everett-Moore embarrassment, met last week and decided to liquidate. F. S. Borton, president of the company, and Charles Wason were authorized to take charge of the details of the liquidation, which will take place Nov. 1. It is stated that all debts will be paid in full. The company was organized to finance Everett-Moore propositions.

CLEVELAND, OHIO.—The Everett-Moore syndicate has completed a general plan for financing the Lake Shore Electric Railway, and the details will be announced next week. The plan has been accepted by the Cleveland banks, which are to purchase a large block of bonds. As soon as the plan becomes operative, the road will be taken out of the hands of the receiver. The plan contemplates a general consolidated mortgage of $6,000,000. Under this there will be a $4,000,000 issue of first consolidated bonds, $750,000 of which will go to take the Lorain & Cleveland outstanding bonds, and $1,500,000 to retire the Toledo, Fremont & Norwalk bonds. The remaining $1,750,000 will be taken by Cleveland banks at 90 and accrued interest. This will yield $1,575,000 cash that will be used to retire $500,000 Sandusky & Interurban bonds, and about $350,000 receiver's certificates, leaving over $750,000 cash in the treasury. The first consolidated bonds will be a first lien on the 80 miles included in the Sandusky & Interurban and Sandusky, Norwalk & Southern, and a second lien on the Lorain & Cleveland and the Toledo, Fremont & Norwalk. Of the additional $2,000,000 bonds that will be used as general bonds, $1,000,000 will be exchanged bond for bond for the present outstanding Lake Shore Electric bonds, nearly all of which are held by the Everett-Moore syndicate; the remaining $1,000,000 will be held in the treasury for future needs. The company is now operating through service from Cleveland to Toledo and the property will be improved as rapidly as possible.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has called for redemption, at 105 and interest, twenty-two Philadelphia Traction 4 per cent collateral trust bonds of 1917.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., July '02	81,130	40,588	40,542	......	......
	1 " " '01	66,898	33,484	33,414	......	......
	6 " June '02	318,937	165,362	153,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,722	*317,475	196,249	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., July '02	140,209	89,012	51,197	23,806	27,331
	1 " " '01	134,370	79,638	54,732	......	......
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,076	......	......
	1 " " '01	15,678	9,341	6,337	......	......
	10 " " '02	187,658	108,986	88,672	......	......
	10 " " '01	169,756	94,355	75,401	......	......
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,809,496	7,236,597	3,582,899	2,896,350	686,580
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,840	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,189	3,215,480	1,862,648	957,206	905,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., June '02	1,165,288	*732,152	433,136	......	......
	1 " " '01	1,181,023	*732,740	448,283	......	......
	12 " " '02	12,780,705	*8932214	3,887,490	......	......
	12 " " '01	12,101,198	*7970635	4,130,563	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., June '02	271,245	147,614	123,632	97,043	26,589
	1 " " '01	409,206	192,265	216,941	94,098	122,842
	1 " " '00	218,739	106,174	112,565	65,348	47,217
	2 " " '02	786,280	436,915	349,366	289,063	60,303
	2 " " '01	952,702	485,809	466,894	272,864	194,030
	2 " " '00	631,371	333,927	297,444	221,844	75,601
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., July '02	48,569	30,509	18,059	13,617	4,442
	1 " " '01	46,067	27,021	19,046	13,639	5,407
	5 " " '02	313,767	172,009	141,758	67,707	74,051
	5 " " '01	200,964	134,849	66,115	68,922	†2,807
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., July '02	23,591	7,586	16,005	......	......
	1 " " '01	23,459	7,689	15,770	......	......
	7 " " '02	102,531	45,638	56,893	......	......
	7 " " '01	88,920	42,091	46,829	......	......
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	......	......
	12 " " '00	757,954	378,661	379,293	......	......
Union Traction Co.	12 m., June '02	7,942,468	4,570,719	3,371,749	3,619,277	†247,528
	12 " " '01	8,158,809	3,942,194	4,216,615	4,058,040	158,575
CLEVELAND, O. Cleveland & Chagrin Falls	1 m., Feb. '02	2,454	2,255	1,199	......	......
	1 " " '01	2,435	3,016	†581	......	......
	12 " Dec. '01	47,976	*32,002	15,974	13,023	2,951
	12 " " '00	49,646	*33,372	16,274	13,294	3,080
Cleveland & Eastern	1 m., Feb. '02	4,916	3,616	1,300	......	......
	1 " " '01	3,535	4,047	†512	......	......
	12 " Dec. '01	90,390	52,082	38,308	43,678	†4,310
	12 " " '00	62,895	36,674	26,221	36,148	†9,927
Cleveland El. Ry. Co.	1 m., May '02	217,568	......	......	......	......
	1 " " '01	187,049	......	......	......	......
	5 " " '02	962,890	......	......	......	......
	5 " " '01	854,594	......	......	......	......
	12 " Dec. '01	2,296,808	1,265,963	1,030,845	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., July '02	28,542	13,875	14,667	......	......
	1 " " '01	24,229	11,810	12,419	......	......
	7 " " '02	156,984	91,633	65,351	......	......
	7 " " '01	131,255	76,068	55,187	......	......
	12 " Dec. '01	249,259	136,865	112,394	57,023	55,371
	12 " " '00	179,608	102,305	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., June '02	17,747	9,520	8,227	......	......
	1 " " '01	15,748	8,035	7,714	......	......
	6 " " '02	79,337	44,670	34,867	......	......
	6 " " '01	65,449	36,228	29,221	......	......
	12 " Dec. '01	161,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*89,598	71,590	72,500	†990
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.	1 m., June '02	77,545	*42,671	34,875	15,614	19,261
	1 " " '01	72,201	*42,147	30,054	15,746	14,308
	6 " " '02	422,150	*247,877	174,273	93,025	81,248
	6 " " '01	384,638	*235,852	148,786	94,105	54,681
DENVER, COL. Denver City Tramway Co.	1 m., Apl. '02	124,516	66,583	57,983	32,865	26,119
	1 " " '01	116,857	62,866	53,490	31,304	22,186
	4 " " '02	481,348	311,118	220,230	131,259	88,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,507,298	818,321	688,965	383,180	305,785
	12 " " '00	1,302,380	722,458	579,889	274,891	305,548
DETROIT, MICH. Detroit United Ry	1 m., July '02	335,898	182,848	143,050	......	......
	1 " " '01	302,988	149,812	153,176	......	......
	6 " June '02	1,600,675	*917,044	683,631	386,739	297,892
	6 " " '01	1,384,181	*775,347	608,834	345,119	263,715
	12 " Dec. '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,302	11,319	10,568	651
	1 " " '01	28,877	18,062	10,816	9,696	1,124
DULUTH, MINN. Duluth-Superior Tr.	1 m., July '02	52,672	24,965	27,647	9,695	17,952
	1 " " '01	45,963	22,117	23,866	9,218	14,647
	7 " " '02	298,098	157,394	140,640	67,529	73,111
	7 " " '01	254,322	141,720	112,602	63,984	48,618
ELGIN, ILL. Elgin, Aurora & Southern Tr	1 m., July '02	40,473	21,197	19,275	8,333	10,941
	1 " " '01	36,454	16,218	20,236	8,333	11,903
	7 " " '02	226,229	136,723	90,306	58,333	31,973
	7 " " '01	204,102	119,142	84,960	58,333	26,627
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., June '02	20,714	9,906	10,808	......	......
	1 " " '01	16,257	8,969	7,288	......	......
	6 " " '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O. Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	9,125	7,500	1,625
	12 " " '02	253,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT. London St. Ry. Co.	1 m., July '02	16,337	9,297	7,040	2,311	4,729
	1 " " '01	15,303	8,767	6,537	2,144	4,393
	7 " " '02	81,401	52,464	28,937	15,904	13,033
	7 " " '01	75,416	48,718	26,698	14,076	12,622
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m. July '02	237,376	110,928	126,448	67,990	58,458
	1 " " '01	239,043	102,095	136,948	67,992	68,956
	7 " " '02	1,512,005	738,232	778,773	457,548	321,230
	7 " " '01	1,368,607	688,559	674,249	433,315	240,934
	12 " Dec., '01	2,442,342	1,185,584	1,256,808	755,139	501,669
	12 " " '00	2,330,098	1,129,787	1,090,311	824,665	266,047
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., July '02	337,452	142,369	195,083	56,733	138,349
	1 " " '01	290,648	135,349	155,298	57,820	97,478
	7 " " '02	2,004,892	922,740	1,081,152	410,266	670,885
	7 " " '01	1,748,162	883,660	864,501	327,548	536,953
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., June '02	187,662	80,655	107,007	19,391	87,615
	1 " " '01	160,926	77,782	83,144	14,272	68,871
	9 " " '02	1,445,180	846,893	598,287	144,299	453,988
	9 " " '01	1,355,086	841,400	573,537	90,306	483,286
NEW YORK CITY. Manhattan Ry. Co.	3 m., Dec. '01	3,088,465	1,404,971	1,683,465	753,185	930,329
	3 " " '00	2,738,596	1,340,606	1,397,990	749,857	668,045
	12 " Sept. '01	10,455,872	5,328,649	5,127,223	2,682,182	2,444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Dec. '01	3,867,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786,030	1,690,649	2,096,381	1,128,467	947,914
	12 " June '02	15,906,641	7,393,883	8,460,758	4,815,421	3,665,337
	12 " " '01	14,720,757	6,755,121	7,965,636	4,584,068	3,431,567
OLEAN, N. Y. Olean St. Ry. Co.	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	54,018	28,228	25,790	16,755	9,035
PHILADELPHIA, PA. American Railways	1 m., July '02	112,870	......	......	......	......
	1 " " '01	89,658	......	......	......	......
	12 " June '02	1,009,509	......	......	......	......
	12 " " '01	841,398	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., June '02	89,236	46,800	42,436	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	537,742	298,006	239,737	148,608	91,130
	6 " " '01	495,296	306,966	188,330	147,157	41,102
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., June '02	60,[illegible]	34,780	26,064	19,025	7,039
	1 " " '01	56,[illegible]	30,942	26,010	18,947	7,063
	12 " " '02	603,281	384,265	219,019	138,246	80,773
	12 " " '01	621,390	340,830	280,[illegible]	223,918	56,580
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., June '02	122,682	65,143	57,539	37,854	19,685
	1 " " '01	112,900	53,923	58,977	24,271	34,707
	6 " " '02	671,284	352,382	318,902	227,033	91,869
	6 " " '01	598,929	303,412	295,526	145,625	149,901
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	*616,945	565,572	409,061	156,511
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	†3,986
	3 " " '01	56,036	36,000	22,[illegible]	25,000	†2,983

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Boston Elevated Litigation

The decision of Chief Justice Mason, of the Supreme Court, in the case of E. F. Baker against the Boston Elevated Railway Company for damages arising from the noise caused by the operation of that road, is not final, as the Supreme Court of the State will be called upon to review it, but it is, nevertheless, a very interesting document. Heretofore the noise caused by a railway has not been considered a fair ground for assessing damages; the improvement in the facilities for transportation afforded by the establishment of such lines being considered sufficient to offset the annoyance arising from the increase in noise. In the case of electric street railways, it has been pointed out, the cars do not occasion loss of light and air, as they do not obstruct the streets more than other vehicles. They do, however, occasion a certain amount of noise, yet it has not been considered that this constituted sufficient ground for an action for damages on the part of abutting property owners. The contention is made that the noise created by the trains of the elevated railway is very much louder than that caused by the surface cars, but, on the other hand, it is doubtful if this increase is sufficient to warrant such a radical departure from former rulings. Another difficulty in assessing such damages is met in determining the loss to a plot of real estate caused by the noise made by the trains of a railway system running in close vicinity to it. It is doubtful, moreover, whether any general rule can be laid down that could fairly apply. Where the "L" trains, for instance, run between blocks of high buildings the noise by reverberation is much more intense than if the sides of the street were open land or only covered by low buildings. In the case in question the Superior Court found that the petitioner's estate had been damaged more than it had been benefited by the construction and operation of the elevated road, "not including any damage resulting from the impairment of the facilities of public travel, or any annoyance or discomfort to any in the use of such facilities," to the extent of $2,000, and that one-half the damage was caused by noise, and that the damage caused by noise was $100 more than it would have been if the road had been constructed in that part of the street the fee of which was not owned by the petitioner.

It is admitted on all sides that the company is endeavoring to discover and apply some means of reducing the noise which now accompanies the running of its trains, and that this noise is entirely due to the character of the service given, but that at the present time it cannot be obviated without greatly crippling the business of the city. These facts will undoubtedly be impressed upon the Supreme Court when the case comes up for review, and it is hoped that that tribunal will appreciate the necessity of relieving the corporation of any unnecessary burdens in the form of damages.

The Right to Labor

The legal proceedings instituted last week against the Pawtucket Street Railway Company comprise one of several actions intended to test the validity of the ten-hour law passed by the last General Assembly of the Rhode Island Legislature for the benefit of motormen and conductors. The companies affected declare that the law is unconstitutional, but the labor unions which secured its passage insist upon its strict observance. It was this conflict of opinion that led to the recent strike on the Providence and Pawtucket lines. That movement was a complete failure, and resulted most disastrously for the union, as the men suffered great loss in wages, and forfeited the respect and sympathy of the community by their violence, destruction of property and outrages. They were finally glad to go back to their positions under the old terms. The company had expressed a willingness to submit the questions in dispute to the proper tribunal for judicial settlement before the strike was declared, and, although the men rejected the offer, the company upon the settlement of the strike at once took steps to secure a judicial interpretation of every phase of the ten-hour law.

Aside from the purely local features of the case the present

controversy is interesting, as it involves such questions as the right of private contract, union dictation in the matter of regulating hours of labor and the principle of labor organizations preventing individual workmen from securing employment in place of strikers. Why should not an employer and workman enjoy the right to enter into a contract governing the terms of employment, whether it provides for ten hours a day or some other period? Why should an organization be allowed to dictate to individual workmen when and where and how they shall be employed and what compensation they shall receive? Why should any man be deprived of his right to labor because he is not a member of a union or because the union will not permit its members to work? These are vital questions, and they are constantly confronting street railway managers and other employers of labor, though not less vitally than they do the man who seeks an honest livelihood, and whose only commodity is the labor which he can perform.

The attitude of the companies generally in the matter of compensation is that the scale of wages in the several departments must be based upon the earnings of the system, and the proportionate value of the services contributed. This is a fundamental principle in every large industrial organization, and there is nothing in the make up of street railway properties that justifies the violation of this rule. Legislation will not change conditions in the commercial and financial world, and every attempt to enact and enforce oppressive measures of the kind under considerations, or regulations at variance with sound business judgment, is bound to react upon those who originate them.

The right to labor and to sell one's services to the best advantage is denied to the individual workman when it conflicts with union regulations. The man who has the capacity and inclination to do more and better work than his associates is restricted by the rules of the union. He must not work more than a certain number of hours, he must not perform more than a limited service every day. It matters not if the requirements of his family or his personal ambition prompt him to excel his fellow workmen, or that he may have the ability and desire to win honorable promotion by faithful service. The gifts with which he has been endowed must lie dormant and his responsibilities and domestic needs must be disregarded in compliance with the precept of the union. The Higher Law must be modified to conform with the union rules.

It is not strange under the circumstances that employers at times become exasperated because of the unreasonable demands of the union and find it necessary, in self-defence, to oppose the organization. The attitude of the labor leaders has not been conducive to better understanding, and often, as in the present case, they have been encouraged by the support of political demagogues who pass such measures as that complained of in Rhode Island, and then not only excuse, but even assist such lawless demonstrations as those which marked the Pawtucket strike. The right to labor is inalienable, and any organization that seeks to prevent an individual from exercising that right is proceeding upon a radically wrong principle.

Freight Terminal Stations

Three or four years ago it was a question whether the haulage of light freight and express matter on electric railways paid. There is no doubt on the subject now: that question has been settled by the large amount of this business which has been obtained and is being successfully carried on by the electric interurban railways, large and small, which have been completed during the past seven or eight years. A few States still have statutes against the transportation of freight by electric railways, on the theory that the highways are not intended for freight cars and that, consequently, they should not be allowed there. This, however, is a specious argument, for three-quarters of the vehicles which traverse these roads are for the transportation of merchandise, and if this merchandise can be carried more cheaply and quickly within an electric car than on a cart or dray, the shipper, as well as the public, is benefited.

As the electric freight business has been conducted to a greater extent on the extensive interurban railways of the middle West than in any other part of the country, it is natural to look for the latest developments in this direction to that section of the country. It is not surprising, therefore, to find that, in some of the larger cities in this center of interurban traffic, it has been found advisable to build regular freight terminal stations to be used only by electric railway freight cars. One of the latest, as well as one of the largest stations of this kind, is that owned by the Interurban Terminal Company in Cincinnati, and which is fully described and illustrated in this issue. This station, which is used by three interurban lines centering in Cincinnati—the Rapid Railway, the Suburban Traction Company and the Cincinnati & Eastern Electric Railway Company—is designed to accommodate passengers as well as to handle incoming and outgoing freight. The detailed arrangement of the floors, of which there will be six, and the arrangement of tracks within the building are fully described elsewhere in this issue, and need not be referred to again here, except to call attention to the building, and comment on it as an interesting indication of the rapid development of the suburban electric freight service.

* * *

The great difference which has always existed between the passenger transportation business by steam and by electric power, and the principal advantage possessed by electricity for this service, has been in the possible economic subdivision of power by making the car the unit, instead of the train. Electricity would not now be used as extensively as it is for passenger transportation if it had not been for the fact that single electric cars can be operated almost as cheaply as long trains, and consequently that a short headway could be adopted with small units where, with the steam trains, the traffic to secure economy has to be divided between comparatively fewer and larger units. The general public and investors, however, may not realize that the same principles apply in the transportation of freight except, possibly, between large cities. In fact, the possibilities of economy through a frequent electric freight transportation service between small communities, as compared with the old steam train idea, are so great that they will and are, where the system is in force, almost revolutionizing methods of conducting business. To understand clearly just how this is brought about, we will refer briefly to the present system of steam freight transportation.

On steam railroads, the margin between profit and loss is so small that the freight train schedule must be made up so as to make as many cars compose a train as possible; and to still further reduce expenses, the tendency is constantly growing to build larger and heavier locomotives, so that more freight cars can be hauled in each train. The result is that freight received at any distributing center, like a large city, is held at that point until a sufficient quantity has collected to justify the running of a long train. For a small town, where the aggregate amount of freight received or shipped is not considerable, enought cars on the average may not be received at or for the distributing point to justify a schedule of a train oftener to serve that point than once a day or once in two days, or possibly at longer intervals. The result of this is twofold; in the first place, the merchant has to have his goods shipped a long time ahead, so that they will be received at the time wanted, and either he or the shipper, which means ultimately that the public, has to pay the interest on those goods while in transit. In the second place, the consignee is obliged to carry a large stock on which he also has to pay interest and insurance, and to keep a good-sized corps of warehouse clerks, as his goods are received by him at rare intervals and in large quantities.

Assume, however, that his goods can be shipped immediately on receipt of his order, even if they amount to only a half of a car load or even less, and can be delivered promptly. Even if he has to pay a higher rate per ton mile he will not only avoid the loss in interest and the warehouse expenses mentioned above, but he

can often also transfer the goods directly to the shelves of his shop without storing them, and will thus save one extra handling. In other words, the local merchant would be a distributor only and not a warehouse keeper.

This is, theoretically as well as practically, one important saving being made through a frequent freight train service by means of small units, a saving which, ultimately, as in the case of all economies of this kind, goes to the public. On some of the Ohio lines, for example, it is not an uncommon practice for the local dealers in fresh provisions in a small town to telephone their orders to the large markets, which may be fifteen or twenty miles away, the same day in which the goods are delivered and sold. Thus, if the orders are transmitted early in the morning, the goods are placed on the electric freight car within an hour, and will be in the local market in time for the day's deliveries.

In this discussion we have not attempted to refer to the corresponding economies possible by a frequent freight transportation service from the small towns to the large one, but it is apparent that the same arguments will apply in this case as in the one just cited. In other words, the electric freight service possesses intrinsic advantages without encroaching in any way upon the through freight business of the steam railroad companies, and these advantages are so considerable that freight haulage on electric railways must, ultimately, form a very large percentage of the total business done. This phase of the economy of electric railway freight operation has been touched upon briefly in these columns before, but the principle of frequent train service is so important, whether it be for passengers or freight, that it should not be lost sight of. The electric railway freight business of this country is yet comparatively small, but its possibilities are enormous, and far-sighted managers are making arrangements to take care of it when it comes, if they have not already instituted a service of this kind.

Special Conditions in Franchises

We had occasion last week to publish an editorial on the subject of "Special Conditions in Franchises," and recited an incident which occurred in New York State within the last month, where a railroad company absolutely declined to insert any special conditions in its franchise in a certain city and stood upon its statutory rights in the premises. The subject is one which intimately concerns the prosperity of railway companies, yet is so broad and has so many phases that everything pertinent to the subject could not be said in one editorial or even in a dozen. Nevertheless cases are constantly occurring where railway companies are seriously hampered in one direction and in another by clauses of this character which have been insisted upon by the local authorities, and as a result of which they are prevented from giving the best possible service to the public.

Experience has shown that when a railway company has once accepted a condition to a franchise every obstacle is put in the way of efforts made for its removal, whether such a change would be for the benefit of all or not. For this reason, the question is one which should be settled, if possible, fairly and squarely by the railroad company before it has committed itself to the franchise by the construction of track in a city or the investment, in any other way, of capital which cannot easily be recouped. We do not propose, in these remarks, to exhaust the subject of the franchise question, but there is, perhaps, one point in connection with the incident related last week, to which we did not have space to refer with especial emphasis in our last issue, but whose application might be of benefit in some cases.

It is fair to say that no railway line or, in fact, no public improvement was ever suggested in any city which did not encounter some objectors. The obstructionists to a railway line, or in fact to any proposed public improvement, will be found to consist of four classes: First, those who raise objections as a matter of business, in other words, the blackmailers, either political or otherwise, who wish to be bought off; second, the politicians, who adopt an obstructive policy entirely from political motives, independent of whether the project will be an improvement to the city or not, in other words, the demagogues, who hope to secure a certain amount of notoriety and popularity, as well as reputation for far-sightedness by opposing a plan which certain other people advance. The third class in this classification consists of the cranks, who, while acting from conscientious motives, cannot fail to see jobbery and corruption in every corporate undertaking. They are pessimists, who, in their social relations or family life may be highly estimable, but when it comes to matters of public concern, are an unmitigated nuisance, especially when their action is followed as an example by others who should be better informed. The fourth class consists of other citizens, who, also acting from conscientious motives, do not believe that the proposed road or other project is of benefit to the city, but their opinion can be changed by argument and proof, if the merits of the project are such as to warrant it.

Of these four classes of objectionists the first will constitute only a very small minority and can easily be outvoted, while the second will change front like a weathercock with a change in public sentiment. The third class will be found the most unreasonable of all, and make more noise and opposition in proportion to their numbers than all of the other three classes combined. Practically no amount of argument and proof of the benefits of any proposed undertaking will suffice to change their opinion. They are naturally obstructionists and will insist that no proposed change is for the better. The only hope of overcoming opposition then is to appeal to the fourth class of citizens and show them clearly, provided the property has merit, that it will be of benefit to the community at large, and thus bring around the public sentiment in its favor.

In the case mentioned last week this was done by a public meeting. It is not always advisable to call such a meeting unless the merits of a company's position have been pretty thoroughly discussed previously in the local papers and elsewhere, so that people will not attend in a prejudiced state of mind. When, however, the subject has been thoroughly debated for some time and enough interest exists to insure a representative expression of opinion, a public meeting, in a small town, offers the best opportunity for refuting specious arguments against the undertaking, stiffening the backbones of those in favor of it, and winning over those whose minds are open to argument but who are undecided as to the proper course. The American public has a very large bump of common sense, and, when a question is thoroughly understood, has very little patience with cranks who object to a proposition simply for the sake of doing so. An officer of the company who can state the position of his corporation clearly and precisely, and who can show why such a proposition can be allowed and why such an one cannot, and who, above all, has merit and common sense on his side, can nearly always bring over to his way of thinking such a large percentage of his audience that the few remaining objectors, for one reason or another, will be overruled.

Standing in Open Cars.

For New York and such other cities as have in contemplation the passage of an ordinance to prohibit passengers standing between the seats of an open car there is a lesson in a court decision handed down recently at Fall River. It would seem that residents of that city with ideas as to how a street railway ought to be run succeeded in having passed an ordinance to the effect that passengers could not stand between the car seats. Some one who could not get a seat instituted legal proceedings against the local company, and the judge before whom the case was heard ruled that any such ordinance was unconstitutional. We believe that if there was an effort to enforce such a law, unless passengers were allowed to stand on the running board, there would be just as much, if not a great deal more, complaint from people who could not get on a car, than there is now.

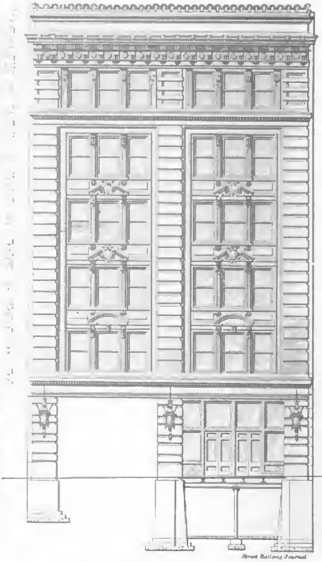
Large Interurban Terminal Station in Cincinnati

The extent of the interurban electric railway business centering in Cincinnati has led to the establishment in that city of a large terminal station, which will be used by the Rapid Railway, the Suburban Traction Company and the Cincinnati & Eastern Electric Railway Company. The building is being erected by the Interurban Terminal Company, of which G. R. Scrugham is president and general manager, and is being built on Sycamore Street, between Fourth and Fifth Streets. This is within one block of the government building in Cincinnati, and is practically at the center of the city. Through the courtesy of Mr. Scrugham this paper is able to present plans and front elevations of the building, which will be completed by Oct. 1.

As will be seen from the elevations, the building possesses six floors. The ground floor is devoted partly to a double track, through which the interurban cars run, and partly to waiting rooms. In the rear of the building is a large freight shed. The waiting rooms comprise one large general room with ticket office and checking room, news stand, etc., a ladies' waiting room, toilets, etc., and passenger elevator. The freight shed, which is in the rear of the building, is connected with the upper floors by a freight elevator. At present the company will deliver freight coming in on the cars using the station through a local delivery company, and the freight shipped out of the station will be delivered at the freight depots by the consignor. The company proposes, however, next year to start a system of express delivery wagons, not only for delivering the freight and express matter coming in on the roads, but also to collect freight and express from different points in the city to be shipped to points along the interurban lines. The system of handling this freight will be very similar to the well-established methods of express companies, having all packages charged and bills made out for everything placed on the cars. The company will also establish express and freight depots at every village along the lines of the interurban railways operating from this depot, and will place an agent in charge.

It is the plan of the company to operate hourly upon each of the three roads mentioned combination cars, which will handle light packages and mail, and at night to operate regular freight cars. These cars will be equipped with four motors each, and will measure 40 ft. inside. They will be able to handle heavy freight, such as dry goods and groceries, but it is not the immediate intention of the company to haul bulk freight, such as grain, coal or lumber.

TERMINAL STATION OF INTERURBAN ROADS AT CINCINNATI

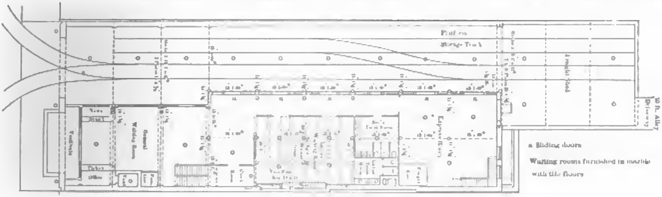


ELEVATION OF INTERURBAN TERMINAL STA ION

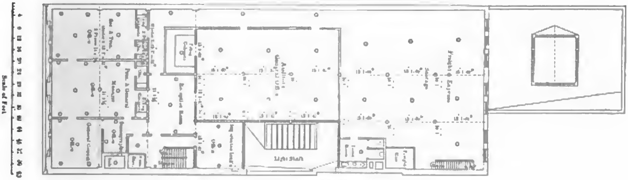
A great part of the territory just outside of Cincinnati is extremely fertile and is devoted largely to market gardening. At present most of this produce is hauled to the markets by wagon. The proposed system for electric freight hauling, however, will allow the shipment of this produce by the electric freight cars, and as the terminal station is within a radius of three blocks of five of the largest produce markets in Cincinnati, a large business, it is expected, will be secured. By this system it is expected that vegetables can be delivered at the markets in much better shape than they possibly can be delivered by wagons, and at a very much lower cost than the system now employed. In addition, the city will be rid of a great deal of carting, which wears out the pavements, produces unnecessary noise and blocks the streets.

One of the engravings shows the plan of the second floor in the terminal station, and the floors above this are to be finished in the same manner. As will be seen, rooms for offices are provided in the front part of the building, while the rear of the floors gives large storing capacity, amply sufficient to enable the company to keep separate the freight and express matter for the different roads.

It should be stated in this connection that the building, as indicated in the illustration, is being erected in the most substantial manner. The waiting rooms are finished as fine as any hotel corridor, with separate waiting rooms for ladies and with all necessary conveniences. The building itself will cost about $130,000, which may seem to some a very large sum for a depot devoted to interurban electric railway service. Mr. Scrugham, however, considers that this is the right policy to pursue. He believes that with a station of this kind the general public will become accustomed to using the interurban depots as they would a central union depot of steam railroads, and by locating these stations in the very center of the business district, electric roads will be in a far better position to compete for the commuter travel than if they used belt lines or loops and had the general public wait on street corners for cars.



PLAN OF GROUND FLOOR



ARRANGEMENT OF OFFICES ON SECOND FLOOR

So far as the freight business is concerned there seems to be no question but that far better results can be secured, certainly where the business is a large one, by having a depot for loading and unloading cars near the center of the city, where the business can be carried on on a large and consequently economical scale.

The architects for this building are the well-known firm of Werner & Adkins, and L. P. Hazen & Co. are the general contractors.

Profit Sharing for Employees of a Canadian Company

The British Columbia Electric Railway Company, Ltd., operating the street railway lines in New Westminster, Vancouver and Victoria, B. C., and a 12-mile interurban line connecting Vancouver and New Westminster, has announced that its employees are to share in the profits of the company when the latter exceed the amount necessary to pay a 4 per cent dividend on the stock. The amount of profits available for distribution after the regular 4 per cent dividend is paid to the stockholders will be divided into three parts, two of which are to go to the stockholders of the company, while the remaining third will be divided among the employees. With the announcement of the profit-sharing plan the company also announced a general increase in wages. The old rate for conductors and motormen was 20 cents per hour for the first year of service, 21 cents for the second and third years, and 22 cents thereafter. The company will now pay 20 cents for the first year, 22 cents for the second, 23 cents for the third, and 25 cents thereafter. The only other company, so far as can be recalled, with a similar system of profit sharing is the Columbus Railway, of Columbus, Ohio.

The Detroit Convention

A circular letter has just been issued by T. C. Penington, secretary of the American Street Railway Association, giving some additional information in regard to the Detroit Convention.

The letter states that the meetings will be held at the Light Guard Armory in Detroit. Sessions of the association will be held on Wednesday, Oct. 8, and Friday, Oct. 10. Thursday, Oct. 9, has been set apart as Exhibitors' Day. No session of the association will be held, so all may have time to examine the exhibits.

The headquarters of the association will be at the Cadillac Hotel. Other first-class hotels are: Russell, Wayne, St. Clair, Normandy, Griswold and Metropole. The annual dinner will be held at the Cadillac Hotel on Friday evening, Oct. 10, when the officers-elect will be installed.

The following resolution has also been unanimously adopted by the executive committee: "The secretary is directed to request the chief executive officer of the different companies to notify all delegates and heads of departments attending the convention that they are expected to be present at all sessions of the meeting and take part in the discussions."

Special arrangements have been made for the entertainment of ladies, and the Detroit committee promises all who attend a very enjoyable time.

The passenger associations have granted excursion fares from all points (except in Michigan from points on the Michigan Central Railroad and Lake Shore & Michigan Southern Railroad, from which the rate of fare is 2 cents per mile).

To secure this rate persons attending the convention must purchase regular tickets to Detroit and get, at the time of purchasing their tickets, properly executed certificates from the ticket agent.

Tickets for the return journey will be sold by the ticket agent at Detroit for one-third the first-class limited fare to those holding certificates signed by the ticket agent at the point where ticket is purchased, countersigned by the secretary of the association and signed and stamped by a special agent of the Michigan Passenger Association.

Tickets for return journey must be purchased within three days after the adjournment of meeting, Sunday not being reckoned as one of the three days.

No certificates will be honored if issued in connection with any ticket unless full fare shall have been paid to Detroit, and certificates are not transferable. The secretary states that no refund of fare can be expected if the delegate does not get a certificate when

his original ticket is purchased. All certificates thus secured are to be left with the clerk at the exhibit hall when the member registers.

John H. Fry, chairman of the exhibit committee, has also made the following announcements concerning the rules and regulations governing the exhibits:

The exhibition will open Oct. 8, 1902. The building will be open for the reception of exhibits commencing Monday, Oct. 6. All articles intended for exhibition shall be delivered at the Light Guard Armory by the agent or owner and at his expense; but the local committee has made arrangements with the Riverside Storage & Cartage Company to haul and deliver all shipments to and from the building, if desired, at low rates. Mark goods to yourselves, care of Riverside Storage & Cartage Company, Detroit, Mich., send this company bill of lading, or advice of shipment, and prepay charges. Under no circumstances will exhibits be received on which there are charges of any kind.

Ship all goods early to insure delivery in time. All apparatus or material for exhibits should be shipped so as to arrive in Detroit not later than Saturday, Oct. 4

Electric Interurban Railways in Indiana

The projecting and building of electric interurban railways in the State of Indiana has taken place so rapidly that it is difficult to keep accurate record of the progress of all the projects, but the accompanying map shows the roads built and actually under construction, as far as can be ascertained.

A level, thickly-settled country, with good-sized towns at frequent intervals, are the factors that have made the central part of Indiana one of the important interurban districts of the United States. Indianapolis is now a great interurban electric railway center, as it has in the past been for a number of years a great steam railroad center.

The most extensive of the Indiana interurban systems is that of the Union Traction Company, of Indiana (No. 1), which already has 100 miles of interurban line in operation. This road is one of the leaders among the electric interurbans in the country, not only in size but in advanced practice and high speeds. Many of its excellent peculiar features have been described in these columns the past year. With the completion of the new lines acquired by the lease of the projected Indianapolis & Northern Railway, the company will almost double the mileage of the system. All these lines parallel steam roads, and are on private right of way, equipped and graded to make high speeds of over 50 miles per hour. The following is a list of towns served by the Union Traction Company of Indiana, and also those which will be reached by the new lines, together with the population of each in 1900:

	Population		Population
Indianapolis	169,164	Gas City	3,622
Lawrence	385	Elwood	12,950
Oaklandon	300	Hobbs	222
McCordsville	301	Tipton	3,764
Fortville	1,006	Atlanta	1,000
Ingalls	542	Arcadia	1,413
Pendleton	1,512	Cicero	1,003
Anderson	20,178	Noblesville	4,792
Chesterfield	164	Nora	70
Daleville	500	Broad Ripple	487
West Muncie	200	Jackson	72
Muncie	20,942	Sharpsville	500
Linwood	100	Kokomo	10,609
Alexandria	7,221	Bunkerhill	568
Summitville	1,432	Peru	8,463
Fairmount	3,206	Lincoln	107
Jonesboro	1,838	Walton	498
Marion	17,337	Logansport	16,204

The Indiana Railway Company (No. 2) is the most extensive system in the northern part of the State, and joins a prosperous belt of towns. It has been in operation a number of years, and connects the following:

	Population		Population
Goshen	7,810	Mishawaka	5,560
Elkhart	15,184	South Bend	35,999

From South Bend an extension is being built to Niles, Mich., and thence to St. Joseph and Benton Harbor on Lake Michigan.

The Fort Wayne & Southwestern Traction Company (No. 3) is a new road, of which W. B. McKinley, of Champaign, Ill., is president, and is built from Fort Wayne to Wabash. The towns through which it runs are:

	Population		Population
Fort Wayne	45,115	Andrews	746
Aboite	40	Lagro	456
Roanoke	536	Wabash	8,618
Huntington	9,491		

The Muncie, Hartford & Fort Wayne Electric Railway Company (No. 4) is under construction from Muncie to Montpelier, through Hartford City. Cleveland and Muncie men are officers of the road, and E. P. Roberts & Company, of Cleveland, are engineers of the construction. The towns and population served by the Muncie, Hartford & Fort Wayne Electric Railway are:

	Population		Population
Muncie	20,942	Hartford City	5,912
Royerton	250	Mollis	18
Eaton	1,567	Montpelier	3,405

The Indianapolis, Greenwood & Franklin Railroad Company (No. 5), running south from Indianapolis, has operated some time between Indianapolis and Franklin, and will soon operate as far as Columbus. Its towns and their populations are as follows:

	Population		Population
Indianapolis	169,164	Amity	91
Southport	285	Edinburg	1,830
Greenwood	1,608	Taylorsville	450
Whiteland	334	Columbus	8,130
Franklin	4,005		

The Terre Haute Electric Company (No. 6) has an interurban line from Terre Haute to Brazil and Knightsville, the latter being coal mining centers and the former the largest town in that part of the State. The territory served by the road is:

	Population		Population
Terre Haute	36,673	Brazil	7,786
Glenn	76	Knightsville	1,171
Seelyville	129	Harmony	1,020
Cloverland	155		

The Indianapolis & Eastern Electric Railway, formerly the Indianapolis & Greenfield Rapid Transit Company (No. 7), is another interurban that has been operating out of Indianapolis for some time. Its towns are as follows:

	Population		Population
Indianapolis	169,164	Philadelphia	182
Irvington	1,799	Greenfield	4,489

This road extends almost due east from Indianapolis, and in the course of time it will be possible to ride on electric cars as far as Richmond, almost to the eastern boundary of the State. It is also likely that the western boundary of the State, at Terre Haute, can be similarly reached.

The Indianapolis & Martinsville Rapid Transit Company (No. 8) is operating part of its line. This is a company of which Charles Finley Smith, an Indianapolis banker, is president. The towns it will serve are:

	Population		Population
Indianapolis	169,164	Martinsville	4,038
Mooresville	974		

The Indianapolis, Shelbyville & Southeastern Railway (No. 9) is a property recently completed by Townsend, Reed & Co., of Indianapolis, reaching the following towns:

	Population		Population
Indianapolis	169,164	Brookfield	300
Bethel	141	Fairland	512
Acton	460	Shelbyville	7,169

The Indianapolis, Lebanon & Franfort Railway (No. 10), now being built and financed by Townsend, Reed & Co., of Indianapolis, is second in extent only to the system of the Union Traction Company of Indiana. Like the Union Traction it is being built for high speed and will employ polyphase current distribution. The road is being built from Indianapolis northwest to Lebanon, where it branches, one line going to Crawfordsville and the other to Frankfort and Lafayette. It will give service between the following towns:

	Population		Population
Indianapolis	169,164	Crawfordsville	6,649
Zionville	765	Frankfort	7,100
Whitestown	700	Lafayette	18,116
Lebanon	4,465		

In the southwestern part of the State the Evansville & Princeton Traction Company (No. 11) seems to be the most advanced of any of the projected lines. The towns through which this road is being built are:

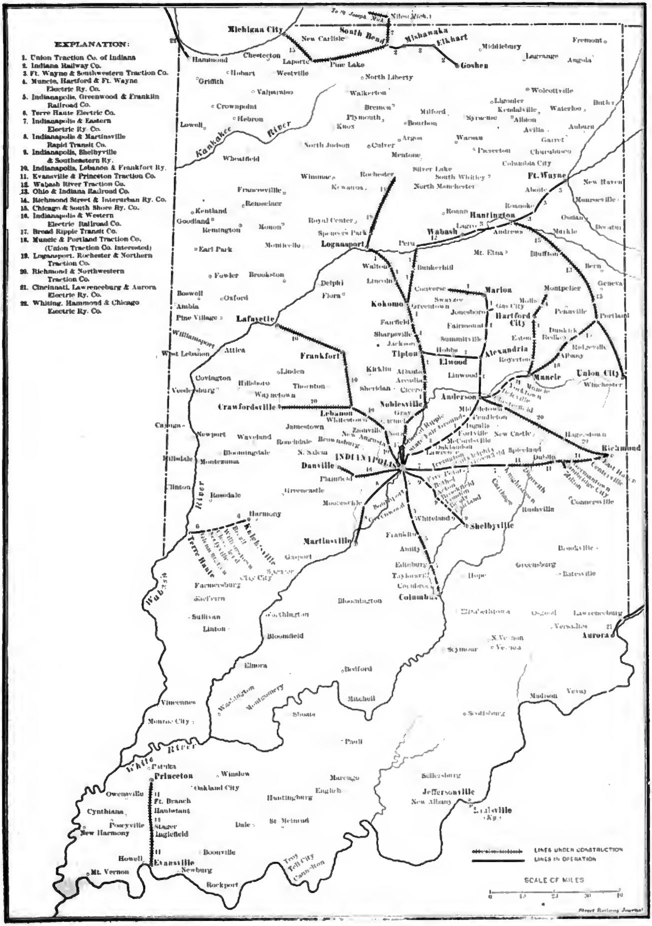
	Population		Population
Evansville	59,007	Fort Branch	849
Inglefield	52	Princeton	6,041
Haubstadt	448		

The Wabash River Traction Company (No. 12) connects Wabash with Peru:

	Population		Population
Wabash	8,618	Peru	8,463

The same company expects to connect Peru and Logansport.

The Ohio & Indiana Railroad Company (No. 13) has done part of the grading for a line from Huntington to Union City, as indicated. Bracey & Howard, contractors, Chicago, are behind the



MAP OF INDIANA, SHOWING INTERURBAN ELECTRIC RAILWAYS

road, S. H. Bracey, of that firm, being vice-president. The towns served and populations are as follows:

	Population		Population
Huntington	9,491	Portland	4,798
Bluffton	4,479	Union City	2,716

The Richmond Street & Interurban Railway (No. 14) has a line just being completed from Richmond as far west as Dublin and the line from there to Greenfield, to connect with Indianapolis, is under contract. The towns along this route are:

	Population		Population
Richmond	18,226	Dublin	698
Centerville	785	Dunreith	295
East Germantown	305	Knightstown	1,942
Cambridge City	1,754	Greenfield	4,489

The Chicago & South Shore Railway Company (No. 15) is just completing a line from Laporte to Michigan City. This is being built by the Electrical Installation Company, of Chicago. W. C. Burns, of Chicago, formerly president of the Indiana Railway Company, is president.

	Population		Population
Laporte	7,113	Michigan City	14,850

The Indianapolis & Western Electric Railroad Company (No. 16) is building west from Indianapolis to Plainfield.

	Population		Population
Indianapolis	169,161	Plainfield	909

Albert Lieber, of Indianapolis, 1001 Stevenson Building, is president, and the Electrical Installation Company, of Chicago, electrical engineer of the company.

The Cincinnati, Lawrenceburg & Aurora Electric Railway Company (No. 21) runs from Cincinnati to Aurora by way of Lawrenceburg, serving a considerable population in the extreme southeastern part of the State. The Whiting, Hammond & Chicago Electric Railroad (No. 22) runs between Chicago and Hammond, serving a large population in the northwest corner of the State.

There are a number of additional lines projected, including a trunk line from Indianapolis to Springfield, Ill., by way of Terre Haute; and from Indianapolis to Cincinnati, by way of Rushville and Hamilton, Ohio.

The Indianapolis Terminal Traction Company proposes to expend $1,200,000 in the construction of terminal loops, passenger and freight stations, making the most systematic and advantageous terminal system for interurban roads to be found in the country.

Club Rooms for Employees of Washington Company

The members of the Washington Traction & Relief Association, composed of employees of the Washington Traction & Electric Company, have recently been presented a handsome clubhouse on behalf of the company by Gen. George H. Harries, the vice-president and general manager.

The building that has been fitted up for the use of the association has been known to several generations of Washington as Marini's Hall, and was for years occupied by the Government as a storage place for the records of the Census Office. The building has been thoroughly renovated, about $4000 having been expended in this work. It is a long, broad structure, and contains two great halls on the first and second floors, with numerous smaller rooms on the sides. The entrance hall has been entirely repainted, papered, and carpeted. Brass rails lead up to the double doors that open into the main assembly room on the first, or ground floor. This room is about 50 ft. long, and equally as wide, and is provided with pool and billiard tables. The lighting arrangements of the room have been made perfect. The room has been so arranged that a platform can be erected at the northern end and the meetings of the association held in it.

On the left of the entrance a small room has been fitted up as an office for the secretary, and for use as a committee room. Handsome etchings adorn the walls of this apartment and the walls have been finished in a delicate shade that harmonizes with the heavy oak furniture. To the right of the main entrance is the library, a room somewhat larger than the reception room and filled with magazines and periodicals. In a few months it is hoped that this room will be lined with shelves which will overflow with books of the best sort. This room is carpeted and furnished with easy chairs and will be used as a smoking room.

In the rear of the main assembly room is a bowling alley equipped with the most modern apparatus. On the second floor, the old dancing hall is fitted up with six different alleys. This section will be reserved for use of ladies and for those who can not be accommodated on the lower floor. The general public will also be admitted to this larger alley at all times. On the second floor also are the retiring rooms for the association, containing all modern appliances for shower baths, etc.

The first floor of the building will be open to members of the association only, and a small fee will be charged for the use of the pool and billiard tables and the bowling alleys. It costs nothing to patronize the library and smoking-room, however, and it is expected that the men will make themselves at home in the building. The association will maintain the building from the fees received from the amusements and from the dues of its members. The association has about 900 members who enjoy a life insurance and sick benefit.

The celebration which accompanied the presentation of the rooms was presided over by General Harries, who is president of the association, as well as the general manager of the company. General Harries made a short speech, in which he turned over the building to the house committee selected to receive it. The keys were delivered to R. E. Lee, the chairman of the house committee. General Harries spoke of the excellent work of the men and the high standing of the relief association. He referred to the fact that a place of amusement was needed for them and that the company had provided it.

He then introduced John Joy Edson, who made a short address, advising the men to be faithful to their employers and to perform their tasks so that they would become indispensable to the success of the company. He referred to the fact that in this country every man had a chance to become a leader, and that it was upon the employees that the entire success or failure of a business enterprise depended. S. W. Woodward made an address in a similar strain, and he was followed by John B. Larner. The meeting was then turned over to Chairman Lee, of the house committee.

As soon as the meeting was formally turned over to Mr. Lee, the latter advanced to the platform, and in a short speech thanked General Harries and the others on the platform for their presence and advice. He said that the men had received a great deal of good advice from General Harries in times past, and that they had been very successful in its application. As the general manager did not seem to get anything in return for his kindness, he said, it had been determined to reward him in some way on this occasion, and therefore, Mr. Lee said, it gave him great pleasure to present to him, in the name of the relief association, a slight token of their affection and esteem, in the form of a solid gold watch chain with a charm set with a magnificent diamond. On the reverse side of the charm was engraved General Harries' name and the date of the presentation, together with the name of the association which presented it. General Harries was so completely surprised that he lost the power of speech. In a few moments he recovered sufficiently, however, to thank Mr. Lee and the members of the association for the present, but more for the motives which prompted the presentation.

Observation Cars in Cleveland

An observation trolley car, similar in idea to those in use in some other cities and described in past issues, will be put in commission in Cleveland, by the Cleveland Electric Railway Company "Big Consolidated" lines, next spring, and will make regular trips throughout the city at stated intervals, giving visitors an opportunity to see the town. The fare will be 25 cents, and an attendant will point out the places of interest.

The car for this purpose is now being built. It will be exquisitely appointed and have every luxury. President Andrews, Superintendent Stanley, Secretary Davies and Excursion Agent J. W. Butler began the work of selecting a route last week. The one most favored is:

Start at Public Square, through the business district, wholesale and retail, including a glimpse of the lake front; up Euclid Avenue to Erie, to Prospect, to Case, to Euclid, to Wade Park, past the Boulevard and the universities, to within a block or so of Lake View Cemetery. The car will then turn up East End Avenue to Mayfield Street, where the excursionists will catch a glimpse of Little Italy, the Alta House and the Garfield monument. Passing Mayfield Cemetery the car will turn into Coventry Road to Euclid Heights, the most fashionable of Cleveland's suburbs, down the heights to Cedar Glens, to another part of the Boulevard, to Cedar Avenue west and to Willson Avenue.

Resuming the tour on Willson Avenue south, the car will continue out Broadway, past the numerous rolling mills, to the State Asylum, around the "Y" at Garfield Park, and back by way of the Union Street loop, down town by way of Willson Avenue, Kingsbury viaduct, Orange, Broadway to the Central viaduct, across the flats to Jennings, across the Abbey Street viaduct to Pearl, past the market house, down Pearl to the Superior Street viaduct and over lower Superior Street back to the starting place.

Plotting Speed-Time Curves—VI

BY C. O. MAILLOUX

APPENDIX C.

FORMULA FOR TIME VALUES OF SPEED-TIME CURVES

The most convenient and practical way of drawing a speed-time curve is to locate or "plot" on a sheet of paper, the co-ordinates for a certain number of points of the curve, sufficiently close together for the purpose, and to then draw a line passing through or near these points. The more precisely these points have been determined and plotted, and the more numerous they are, the more perfect will be the curve, and the fewer the points which are, so to speak, out of line of the "mean path" through the aggregation of the co-ordinate points.

The data of each case furnish the necessary information regarding the speed, which is the ordinate value for each co-ordinate point of the curve; but they give no direct information about the time value corresponding to each speed value, that is to say, about the horizontal distance of the next ordinate, either from the starting point, or from the last point plotted. Fortunately, the data either give or furnish the information necessary to obtain the value of the differential coefficient, or the time-rate of speed variation, which corresponds to each speed value, and which determines the inclination or slope of the curve at that particular speed point. Taking advantage of this circumstance, a formula for pre-determining the time values corresponding to the speed values, may be obtained by the solution of a simple geometrical problem. This problem may be stated as follows:

Given the ordinate (y) and the differential coefficient (dy/dx) at any point of a curve to find the abscissa (x) corresponding to said ordinate, or the distance of said ordinate from the axis of ordinates (OY).

There are two cases:

First.—Curves having a positive differential coefficient, or an upward slope.

These curves are generally concave to the axis of x.

This case includes all acceleration curves.

Second.—Curves having a negative differential coefficient, or a downward slope.

These curves are generally convex to the axis at x.

This case includes all retardation curves.

First Case.—(Fig. 17). Let dotted lines, a-b, c-d, e-f, be drawn tangent to the curve $O\ E\ F$ at various points. Let the vertical lines, y and y', be ordinates which are very close together and correspond to the point of tangency (E). The time space or difference (dx) between these ordinates, or

$$dx = x' - x \qquad (a)$$

and the difference between the ordinates, or the speed increment

$$dy = y' - y \qquad (b)$$

are both assumed to be infinitely small.

By similar triangles, we have

$$\frac{y}{cx} = \frac{dy}{dx} \qquad (c)$$

Or the ordinate (y) at the point of tangency, divided by the "sub-tangent" (cx) is equal to the differential coefficient for the said point. The numerical value (k) of this differential coefficient is known, or can be calculated from the data of the case, so that we have

$$\frac{dy}{dx} = k$$

whence

$$dx = \frac{dy}{k} \qquad (d)$$

It should be noted that dx is really the sub-tangent of the small or differential triangle $E\ dy\ dx$.

Equation (d) may also be written

$$dx = dy \times \frac{1}{k} \qquad (e)$$

This means that the time element dx, corresponding to the infinitely small change in speed dy, is equal to this change in speed multiplied by the *reciprocal* of the differential coefficient. The total time x' would be, from (a)

$$x' = x + dx \qquad (f)$$

Such time increment values (dx) would be too small for practical use in plotting curves, however.

NOTE.—The first instalment of this paper appeared in the STREET RAILWAY JOURNAL July 5, and contained Figs. 1 to 4; the second part, July 26, and contained Figs. 5 to 10; the third part, Aug. 9, and contained Figs. 11 to 13; the fourth part, Aug. 16, and contained Fig. 14, and the fifth part, Aug. 23, and contained Figs. 15 and 16.

If we increase the difference between x and x', we will have, instead of equation (a) and (b), the following:

$$x' - x = \triangle\ x \qquad (g)$$

$$y' - y = \triangle\ y \qquad (h)$$

and equation (c) will become

$$\triangle\ x = \triangle\ y \times \frac{1}{k} \qquad (i)$$

while equation (f) will become

$$x' = x + \triangle\ x \qquad (ii)$$

when $\triangle\ y =$ the speed increment corresponding to the time increment $\triangle\ x$.

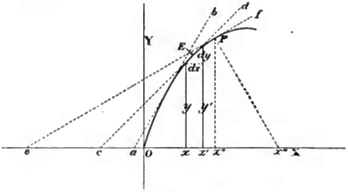


FIG. 17

An important question arises in this case, however. So long as the time difference was very small ($= dx$), and the ordinates y and y' remained very close to each other, the differential coefficient had substantially the same numerical value (k) at the ordinate y as at the ordinate y', and no substantial error would result from taking either of the two values of this coefficient.

When the time distance is increased (to $\triangle\ x$), however, the differential coefficients at the two ordinates y and y' may be materially different. This is illustrated in Fig. 18, where the conditions are purposely exaggerated. In this case we have

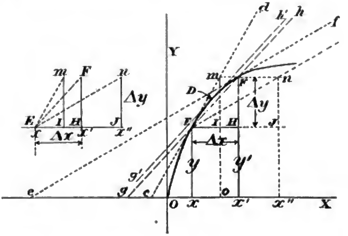


FIG 18

$$\frac{dy}{dx} = \frac{y}{cx} = k \qquad (j)$$

at the point E, and

$$\frac{dy'}{dx'} = \frac{y'}{cx'} = k' \qquad (k)$$

at the point F,

the two being evidently different in value, and one being evidently larger, the other smaller, than the differential coefficient corresponding to some intermediate point of the curve, such as D, between E and F. If we draw the line g, h, parallel to the tangent line g', h', we have the differential triangle E F H, exactly similar to the differential triangle corresponding to the point D, and we can write

$$\frac{dy''}{dx''} = \frac{\triangle\ y}{\triangle\ x} = k'' \qquad (l)$$

where y'', x'' are the co-ordinates of the point D, and $k'' =$ the differential coefficient thereof.

The differential triangles E m I and E n J correspond, respectively, to the co-ordinates of the points E and F and to their differential coefficients, k and k', as defined in equations (j) and (k). These two differential triangles and the differential triangle $E\ F\ H$ are reproduced by themselves in the left-hand portion of Fig. 18.

As pointed out in connection with equation (d) the sub-tangent of the differential triangle is the time increment ($\Delta\ x$) in each case. Hence, the three triangles show graphically the different values of $\Delta\ x$ obtained by equation (i) when, with the same value of $\Delta\ y$, the different values of the differential coefficients (k, k'', k') corresponding to the points E, D and F, are used.

It is seen that the intermediate coefficient value k'' is the one giving the correct time increment value ($\Delta\ x$). The lower value, k, makes the time increment too small by the distance I H; while the higher value, k', makes it too large by the distance H J. The point D is approximately midway between the points E and F. If the curve had a constant rate of curvature, like the arc of a circle, the point D would be exactly midway; it would be shifted to the left if the rate of curvature is decreasing, and to the right if the rate of curvature is increasing. In practice the error in the value of time increment ($\Delta\ x$) will be negligible if the value of the differential coefficient is that corresponding to the midway point or the mean (y'') of the two speed values y, y', such that

$$y'' = \frac{y + y'}{2}$$

and, of course, the nearer the two values y and y' are to each other (or the smaller $\Delta\ y$ is taken), the smaller the error.

The error made may easily be calculated. If we designate it by $\Delta\ x$ we may write, from equation (i)

$$\begin{aligned} \Delta x &= \Delta x' - \Delta x'' \\ &= \frac{\Delta y}{k'} - \frac{\Delta y}{k''} \\ &= \Delta y \left(\frac{1}{k'} - \frac{1}{k''}\right) \\ &= \Delta y \left(\frac{k'' - k'}{k'\ k''}\right) \end{aligned} \qquad (1)$$

where

Δx = amount of error,
$\Delta x''$ = the wrong value,
$\Delta x'$ = the correct value,

and the proportion of error would be,

$$\frac{\Delta x}{\Delta x'}$$

The above equation (1) in reality gives the difference in time value resulting from having assumed some greater or less value than the proper value (k') of the differential coefficient. If the value of k'' was taken too great (which is the case symbolized by the differential triangle E m I), the factor $k'' - k'$, and consequently the value of $\Delta\ x$, representing the correction for error, will have the positive sign. On referring to the first line of equation (1) we see that $\Delta\ x$ can only have the plus sign when $\Delta\ x''$ or the "wrong" time value is less than $\Delta\ x'$, the correct time value. Hence, the plus sign will mean that the correction is to be made by adding the amount $\Delta\ x$, obtained by equation (1), to the "incorrect" time value ($\Delta\ x'$), previously obtained. If the value of k'' was taken too small (as in the case symbolized by the differential triangle E n J), the sign of $\Delta\ x$ will be *negative* showing that this amount $\Delta\ x$ is to be subtracted from the incorrect amount, $\Delta\ x'$.

In practice, the speed differences ($\Delta\ y$) between any two successive points of the curve are expressed in miles per hour, or fractions thereof, and the time values $\Delta\ x$ are taken in seconds.

Equation (1) shows that the error would increase in direct proportion with the speed increment ($\Delta\ x$), and in inverse proportion with the product of the reciprocals of the two differential coefficients considered.

[NOTE.—Usually k' and k'' have very nearly the same values, hence the product k', k'' is very nearly equal to the square of either k' or k''.]

The total time value or the abscissa (x') corresponding to any speed point (y') is obtained, as indicated in equation (ii) by adding the latest time value ($\Delta\ x$) to the sum of all the previous values. This summation of previous values is symbolized by x in equation (ii).

Second Case.—(Fig. 19). The dotted line, c-d, being drawn tangent to the point E, we have, by similar triangles

$$\frac{dy}{dx} = \frac{y}{xd} \qquad (m)$$

just as in equation (c). In this case, however, we observe that the symbol dy represents a diminution of speed, because y is greater than y', and, consequently, if we applied equation (b) we would have

$$y' - y = -\ dy \qquad (n)$$

since $y = y' + dy$.

Hence, equation (m) should be written

$$-\frac{dy}{dx} = -\frac{y}{xd} = -\ k \qquad (n)$$

and we have, by analogy to equation (e)

$$dx = -\ dy \times \frac{1}{k} \qquad (o)$$

and by analogy to equation (i),

$$\Delta x = -\ \Delta\ y \times \frac{1}{k} \qquad (p)$$

or the successive time increments, $\Delta\ x$, correspond to descending speed values ($-\ \Delta\ y$), in the curve.

In this case, as in the first case, there will be an error, if the wrong differential coefficient is used in applying equation (p).

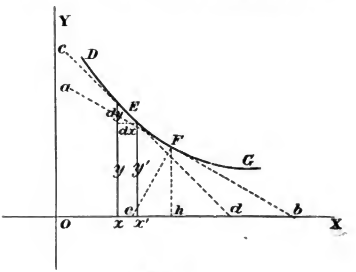


FIG. 19

This error has, however, a slightly different expression, resulting from the negative sign in (p).

Using the same notation as before, we have

$$\begin{aligned} \Delta x &= \Delta x' - \Delta x'' \\ &= -\frac{\Delta y}{k}\left(-\frac{-\Delta y}{k''}\right) \\ &= \frac{\Delta y}{k''} - \frac{\Delta y}{k'} \\ &= \Delta y \left(\frac{k' - k''}{k''\ k'}\right) \end{aligned} \qquad (q)$$

In this case a positive sign for $\Delta\ x$ will mean that the incorrect value ($\Delta\ x''$) is too large, and must be reduced by an amount equal to $\Delta\ x$. Since the general form of equation (q) is the same as that of equation (1), the remarks already made concerning the proportionality of the error will also apply to this case.

The practical significance and application of the foregoing analysis and reasoning are as follows:

Accuracy in plotting speed-time curves requires that:

First.—The speed points should not be taken too far apart (or the speed differences should not be taken too great).

Second.—The "flatter" the curve (or the smaller the rate of acceleration), the smaller the speed differences ought to be.

Third.—For high accelerations (corresponding to the lower portions of acceleration curves), the speed differences may be taken from 1 mile per hour to 10 miles per hour, or even higher, according to the degree of precision required.

Fourth.—For low accelerations the speed differences must be gradually reduced as the rate of acceleration decreases (as in the flat parts of acceleration curves), until it amounts to a small fraction of a mile per hour—from five-tenths to one-tenth or less, according to the degree of precision required.

Fifth.—The speed increment (Δy) should be reduced whenever it gives by equation (i) a too high time increment value (Δx). The time value may be considered high when it exceeds two seconds for high accelerations, five seconds for medium accelerations and ten seconds for low accelerations. For very accurate work, the limits ought to be set considerably lower, or one-half second for high accelerations, two seconds tor medium accelerations, and five seconds for low accelerations.

These observations have been verified and confirmed by practical experience.

APPENDIX D.

BRAKE CURVE PROBLEMS

To plot any portion of a braking curve which follows or which is assumed to follow a straight line, we only need to determine the co-ordinates of the first and last points of the said portion of curve.

The three following "problems" show how the co-ordinates may be determined in different cases.

Problem I.—At what speed point must the brakes be applied in order to bring the car to a stop at an exact given point, the rate of retardation being constant and known or assumed?

This problem is the same as that of finding the point g in Fig. 20.

Let ordinates (y) represent speeds (m. p. h.)
Let abscissæ (x) represent time (seconds)
Let s = distance, in miles.
Let A = area (m. p. h. seconds).

It has been shown in Appendix A (equation e) that the area of any portion of a speed-time curve is equal to a distance.

In this case the rate of retardation being assumed constant, and the speed-line being consequently straight, the area of the portion considered ($h\ g\ B$), is the area of a right-angled triangle, which, it is well known, is equal to

$$A = \frac{yx}{2} \qquad (a)$$

In this case the value of x is not given. We can obtain it, however, from the rate of retardation

$$\frac{dy}{dx} = k \qquad (b)$$

Since k is assumed constant, we may write $y / x = k$, whence

$$x = \frac{y}{k} \qquad (b)$$

Substituting this value in (a) we have

$$A = \frac{y^2}{2\ k} \qquad (c)$$

The speeds being taken in miles per hour, and the time values in seconds, the area value will be expressed in m. p. h. seconds. A train moving with a velocity of one mile per hour for one hour would cover a distance of exactly one mile. There being 3600 seconds in one hour, it follows that 3600 m.p.h.-seconds of area are equivalent to one mile of distance. Hence, dividing the area A by 3600, we have distance s in miles, or

$$s = \frac{A}{3600} = \frac{y^2}{2\ k\ 3600} = \frac{y^2}{7200\ k} \qquad (d)$$

from which, solving for y, we have

$$y^2 = 7200\ k\ s$$
$$y = \sqrt{7200\ k\ s} \qquad (e)$$

which is the speed point "g" in Fig. 20.

The time value (x) will be (from equation b)

$$x = \frac{y}{k} = \frac{\sqrt{7200\ k\ s}}{k} \qquad (f)$$

Problem 2.—At what speed must braking begin in order to travel a specific distance and still have a certain definite speed, the rate of retardation being constant and known or assumed?

This problem may also be stated as follows:

Given the speed value (e) which a car must still have after having passed over a given distance while being braked, and under a constant given rate of retardation, to find the initial speed value (c) at which the braking must begin.

The area of the portion of curve under consideration (b, c, e, f) is equal to the mean of the ordinates multiplied by the abscissa, or

$$A = \frac{(Y + a)\ x}{2} = (Y + a)\frac{x}{2} \qquad (g)$$

The value of x is obtained, as in the previous problem, by reference to the rate of retardation

$$\frac{dy}{dx} = k \qquad (h)$$

This equation, it is evident, applies only to the upper or triangular portion, $i\ c\ e$, of the whole area. Hence, the value of y, as given in equation (b) must be taken to mean, in this case, that portion of y' which is above the point i. This portion is

$$y = Y - a$$

which value, substituted for y in equation (b), gives

$$x = \frac{Y - a}{k} \qquad (i)$$

This value, substituted in equation (g), gives

$$A = \frac{(Y + a)\ (Y - a)}{2\ k}$$

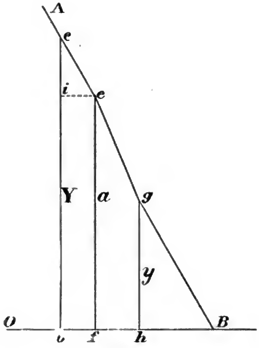


FIG. 20

$$= \frac{Y^2 - a^2}{2\ k} \qquad (j)$$

Dividing by 3600, as before, we have

$$s = \frac{A}{3600} = \frac{Y^2 - a^2}{7200\ k} \qquad (k)$$

whence, solving for Y,

$$Y^2 = 7200\ k\ s + a^2$$
$$Y = \sqrt{7200\ k\ s + a^2} \qquad (l)$$

The value of Y is the speed at the point c in the curve.

Problem 3.—What will be the distance covered when braking for the purpose or reducing the speed from a given initial value to a given final value, the rate of retardation being constant and being known or assumed?

The solution of this problem is easily obtained by solving for s, in equation (1) of Problem 2. The solution gives:

$$s = \frac{Y^2 - a^2}{7200\ k} \qquad (m)$$

[NOTE.—In all three of the preceding problems k is the resultant retardation, and its value is to be obtained according to the formula in equation (X) given in Section II of the paper.]

APPENDIX E.

USE OF METRIC SYSTEM

When the metric system of measurement is used the formulæ and methods of plotting mentioned in this paper will still apply, if modified so as to make due allowance for the difference between the metric and English units employed for measuring distance, speed and weight.

The usual practice, in all countries where the metric system is

in use, is to measure train speed or car speed (*i. e.*, "amount of velocity") in "kilometers per hour," a term of measure analogous to our term "miles per hour." The logical term or unit of measure for acceleration (*i. e.*, rate of velocity), or for the quantity termed the "acceleration coefficient" in the paper, would be "kilometers per hour" per second, which would be analogous to our term "miles per hour" per second. For some reason, however, this unit does not seem to be much used, if at all. The unit of acceleration generally used by European engineers is the "meter per second per second," which is analogous to our "foot per second per second." It certainly would be more logical and less confusing to express both amount and rate of velocity in like terms, using either kilometers per hour, only, or meters per second, only, for the amount, and the same unit *per second* for the rate of velocity (acceleration coefficient).

Train weights, according to the usual practice, when using the metric system, are expressed in metric tons (2204.6 lbs.).

Time values are expressed in seconds, minutes or hours, just as in the English system.

The following table gives, for both systems, the corresponding values of certain quantities which enter in the equations employed in the paper:

WEIGHT

Metric Unit	English Unit
1 kilogram	= 2.2046 lbs.
0.4536 kilogram	= 1.0 lbs.
1 ton	= 1.1023 ton of 2000 lbs.
0.9072 ton	= 1.0 ton of 2000 lbs.

DISTANCE

1 meter	= 3.281 ft.
0.3048 meter	= 1.0 ft.
1 kilometer	= 3281 ft.
1 kilometer	= 0.6214 mile.
1.609 kilometer	= 1.0 mile.

VELOCITY

1 meter per second	= 3.281 ft. per second.
1 meter per second	= 2.24 miles per hour.
1 meter per second	= 3.6 kilometers per hour.
0.305 meter per second	= 1 ft. per second.
0.447 meter per second	= 1 mile per hour.
1 kilometer per hour	= 0.621 mile per hour.

ACCELERATION

1 meter per second per second	= 1 "A" unit of acceleration.
	= 2.24 m. p. h. per second.
1 kilometer per hour per second	= 1 "a" unit of acceleration.
	= 0.621 m. p. h. per second.
0.447 "A" unit	= 1.0 m. p. h. per second.
1.609 "a" unit	= 1.0 m. p. h. per second.
1 "A" unit	= 3.6 "a" units.
1 "a" unit	= 0.278 "A" units.

We now proceed to investigate the effect of these changes in numerical value on the equations given in the paper.

Appendix A.—The same equations will all apply without change. If distance (s) is expressed in meters and time in seconds, then velocity (v) will be expressed in "meters per second." If distance is expressed in kilometers and time in hours, velocity will be expressed in "kilometers per hour."

Appendix B.—Equations (1) to (16) will apply without change, the symbols v, s, g, w, being taken in suitable metric units. All the other equations require modification.

In equation 1*a* when energy (E) is expressed in kilogram-meters, and distance (s) is expressed in meters, force (F) will be measured in kilograms of (pushing or pulling) effort.

The metric value of g being taken as 9.81 (meters per second), and w being taken in kilograms, we will have for equation (17)

$$M = \frac{w}{g} = \frac{w}{9.81} = .102\ w \qquad m(17)$$

and for equation (18*a*)

$$A = \frac{F}{.102\ w} = \frac{F}{w}\ 9.81 \qquad m(18a)$$

the force, F, being expressed in kilograms (not dynes) of effort. Thus, when the force (F) and the weight acted upon (w) are both equal to 1 kg (as in the case of a body falling vertically in vacuo), the rate of acceleration will be 9.81 meters per second per second. If the weight of a train, w, is to be expressed in metric tons, we will have

$$w = 1000\ W$$

where w = weight in kilograms
and W = weight in tons of 1000 kilograms

Substituting for w, in equation 18*a*, we have

$$A = \frac{9.81\ F}{1000\ W} = .00981\ \frac{F}{W} \qquad m(18b)$$

This equation may be used instead of equation 21*a* if velocity is to be expressed as a space-rate per second instead of per hour. To transform the equation into one expressing acceleration in kilometers per hour per second, we note from the preceding table of equivalents that

1 m per second = 3.6 km per hour.

Hence, equation (19) becomes

$$3.6A = a$$

whence

$$A = \frac{a}{3.6} \qquad m(19)$$

Substituting in equation 18*b* we have the equivalent form of equation 21*a*, or

$$\frac{a}{3.6} = .00981\ \frac{F}{W}$$

whence

$$a = .03532\ \frac{F}{W} \qquad m(21a)$$

The values of F and W will, of course, depend on whether acceleration is to be expressed in terms of "A" or of "a."

Solving for F we will have, from equation m (18*b*),

$$F = \frac{W\ A}{.00981} = 101.94\ W\ A; \qquad m(22a)$$

and from equation m (21*a*)

$$F = \frac{W\ A}{.03532} = 28.31\ Wa \qquad m(22)$$

Solving for W we will have, from equation m (18*b*),

$$W = .00981\ \frac{F}{A} \qquad m(23a)$$

and from equation m (21*a*)

$$W = .03532\ \frac{F}{a} \qquad m(23)$$

Equation (24) remains unchanged, but the numerical value of P will evidently depend upon whether the value of F be taken from equation m (22*a*) or from equation m (22); in other words, it will depend upon the unit of acceleration assumed (whether "A" or "a").

Equations (25, 25*a* and 26) will retain the same form, the constant 91.1 being, of course, replaced by either of the corresponding metric constants given in equations m (22*a*) or m (22), according to the unit of acceleration adopted.

The last three equations will also retain the same form, and the values obtained for A' will likewise depend upon the unit of acceleration adopted.

The time-rate of velocity "k" will evidently have a different numerical value, according to the unit of acceleration used. Equation m (19) shows that its numerical value will be 3.6 greater when acceleration is expressed in kilometers per hour per second ("a" units) than when it is expressed in meters per second per second ("A" units).

Appendix C.—All the equations retain the same form. The numerical values obtained by means of the various formulæ will obviously depend upon the units of speed and acceleration adopted, since these govern the values of the speed increments (Δy) and of the acceleration coefficients (k).

Appendix D.—When velocity (y) is expressed in kilometers per hour the equations will all retain the same form. Distances will then be measured in kilometers, the values taken for k being those obtained by reference to equation m (21*a*). When velocity is expressed in meters per second, the constant 3600 disappears from equations (d) (e) (f) (k) (l) (m). Distances will then be measured in meters, the values taken for k being those obtained by reference to equation m (18*b*).

The modified forms of these equations (which, it should be carefully noted, apply only when acceleration is measured in "A" units) will be:

$$s = \frac{y^2}{2\ k} \qquad m(d)$$

$$y = \sqrt{2\ k\ s} \qquad m(e)$$

$$x = \frac{\sqrt{2\ k\ s}}{k} \qquad m(f)$$

$$s = \frac{y^2 - a^2}{2\ k} \qquad m(k)$$

$$y = \sqrt{2\ k\ s + a^2} \qquad m(l)$$

$$s = \frac{y^2 - a^2}{2\ k} \qquad m(m)$$

Specific Equations.—The equations (I) to (XII) inclusive, contained in the body of the paper are mostly derived or adapted from the general equations given in the Appendix, Sections A, B, C, D of the paper.

The following table gives, in parallel columns, the modified forms of each of these equations, when adapted for the metric system:

TABLE III. (Appendix E)

No	First Term Same for All	Last Term of Equation: As Given in the Paper	Modified for Metric System: For "A" Units	For "a" Units
I	$\frac{dv}{dt}$	$= k \pm k' \pm k'' \pm$ etc.	same	same
II	F	$= .01098 \frac{F}{W}$	$= .00981 \frac{F}{W}$	$= .03532 \frac{F}{W}$
III	A'	$= \frac{.01098}{W} (p \pm p' \pm$ etc.)	$= \frac{.00981}{W} (p \pm$ etc.)	$\frac{.03532}{W} (p \pm$ etc.)
IV	A'	$= .01098 (p \pm p' \pm$ etc.)	$= .00981 (p \pm$ etc.)	$= .03532 (p \pm$ etc.)
V	A'	$= .01098 (P - f - c \pm G)$	$= .00981 (P - f - c \pm G)$	$= .03532 (P -$ etc.)
VI	p	$= P - f - c \pm G$	same	same
VII	—A'	$= .01098 (-f - c \pm G)$	$= .00981 (-f - c \pm G)$	$= .03532 (-f - c \pm G)$
VIII	—A'	$= -.01098 f$	$= -.00981 f$	$= -.03532 f$
IX	—A'	$= -.01098 (-B - f - c \pm G)$	$= -.00981 (-B -$ etc.)	$= -.03532 (-B -$ etc.)
X	—A'	$= -1.647 \pm (.01098 G)$	$= -.736 \pm (.00981 G)$	$= -2.65 \pm (.03532 G)$
XI	N	$= \frac{20}{b}$	$= \frac{22.04}{b}$ *	$= \frac{22.04}{b'}$ *
XII	G	$= \frac{Nb}{20} = .05\ Nb$	$= \frac{Nb}{22} = .045\ Nb$	same

* Where b' = increased train resistance in kilograms per degree of track curvature

Metric Curve Plotting.—The methods of curve plotting described in the paper can also be employed in plotting "metric" speed-time curves. In using the chart method, however, special "metric" charts of acceleration coefficients and of reciprocals will be required; and these charts will have to be prepared with special reference to the particular unit of acceleration employed.

Chart of Coefficients.—If acceleration is to be measured in "A" units (*i. e.*, in meters per second per second) the ordinates in the chart of coefficients will represent values of the acceleration coefficients, such as determined by equation m (18b), and the abscissæ will represent speeds, expressed in meters per second. If acceleration is to be measured in "a" units (*i. e.*, in kilometers per hour per second) the ordinates will represent values of the acceleration coefficients such as determined by equation m (21a), and the abscissæ will represent speeds expressed in kilometers per hour.

If the chart of coefficients is to have approximately the same range as the chart shown in Fig. 9, the scales must be approximately as follows: For "A" units of acceleration the scale of coefficients (ordinates) must read to about 1.2 ms per second per second, and the scale of abscissæ must read to about 32 ms per second; for "a" units of acceleration the scale of ordinates must read to about 4.0 km per hour per second, and the scale of abscissæ must read to about 115 km per hour. The scale divisions should obviously be larger in the chart for "A" units than in the chart for "a" units.

The gradient percentage lines will be straight, just as they are in Fig. 9, but their distances from the axis of x will be different in the two cases. A grade of 1 per cent will represent a force (F) of 10 kms per ton in both cases, but the numerical value of the acceleration produced by this effort will depend upon the unit of acceleration used. In "A" units we would have, by equation m (18b),

$A = .00981 \times 10 = .0981$ ms per sec.²

and in "a" units we would have, by equation m (21a),

$a = .03532 \times 10 = .3532$ kms per hour per second?

This means that the scale of gradient percentages at the right-hand end of the chart would be such that the line of equivalent acceleration for a 1 per cent grade would be distant from the axis of x by an amount equal, respectively, to .0981 ms per second² for "A" units, and to 0.3532 kms per hour per second for "a" units, when measured on the scale of acceleration coefficients at the left-hand end of the chart. The corresponding line for a gradient or n per cent would, obviously, be placed at n times the said distance.

Chart of Reciprocals.—The scale of ordinates in the chart of reciprocals will be the same as in the chart of coefficients, for reasons explained in the paper. The scale of abscissæ may be made as desired. The scale being arbitrary it may be the same for the charts of reciprocals used for both "A" and "a" units.

Use of Charts.—The process of plotting "metric" speed-time curves by means of the metric chart just described is substantially the same as indicated in the paper for plotting curves by means of the charts shown in Figs. 9 and 10.

(*Conclusion.*)

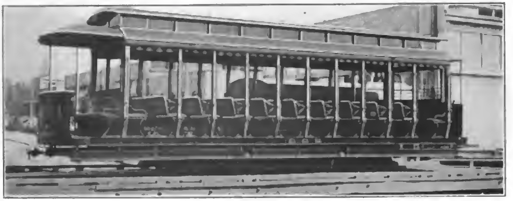
To Examine American Roads

Lieutenant-Colonel Horatio A. Yorke, chief inspecting officer of railroads for the Board of Trade, has been commissioned to prepare a report on the workings of American railroads, with the view of adopting American railroad methods in Great Britain. Colonel Yorke will only be able to spend a month in the United States, but expects to have a busy time, as, in addition to reporting on the steam lines, he is commissioned to investigate the street railroad systems, elevated roads, subways and pneumatic and electric signalling. Lieutenant-Colonel Yorke will confine his inspection chiefly to New York and its vicinity.

New Open Cars for St. Louis

The St. Louis Transit Company has recently put in service 100 new open cars, built by the St. Louis Car Company. One of these cars is illustrated herewith. The principal dimensions of the car 27 ft. 6 ins.; length of platform, platform including bumper, 3 ft.; length of rear platform from inside of dash to center of bulkhead, 4 ft. 6 ins.; length of car body over all, 35 ft.; width of car body at sills, 7 ft. 6 ins.; width over all, including post handles, 8 ft. 8 ins.; height of car from underside of sill to top of trolley board, 9 ft. 3 ins.

The side sills are made of 6 in.-steel channels, and the step hangers are bolted between with filler blocks in the intervening space. The body framing of the car is the best quality of white ash; the seats are of the St. Louis Car Company type, with curvature to make them comfortable for the passengers, as the seats are not reversible, being stationary.



NEW SUMMER CAR FOR ST. LOUIS

As this is a one-end car only, the brakes are placed only on the front end of the car with the motor, and no passengers are allowed to ride on the front platform. This is one of the longest single-truck car bodies ever turned out for summer passenger travel, and it is giving eminent satisfaction. The spring base of the truck is 22 ft. 4 ins., and the wheel base 8 ft.

Noise an Element of Damage

In the Superior Court at Boston, Aug. 20, Chief Justice Albert Mason handed down his decision in the case of E. F. Baker against the Boston Elevated Railway Company, holding that where property is damaged by the construction of the railway, the petitioners have a right to recover for the damages caused by the noise occasioned in the operation of the road. The case was a test suit and the railway company contended that the petitioner could not recover for the noise. This decision will materially increase the damages the company will have to pay if the decision of the Superior Court is sustained by the full bench of the Supreme Court. The decision, substantially, is as follows:

"The facts involved in this cause are simple and so far as not agreed present no unusual difficulty of determination. The important question is one of law, whether under chapter 548, Acts of 1894, and chapter 500, Acts of 1897, either or both, the petitioner can recover for damages to his estate from noise, and if so to what extent.

"The two statutes cited, if not as specific as might be, are certainly broad and sweeping. The Legislature is not limited to what the constitution requires when private property is appropriated to public use, but may make the condition of its grant the payment of damages of any class if its purpose to do so is manifest. The requirement of the constitution and the classification of damages adopted in the interpretation of other statutes are of weight in determining the construction of those under which the petitioner claims.

"Injury of a substantial character to a particular estate resulting directly from an unlawful act, creating noisome smells, noxious vapors, dust, smoke or great and disturbing noises, whereby its occupation is rendered inconvenient or uncomfortable, is damage recoverable in a private action, whether the act is also a public wrong, or otherwise. That the maintenance and operation of the respondent's elevated railway as located would be, but for the statute, a private nuisance to the petitioner's estate by reason of great and disturbing noise, quite independent of the fact that it is also an obstruction and impairment of a public right, and, but for the statute, a public nuisance as well, is obvious to any who make intelligent observation on the premises. As a private nuisance it would be of such gravity that, if not beyond the power of the Legislature to legalize it without providing compensation, it is difficult to believe that it was intended to omit such provision except upon the plainest manifestation of such intent. It is believed that each of the propositions thus far stated is supported by the weight of authority, but it cannot be said that there are no decisions or reasoning in reported cases at variance with this view Time does not permit a critical analysis of all the cases, but it is well to note those cited in the respondent's brief on which counsel lay principal stress as conclusive against the petitioner's right to recover for damage to his estate from noise save to a limited and almost trivial extent."

The Chief Justice considers the cases, and says: "If these decisions can have more than the limited force given them by the dissenting opinion in Rand vs. Boston, 164 Mass. 354, they do not go beyond holding that the private nuisance was of that mild type which the Legislature could legalize without provision for compensation, and that the statute did not clearly make such provision. The decisions cited do not establish as a principle of uniform application, even to ordinary surface steam railroads, that the inevitable effects of proximity of the road and its operation to a particular estate are not elements of damages to be recovered, though often quoted as having such effect. The decisions are limited to the facts then before the court. In Brand vs. Hammersmith & City Railroad Company, 4, Law Reports 171, the court says: 'Ten trains a day at twenty miles an hour might be no nuisance. This might accommodate the public and pay a dividend; but fifty trains a day at thirty miles an hour might be a grievous nuisance, though much better for the public and for economy.' If this be true of the modern conditions of operating ordinary surface steam railroads, how much more emphatically is it so of an elevated railway upon a metallic structure.

"The petitioner does not claim to recover for damage to his estate resulting from the impairment of facilities for public travel, or from the annoyance or inconvenience to travelers from dust, noise or obstruction of light and air. So far as he or his tenants suffer as travelers, more than others because of making more frequent use of the street for travel, it is not claimed that the injury differs in kind from that sustained by the public. It is not the judicial function to make law but to ascertain and apply it.

"The court finds that the petitioner's estate has been damaged more than it has been benefited or improved in value by reason of the location, construction, maintenance and operation of the respondent's elevated railway, not including any damage resulting from the impairment of the facilities of public travel or any annoyance or discomfort to any in the use of such facilities, to the extent of $2,000. The court further finds that one-half of said damage is caused by the noise occasioned by the operation of said railway, and that the damage from noise is $100 more than if said railway were located wholly in that part of the street of which the fee is not owned by the petitioner. The court rules that the petitioner is entitled to recover the sum of $2,000 with interest from Sept. 10, 1901, the date of filing the petition.

"At the request of parties made at the trial the case may be reported for the determination of the Supreme Judicial Court, such judgment to be entered as upon the facts found, the law requires."

Power Brakes for St. Louis Street Cars

The committee appointed by the president's department of the Board of Public Improvements to investigate the practicability of power brakes for street railway cars adopted a report, July 26, which was later presented at the meeting of the Board.

The committee recommends the approval by the Board of the Christensen compressed air brake, with either motor or axle-driven air compressor pump; the Standard (Westinghouse) compressed air brake, with either motor or axle-driven air compressor pump; the Westinghouse electro magnetic track and wheel brake, and the Neal hydraulic brake.

The committee is composed of Hiram Phillips, president of the Board; Joseph P. Whyte, Harbor and Wharf Commissioner; E. A. Hermann, Sewer Commissioner, and Charles Varrelmann, Street Commissioner. The committee visited Pittsburgh, Washington, Philadelphia, New York, Boston, Buffalo, Chicago, Milwaukee and Indianapolis, and examined the street car service in each city. The committee reports that in all of the cities except Washington street car power brakes were in more or less general use. The brakes give satisfaction to the public and owners of the railways, it is stated. The brakes have been in use for two to six years, with the result that the number of accidents has been lessened. The cost of equipping the cars with the brakes has been repaid in from three to five years, by the reduction of the street railway companies' expense account for accidents.

The report contains descriptions and plans of the brakes recommended. It also contains a table showing the approximate distances in which cars can be stopped in cases of emergency. On a level track, with a clean rail, it is stated, a car running at 35 miles an hour can be stopped within 170 ft.; running at 30 miles an hour, within 120 ft.; at 25 miles an hour, within 80 ft.; at 20 miles an hour, within 50 ft.; at 15 miles an hour, within 30 ft.; at 8 miles an hour, within 8 ft., and 4 miles an hour, within 2 ft.

Earnings of the North Jersey Street Railway in Newark

The North Jersey Street Railway Company is required to file, annually, with the city authorities in Newark, N. J., a statement of its gross receipts in that city. The statement which was filed recently covers the year ending April 30, 1902, and while it does not, by any means, cover all the properties operated by the company, gives a good idea of the growth of the Newark business. The gross earnings of the different divisions, as shown by this report, compared with the preceding year, were as follows:

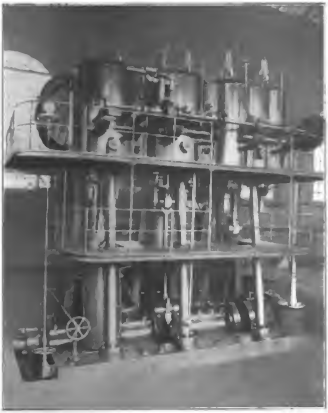
	1902	1901
Plank road	$391,594	$386,131
Belleville Avenue	363,214	390,730
Orange	345,140	321,625
South Orange	337,048	351,194
Bloomfield	239,138	230,149
Turnpike	214,569	209,749
Elizabeth	154,779	142,923
Paterson	123,646	....
Roseville	123,480	115,563
Kinney Street	117,438	107,356
Bergen Street	108,975	100,108
Forest Hill	104,319	132,541
Kearny	102,148	96,041
Central Avenue	77,712	78,032
Norfolk Street	59,309	62,281
Mulberry Street	38,827	44,119
Elizabeth Avenue	30,971	28,523
Totals	$2,966,699	$2,777,034

The mileage operated by the company is 267 miles, and as 151 miles of track are located in the city, the tax paid the city is proportioned to that amount.

The earnings of the Belleville Avenue line for 1901 included the Paterson earnings, which are reported separately for 1902. If the earnings of the Paterson line were included with the Belleville Avenue line for 1902 the total would be $486,859, against $390,730 for 1901.

Large Electric Railway Engine for Kiew

American practice in engine construction has been so fully discussed in these pages that it will undoubtedly be of interest to note how some of the European engine builders undertake to design and build a large engine for electric railway work. Among the steam engine manufacturers abroad who have given especial



2000-HP. ENGINE FOR RUSSIAN RAILWAY

attention to the electric railway field, there is none, probably, who has done a larger business than Franco Tosi of Legnano, Italy. Products from the Tosi works are used very extensively in Italy, France, Spain and Austria, as well as to a lesser extent in a number of the northern countries. Through the courtesy of this firm this paper is able to present in this issue some diagrams and a general view of a 2000-hp vertical triple expansion engine recently built by them for the power station at Kiew, Russia, of the Russische Elektricitäts-Gesellschaft "Union."

These engines are of the three-crank type, one crank for each of the three cylinders. An especially interesting feature of them is that all cylinders are fitted out with poppet valve gear, while, with very few exceptions, all of the large vertical engines built heretofore on the Continent, for electrical plants, have a mixed type of steam distribution; that is, poppet valve gear on the horse-power cylinder only and Corliss valve gear on the intermediate and on the low-pressure cylinders. The advantages of the poppet valve, not only with regard to closer regulation when the engine is working with a very light load or at times with no load, but also with regard to its greater adaptability for the use of highly superheated steam, are generally conceded, and it was for this reason that the valves have been applied to all three cylinders.

The first engine of the two ordered for Kiew has just been shipped from the works at Legnano, where it had been erected on a foundation specially built for the purpose of giving it a thorough shop trial.

The dimensions of the cylinders are as follows: Diameter of the high-pressure cylinder, 700 mm. ($27\frac{1}{2}$ ins.); diameter of the intermediate cylinder, 1100 mm. (47.2 ins.); diameter of the low pressure cylinder, 1750 mm. (68.9 ins.) stroke of pistons, 1050 mm. (41.3 ins.). The number of revolutions per minute is 94. All cylinders are jacketed. On the high-pressure cylinder this is done for the sake of having a hard liner in the cylinder and for warming up the cylinder before starting; superheated steam being used. The jacket will not be heated while the engine is working. The jackets on the intermediate and on the low-pressure cylinders are heated by steam coming from the preceding cylinder.

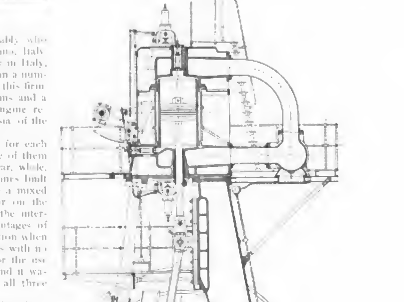
Each cylinder has four poppet valves, two for admission and two for exhaust. As seen in the drawing, they are placed in each head to reduce the waste room to a maximum. The valves of the first and second cylinder, for the purpose of reducing their lift, are made with four seats and, for the same reason, those in the low-pressure cylinder are made with six seats. The latter are probably the only poppet valves of this type ever built.

All the valves take their motion from a revolving shaft carried horizontally on brackets in front of the three cylinders, which shaft, in turn, is driven from the crankshaft by means of two pairs of helical gears and one vertical shaft. The two admission valves on the horse-power cylinder have their valve gear moved by one eccentric, keyed to the revolving shaft acting on one wrist-plate common to both, and the simple trip device is controlled by a Porter governor, which is also driven from the revolving gear-shaft by means of helical gears. All the other poppet valves are moved in pairs of two-admission valves or two-exhaust valves on each cylinder from one wrist plate common to both, and which is moved by one eccentric keyed on the revolving gear shaft. The wrist-plate is connected, by means of rods, to one end of the "rolling" or "progressive" valve-lever, whose other end is attached to the stem of the poppet valve. This valve gear thus combines the advantages of the quick wrist plate motion with those of the rolling lever, the valve is lifted slowly and without shock from its seat, and is then opened quickly.

The cut-off in the intermediate and low-pressure cylinder can be regulated by hand within certain limits.

The admission valve in the lower head of the horse-power cylinder is more than counter balanced by a weight combined with dashpot, in order to secure closure of valve in case of breaking of the spiral spring, thus to guard against running away of the engine. The governor is fitted with sliding weights to vary the speed and also with a safety device which will stop the engine in case of a breakdown of the governor, and which will also enable the engineer, in case of an emergency, to quickly stop the engine by simply moving a lever instead of shutting off the steam at the engine stop valve.

The engine frame consists of three cast-iron stands containing the cross-head guides and of three steel columns, well braced between themselves and the cast iron stands by cast iron struts



CROSS SECTION THROUGH HIGH PRESSURE CYLINDER

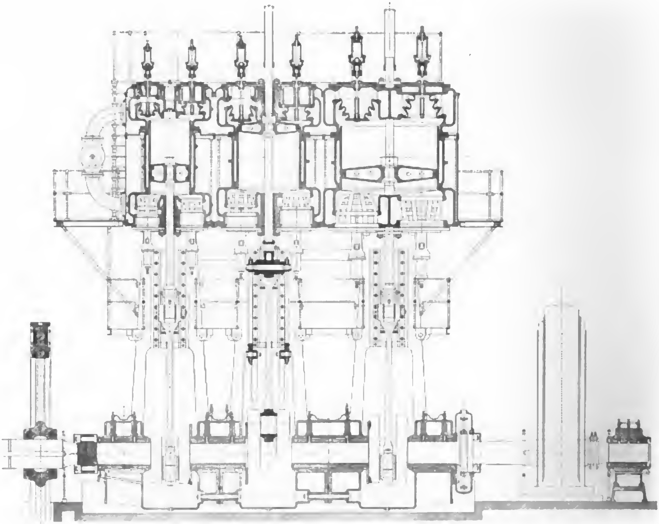
and wrought-iron tie rods, all mounted on a common bed-plate. This bed-plate is cast in three pieces containing four bearings for the crank shaft. All bearings are lined with a special composition of white metal.

The crankshaft proper is made in two pieces, each piece having one forged "U" crank, one end of which flanged to connect to the dynamo shaft, while the other end has one side-crank shrunk on. These two side-cranks are connected by one crank pin, forming thus the third "U" crank. Of the two dynamo shafts connecting to the flanged ends of the crankshaft, one carries a direct-current generator and a fly-wheel, while the other carries an alternator.

The duplex single-acting air pump which is used in connection with a jet condenser is driven from the cross-head by means of connecting rods and beam. Suction valves are omitted, so that the resistance to the water entering the pump is reduced, and a good vacuum is obtained. The passages for the flow of the water and air are of ample size, in order to secure noiseless running at high speed. All delivery valves are made easily accessible.

All cylinders have direct lubrication to the inside through the top heads, and the high-pressure cylinder has, in addition, three further means for oil lubrication, one through the upper admission valve, one through the lower steam pipe and one through the stuffing box. A sextuple oil pump is driven from the gear shaft of the engine by means of two eccentrics. All of the engine lubrication, that is, of all the journals and guides, is accomplished from a reservoir placed at some height over the engine. The spent oil is collected in a tank located in the basement of the engine room. It is then filtered and pumped up again into the reservoir.

The engine can be turned slowly without steam, if desired, by means of an electric motor, which acts through a worm gear and pinion, and which can be thrown in or out of contact with an internal gear on the rim of the fly-wheel.



LONGITUDINAL SECTION 2000-HP VERTICAL ENGINE, SHOWING VALVE DETAILS

Semi-Annual Report of the Bridge Commissioner of New York

The semi-annual report of Bridge Commissioner Lindenthal, of New York, for the first six months of 1902 was published in "The City Record" on Aug. 12. The report is dated July 1, and was submitted to Mayor Low shortly after that time. It goes into detail on all work, mechanical and clerical, that has been done, and mentions all changes in the department since the new administration took office.

The Commissioner believes the Manhattan Bridge will be the most important bridge between New York and Brooklyn, as "it is intended that the Manhattan approach on Canal Street shall be on a line to the North River, and intersect all transportation lines running north and south in Manhattan.

Referring to the Brooklyn Bridge, the Commissioner says that delays have been very few in the traffic, and those chiefly due to heavy snowstorms in February and March. He does not estimate the number of people carried across the bridge in one day, but quotes figures of the Brooklyn Rapid Transit Company for a day of twenty-four hours, in which 295,058 passengers were carried on the trolley cars. This is an increase, he says, of 11,094 passengers over the previous count made last fall. Referring to plans for temporary relief, Mr. Lindenthal says:

"A number of plans have been providing for increased traffic facilities in the Manhattan terminal of the bridge, the most feasible and least expensive being a plan for four additional loop tracks on the lower floor of the terminal for the use of the surface cars until plans for permanent improvement can be carried out; but before such tracks can be built it will be necessary to extend the tail-switching tracks of the bridge railway across Center Street and lengthen out the platforms in order to obtain the approaches and stairways required to replace those which will have to be removed

when the new loops are built. Conflicting interests and circumstances have thus far delayed this improvement.

"These proposed temporary expedients have no relation to the permanent terminal improvements, and should be made on a comprehensive scale for all future needs, and should include the other bridges over the East River now under construction."

The Commissioner then refers to the two plans for relief, one of which was devised by the three experts under the McCarren act, and the other by Chief Engineer Martin, of the Brooklyn Bridge. the Commissioner says further:

"There is good reason for the belief that through the co-operation of the Bridge Department with the Rapid Transit Board a final, adequate and permanent solution will be found for the bridge terminal question."

Cincinnati Franchises Declared Invalid

The Superior Court, Judge Dempsey, Judge Smith and Judge Ferris concurring, has declared unconstitutional the Rogers law, which granted the Cincinnati Street Railway Company an extension of its franchise for fifty years, expiring in 1946. If the Supreme Court sustains the Superior Court, franchises granted elsewhere under the same law will be invalid. The court held that the Rogers law arbitrarily classifies street railways and municipalities and that it is not uniform. The law gave a fifty years' extension of franchise only for such street railways as complied with various conditions on the day it went into operation. It is generally believed that the decision will be reversed when taken before the Supreme Court.

Open Cars for the West Indies

The Island of Trinidad, off the coast of Venezuela, has paved so many of our streets with its famous asphalt that it is only fair that America should contribute something in return. This has been done in the shape of fifteen new cars, built by the J. G. Brill Company, and lately placed in commission on the fine streets of the handsome tropical capital—Port of Spain. The cars were ordered by the Trinidad Electric Company, Ltd. Aside from their fine construction and appearance, are interesting from the fact that they depart from the usual bulkhead construction.

OPEN CARS FOR TRINIDAD

The cars are 30 ft. long over all; the width over the sill plates is 6 ft. 3 ins.; width over the posts is 7 ft. 2 ins., and over all 7 ft 8 ins. The vestibule ends are steel sheathed, and have pockets for the windows. The cars are equipped with "Dedenda" gongs, round-corner seat-end panels, radical draw bars, angle iron bumpers, ratchet brake handles, etc. The trucks are of the Brill 21-E pattern.

New York Street Railway Convention

This convention, as has already been announced, will take place Sept. 9-10, at the Fort William Henry Hotel, Caldwell, and an interesting programme has been arranged.

The committee on rules, which was appointed two years ago, and which made its first annual report at the last meeting, has devoted considerable time to the formation of a second annual report, which will embody the suggestions made at last year's convention, and the best thought of the railroad managers of this State upon the subject during the past year.

The question of the "Economic Use of Power by Motormen" has been assigned to several individuals, and will be taken up as a subject of discussion.

The following papers are also announced:

"Power House Accounting," by R. E. Danforth, of the Rochester Railway Company.

"Supply House Methods," by A. C. Tully, Metropolitan Street Railway Company.

"Accidents," by Charles R. Barnes, inspector of the Board of Railroad Commissioners. At the close of Mr. Barnes's paper this subject will be discussed by W. W. Cole, of Elmira, and Hon. Joseph F. Daly, of New York.

"The Effect of Interurban Service on Small Towns," Colonel N. H. Heft.

"The Removal of Snow and Ice," by W. Boardmann Reed, of the Metropolitan Street Railway Company, of New York.

"Discipline," by C. B. Fairchild.

The Trunk Line Association has granted a rate of fare and a third on the certificate plan to all delegates attending the convention, and the Fort William Henry Hotel has granted a special rate to all delegates.

A special invitation has been extended to both supply men and ladies by the local committee, and it is hoped there will be a large attendance of both. A ladies' reception committee has been appointed, and a reception to the ladies will be held upon the first morning of the convention.

Large accommodations have also been made for an exhibit of street railway supplies for those who wish to take advantage of making an exhibit. The exhibits will be in accommodations adjoining the convention hall, and some person will be in attendance at the Fort William Henry Hotel on Monday morning, Sept. 8, to attend to the wants of the supply men.

The Mersey River Tunnel

The last of the main generators and engines intended to be installed in the power plant of the Mersey Tunnel Railway, Liverpool, are about to be shipped from the Westinghouse Works at East Pittsburgh. These generators are of the railway type (1200 kw, 650 volts, 90 r. p. m.), and are to be direct connected to vertical cross-compound Westinghouse-Corliss engines of 1500 hp each. The power house lighting and the electric light of all stations, sidings, etc., will be supplied from a separate generating plant, comprising two compound-wound generators, each having a capacity of 200 kw at 650 volts, direct connected to Westinghouse compound engines, and running at a speed of 250 r. p. m. The power generating plant will have an aggregate output of about 6600 hp —6000 hp for the railway proper and 600 hp for lighting The Westinghouse electropneumatic system of train control is to be used, and the cars will be equipped with Westinghouse high-speed air brakes. The rolling stock will consist of sixty cars, each about 60 ft. in length. The trains will be formed of five cars each, the first and last cars of a train being motor cars, equipped with four 100-hp motors each.

The Mersey Railway connects Liverpool and Birkenhead, and passes under the river Mersey. The tunnel is double tracked. The route of the railway is about 4½ miles long, the total length of track, including sidings, being about 12 miles long. Its situation is unique, joining two such important business cities, between which the only competition in the transportation of passengers and freight is given by ferry boats on the river, and the traffic on the line is large. The number of passengers carried amounted to between seven and eight millions per year, even with the old steam locomotive system.

The railway is standard gage, laid in accordance with heavy steam railway practice, the rails being of the ordinary English "bull head" type, weighing 86 lbs. per yard. The line is to be fitted with the third rail system, the conductor rail to be laid alongside and just

outside of the running track. The running rails will not be used as the return electrical conductor, but a fourth rail is to be placed between them solely for this purpose. The third and fourth rails will be similar in size and in arrangement. They are to be of T-section, 60 ft. in length, and to weigh 100 lbs. per yard. They will be effectively bonded and carried on stoneware insulators, spaced at intervals of 7 ft. or 8 ft. apart.

It is expected that trains will run on a three-minute service. The tunnel and the seven stations of the system are to be electrically lighted throughout. The power generating station, the machinery and the track work are all being pushed rapidly to completion.

Electric Traction in Russia

According to Thomas E. Heenan, United States consul at Odessa, electricity is coming into use for tramways in Russia. The first electric tramway built in Russia was the one at Kief, which dates from 1893. In 1898 forty-five cities had constructed such lines. Their length exceeded 312 miles. The number of motor cars was about 300 and there were many trail cars. The total length of wire for the electric tramways in St. Petersburg is estimated at 1875 miles. Overhead and underground conductors will be used, and, on the principal streets, the accumulator system will be adopted. Nearly 400 motor cars will be in use, and there will be 300 trail cars. Other cities also contemplate the employment of electricity on a large scale, and plans are under consideration for its use on the great railroads of Russia. These projects include the construction of an electric railroad to connect neighboring towns on the western frontier of Russia, and the establishment of a road to cross the Caucasus Mountains, between the town of Suhkum and one of the stations of the Vladikavkas Railway. To supply power for this latter road it is proposed to harness the mountain streams.

In regard to extending trade in Russia, Mr. Heenan says:

"It will thus be seen that the demand for electrical apparatus and machinery in Russia is relatively but little satisfied by the home manufacturers, and the progress in the application of electricity for transportation, manufacturing, and domestic economy will undoubtedly enormously increase the market for foreign appliances. American manufacturers should have their share of this trade, and there is but one way to secure it—that is, to establish branch houses in this country and place the same in the hands of competent men. The Germans hold the field in supplying this country with electric appliances, because they are ever present and always patient; they study their customers, ascertain their financial condition, give long credit with reasonable interest, and employ men who are either German-speaking Russians or Germans born in Russia, who, of course, speak both Russian and German."

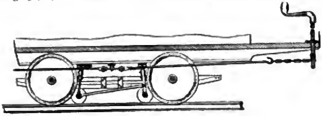
It will require more than a casual visit to Russia on the part of American business men, Mr. Heenan says, if they are to win their proper share of the future business to be done in electrical appliances, and he says that it is not too much to say that in no other branch of trade is there likely to be such material progress in Russia.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED AUG. 19, 1902.

707,120. Car Wheel; G. Killian, Scranton, Pa. App. filed Aug. 30, 1901. Relates to a built-up car wheel, and comprises two disc body portions and a tire which covers the periphery of both discs.



PATENT NO. 707,331

707,149. Brake; A. R. Moore, Charlotte, Mich. App. filed March 19, 1902. Details of a braking mechanism.

707,208. Side and Center Bearing for Car Trucks; E. Cliff, Newark, N. J. App. filed July 2, 1902. The bearing comprises upper and lower members having at each side of a vertical transverse line oppositely inclined track surfaces between which rollers are located, there being means whereby the rollers are kept a definite distance apart.

707,255. Safety Ball for Tram Protecting Rollers; E. Raus, Prague, Austria-Hungary. App. filed April 30, 1902. A fender consisting of a rotating cylinder or cylinders which are covered with elastic balls or fingers.

707,331. Car Brake; W. House, Syracuse, N. Y. App. filed Jan. 16, 1902. Relates to mechanism in which the braking action is obtained by means of rollers forced into frictional contact with the threads of the car wheels and track rails adjacent thereto, which contacts subject the rollers to strains reverse from the rotation of the car wheels.

707,465. Emergency Brake; C. Vogel, Newburg, N. Y. App. filed March 7, 1902. A device having a beak which is adapted to be forced into the surface of the roadbed when it is desired to stop the car.

PERSONAL MENTION

MR. F. M'KENNA, at present road master of the Toronto Street Railway Company, of Toronto, Canada, has been appointed inspector of the company, a newly-created position.

VICE-PRESIDENT C. S. SERGEANT and Chief Engineer of Elevated Lines George A. Kimball, of the Boston Elevated Railway Company, recently sailed for an extended European trip of combined business and pleasure.

MR. F. B. LENEGAN, formerly superintendent of the San Francisco & San Mateo Electric Railway and the Haywards-Oakland Electric Railway, of California, has been appointed superintendent of the Los Angeles Traction Company, of Los Angeles, Cal.

MR. ERNEST W. CARPENTER, who has been in the employ of the Port Chester Street Railway for many years, has recently been appointed assistant superintendent of the New York & Stamford Railway Company, which now controls the Port Chester Street Railway.

MR. W. F. D. CRANE, who has been associated with Sanderson & Porter, 31 Nassau Street, in an engineering capacity, has recently joined the forces of the American Stoker Company, 277 Broadway, New York, as manager of its contract department. Mr. Crane will have his quarters in the New York office of the company.

MR. P. E. GARRISON, master mechanic of the Fonda, Johnstown & Gloversville Railroad, of Gloversville, N. Y., died suddenly in his office in Gloversville a few days ago. Mr. Garrison was formerly connected with the Erie & Central Railroad, and was master mechanic of the Western division of the West Shore Railroad for a number of years.

MR. CHARLES F. WALLACE, of the operating and engineering departments, and Mr. Karl A. Ancien, purchasing agent, of Messrs. Stone & Webster, of Boston, have just returned from an extended trip through the South, West and Middle States, in which a number of the firm's properties were visited, including El Paso, Tex.; Seattle, Wash.; Minneapolis and others.

MR. EDWARD BIRD EDWARDS, who for almost half a century was identified with street railroad enterprises in Philadelphia, died a few days ago at the home of his daughter in East Moorestown, N. J., where he had been visiting. Mr. Edwards was born in Philadelphia in 1822 and after attending Haverford College, entered into business as a flour and feed merchant and later became a lumber dealer. He invested largely in street railway interests and was made president of the Ridge Avenue Passenger Railway Company, of Philadelphia, holding, in addition to this, the presidency of the Board of Street Railway Presidents. It was through Mr. Edwards that 5-cent fares were established in Philadelphia, the Ridge Avenue line being the first to abolish the 6-cent rate.

MR. THOMAS NEVINS, of East Orange, N. J., died at his residence, Mount Shannon, Castle Connell, County Limerick, Ireland, on Aug. 21. Mr. Nevins was a man of wealth and a large shareholder in many electric traction companies in the United States. He was also connected with railroad and gas enterprises in New Jersey. In England Mr. Nevins had engaged to construct under the name of the South Lancashire Electric Traction Company, a number of interurban electric lines between and around Liverpool and Manchester. Mr. Nevins was born at Kells, County Mayo, Ireland, May 30, 1844. He came to the United States in 1864, settled in Orange and embarked in the contracting business. His early work was in connection with the macadamizing of streets and roads. He afterward secured a blue stone quarry, which laid the foundation of his later wealth. He became interested in the development of electric railways, and at one time was largely interested in the street railroads of Detroit, Mich.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR

Sensational Exhibits and Episodes in Accident Cases

In Rost vs. R. R. Company (10 N. Y. App. Div., 478), it was laid down that in an action for damages for personal injuries caused by the alleged negligence of the defendant, it may be proper to exhibit the injured bodily member to the jury, if such exhibition be necessary to enable the jury better to understand the character of the injury, or the conditions which existed when it was received. It was, however, held that where the legitimate purposes of the exhibition are necessarily slight, and the evident tendency of it is to work improper and illegitimate results, the rule does not apply. It was therefore decided that the exhibition of a child's foot, which had been amputated and preserved in a glass jar, was error which called for a new trial.

In Perry vs. Met. St. Ry. Co. (68 N. Y. App. Div., 351), it was held that a plaintiff in an action to recover damages, who alleges that several of his ribs were fractured, that he had been injured about the body and internally, and that the injuries are permanent, may properly be allowed to exhibit his bared body to the jury, and to have pointed out thereon the physical signs of the injuries, where the defendant announces its intention of disputing the question whether the plaintiff's injuries were as serious as he claimed them to be. The distinction between these two cases is one of simple common sense and justice. If a defendant does not controvert the nature and extent of injuries, through a street railway accident or other cause, there can be no practical necessity for introducing the injured or dismembered portions of a human body in evidence. If there be no such probative necessity the exhibition will almost inevitably tend toward placing the jury in an unjudicial frame of mind; toward influencing them to increase a verdict for an injured person through mere horror and physical repulsion.

In connection with those cases there may be instanced two others that came before the Appellate Division of the Supreme Court of the State of New York, Corley vs. N. Y. & H. R. R. Co. (12 App. Div., 409) and McGloin vs. Met. St. Ry. Co. (71 App. Div., 72). In neither of them was a formal introduction in evidence of physical abnormality relied on as error. In the Corley case, however, it presumptively appeared that the plaintiff had, by an elaborate display of fictitious infirmity, feigned very serious injury which did not exist. In the McGloin case it appeared that on the first day of a trial for personal injuries, after adjournment, and in the presence of one or more of the jurors, the plaintiff became prostrated in the court room and was attended by physicians and after about twenty minutes was removed from the room. There was evidence that his physical condition at the trial was the result of the injuries alleged. It was not alleged that the attack was simulated or that symptoms were intentionally manifested before the jury, and the court asked any of the jury so affected by the event that they could not decide the case as if it had not occurred to rise, but no one arose, and a juror who saw the occurrence stated that it would not affect his decision.

In the McGloin case it was very properly and justly held that the refusal of the trial court to grant a new trial would not be disturbed. In the Corley case the Appellate Division, fully as properly and justly, went to very considerable lengths in order to grant a new trial.

Under the present condition of "accident litigation" the policy of discretionary reversal in proper cases is certainly not to be discouraged. The action of the Appellate Division of the New York Supreme Court in the four cases above cited certainly tends to show that it will endeavor, upon some available legal theory, to do substantial justice with regard to veritable claims, as well as fictitious and fraudulent claims, and the policy pursued by that tribunal may well be adopted as a model elsewhere.

LIABILITY FOR NEGLIGENCE.

GEORGIA.—Second Appeal—Law of the Case.

A judgment denying an interlocutory injunction, when the same depends entirely upon questions of law, is, upon its affirmance by the Supreme Court, conclusive against the plaintiff in error as to every such question made by his assignments of error, though there be no express reference to all of them either in the opinion filed, or in the synopsis of the points decided.—(Savannah, T. & I. H. Ry. Co. vs. Mayor, etc., of City of Savannah, 41 S. E. Rep., 592.)

NOTE.—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York City.

ILLINOIS.—Carriers—Street Railways—Injury to Passenger—Complaint—Amendment—New Cause of Action—Allegations—Evidence—Special Damages—Elements of Damage—Unskillful Medical Treatment—Instructions—Remarks of Court—Harmless Error.

1. Where, in an action against a street railroad and another for injuries, the complaint alleged that the servants of the railroad so carelessly managed the car in which plaintiff was seated and the other so carelessly managed a truck he was driving that the car and truck collided, and injured plaintiff, a contention that an amendment, after the time limited for bringing an action for the injuries, to the effect that plaintiff was in the exercise of ordinary care for her safety, was a statement of a new cause of action, so that the bar of limitations might be interposed, was without merit.

2. Hurd's Rev. St. 1899, p. 1287, enacts that the adjudication of the court allowing an amendment shall be conclusive evidence of the identity of the action. Held, that a contention that an objection to an amendment as the statement of a new cause of action barred by limitations could not be taken by plea, but should be taken by exception, because the allowance was conclusive, was of no merit; limitations being a privilege which must be pleaded to be availed of, and a count on a new cause of action being good unless the defense of limitations is interposed.

3. Where, in an action for injuries, the complaint alleged that plaintiff sustained serious physical injuries, causing great pain and suffering and impairment of bodily health, strength, and ability to labor, evidence of a miscarriage seven months after the accident was admissible.

4. In an action for injuries, counsel for defendant had been inquiring about plaintiff's testimony as to her health before the accident. His questions had been fully answered, and plaintiff had stated she had not had a doctor, but had sometimes taken a little medicine in the spring. The court then said, in effect, that he should have to interpose an objection if counsel were going to consume time with immaterial matter; that she might as well be asked if she did not get up in the morning during the several years; that thousands of people took medicine in the spring, and it did not prove her health bad. Held, that the remarks were improper.

5. The remarks were not prejudicial.

6. It did not appear that the cross-examination was improperly abridged.

7. In an action for injuries, an instruction that, if plaintiff exercised ordinary care in seeking medical aid, she might recover for all physical impairments, though they resulted "in whole" from mistakes of medical attendants, was improper.

8. The error was harmless, it appearing from the evidence that her impairments were not wholly due to mistakes in treatment.

9. Where mistakes are made in the treatment of one injured, who has used ordinary care in the selection of medical attendants, injuries from such mistakes are a part of the damages resulting from the original injury.—(Chicago City Ry. Co. vs. Cooney, 63 N. E. Rep., 1029.)

ILLINOIS.—Street Railroads—Action for Injuries—Child on Track—Evidence—Sufficiency—Admissibility—Credibility of Witnesses—Previous Contradictory Statements—Jury Questions—Contributory Negligence—Capacity of Child Under Seven—Negligence of Parent—Imputation—Instructions.

1. Plaintiff's evidence tended to show that, when he, a six-year-old boy, was run over by defendant's electric street car, he was standing on defendant's track, about 20 ft. from a street crossing, with his back toward the approaching car, and talking to a boy standing on the sidewalk; that the car was running about 16 miles an hour; that no bell was sounded for the crossing, and that, when the boy on the sidewalk saw it, he warned plaintiff, who attempted to get off the track, but too late, the car being only 15 ft. away; that plaintiff was standing in full view of the motorman; and that, when the car stopped after running over him, it had passed him 75 ft. Defendant's evidence tended to contradict plaintiff's on all material points, and there was evidence of previous contradictory statements by plaintiff's principal witnesses. Held, that the evidence was sufficient to justify the submission of the case to the jury.

2. The fact that a street car runs an unusual distance before it is stopped, after running over a person, is some evidence of improper management thereof.

3. Where, in an action against a street railway company for injuries, defendant introduced evidence, based upon notes taken in an interview with plaintiff's witnesses immediately after the accident, and on a subsequent interview between such witnesses and defendant's attorneys, which was taken down by a stenographer, tending to contradict the testimony of the witnesses at the trial, whether the witnesses were in fact contradicted was for the jury.

4. In an action against a street railway company for injury to a child of tender years, it appeared that he had been going for several months to a school two blocks from his house, to reach which he had to cross defendant's tracks, which ran by the school; but it did not affirmatively appear that he went to school alone, and his mother testified that she never allowed him to go alone to visit his playmates, only a block and a half away. Held, that the evidence was insufficient to show that the child was of sufficient intelligence or capacity to exercise any care for his own safety, especially in view of the presumption that defendant obeyed the law and exercised greater care at the crossings frequented by school children than at the ordinary crossing, where the child was injured.

5. A child under seven years of age is incapable of such conduct as will constitute contributory negligence.

6. The giving of an instruction which states the law incorrectly is not reversible error, where it appears that under the evidence the jury could not have found otherwise than in accordance with the effect of the instruction.

7. Where an instruction, in an action against a street railway company for injury to a pedestrian, that defendant, in using the highway, was bound to use "every reasonable effort to avoid injury to others," was qualified by other instructions that defendant was not bound to use the highest degree of care, but only ordinary care under the circumstances of the case, and possible error in the first instruction was cured by the others.

8. In an action against a street railway company for injuries, the court instructed that in considering the credibility of witnesses, and in determining the worth of their testimony, the jury might consider the fact that a witness was in defendant's employ, and also his connection, if any, with the accident complained of. Other instructions stated that defendant's employees were competent witnesses, and that their testimony could not be arbitrarily rejected because they were such employees, and that, if the jury believed that any witness was interested in the result of the suit, they might consider such interest, together with all the other circumstances which would aid them in determining the credit to be given such witness. Held, that any possible defect in the first instruction was cured by the others.

9. In an action against a street railway company for injury to a six-year-old boy, which was tried four years after the accident, plaintiff testified that he did not remember how he was hurt, whereupon defendant introduced evidence of previous statements made by him to his playmates as to the manner in which he was injured. Held, that there was no error in instructing that the admissions of a child of plaintiff's age when his admissions were made should be received more cautiously than those of an adult, and should be weighed with reference to his age and understanding.

10. The negligence of the parent of a child six years old in allowing him to go across street car tracks with a boy eleven years old was not imputable to the child, so as to support the defense of contributory negligence to his action for injuries received through the negligence of the railway company.—(Chicago City Ry. Co. vs. Tuohy, 63 N. E. Rep., 997.)

KENTUCKY—Unrecorded Mortgage—Purchaser Without Notice—Waiver of Lien by Acceptance of Personal Security—Property Added to Street Railroad Covered by Prior Mortgage on Road.

1. The lien of an unrecorded mortgage is inferior to the lien subsequently acquired by a mortgagee who gave credit without notice of such prior lien.

2. A seller who had a lien for the purchase price on property sold to a corporation waived his lien by accepting in satisfaction of his claim the notes of the corporation indorsed by the individual stockholders.

3. Property added to the plant of a street railroad company, and which becomes an essential and integral part of its road, passes under a mortgage previously executed and recorded, conveying its entire road, constructed and to be constructed, though the property thus added was furnished under a contract stipulating that the title was to remain in the seller until payment made.—(Westinghouse Electric Mfg. Co. vs. Citizens' St. Ry. Co. et al., 68 S. W. Rep., 463.)

KENTUCKY.—Carriers—Street Railroads—Care Due Passengers—Contributory Negligence—Panic Among Passengers—Proximate Cause—Instruction as to Burden of Proof.

1. The duty of a street railroad company to a passenger to protect her from injuries from its appliances is not fulfilled by recent inspection of its cars, or by an inspection by a competent employee, but the law requires of it "the utmost care and skill which prudent men are accustomed to use under similar circumstances."

2. It was error to instruct the jury that it was the duty of plaintiff, when going upon defendant's cars, "to exercise due care and caution, use her eyes, and act with reasonable care and judgment for her own safety, more especially if she found the car unusually overcrowded with passengers," but the court should instead have instructed the jury that it was incumbent on plaintiff while on the car "to exercise such care and caution as might be reasonably expected of a person of ordinary prudence situated as she was."

3. If the negligence of defendant produced a flash of fire, followed by smoke in the car, causing a panic among the passengers, whereby plaintiff was injured, that negligence was the proximate cause of the injury, provided the conduct of the passengers was such as might reasonably be expected under similar circumstances, considering the crowded condition of the car and the fact that it was moved by electricity.

4. A passenger makes out a prima facie case against the carrier when he shows an injury resulting from a defect in any of those things the carrier is bound to supply.

5. It is safer to so frame instructions as to indicate the burden of proof without expressly referring to it, and therefore the court should have instructed the jury that, if plaintiff's injury was due to any defect in the car or cars on which she was riding, or the machinery or appliances connected therewith, and she did not, by her own want of ordinary care, contribute to the injury, they should find for her the damages she thereby sustained, unless they believed from the evidence defendant had exercised the utmost care and skill which prudent men are accustomed to use under similar circumstances to ascertain any defects in the car and appliances and secure their safety.

6. When specific facts are alleged constituting contributory negligence, the instructions should be confined to those facts.—(Davis vs. Paducah Ry. & Light Co., 68 S. W. Rep., 140.)

LOUISIANA.—Street Railroads—Injury to Person on Track.

Where a boy of 13 walks from one side of a street, on which there are double car tracks, toward the other side, at night, and, without stopping, collides with a car, blazing with light, loaded with passengers, and moving at the rate of six miles per hour, which there was nothing to prevent his seeing and hearing, there can be no recovery for injury resulting from such collision.—(Kaiser vs. New Orleans & C. R. Co., 32 Southern Rep., 75.)

MASSACHUSETTS.—Carrier—Street Cars—Ring in Floor—Injury to Passenger—Negligence of Company—Evidence—Admisibility.

1. Evidence is admissible in an action against a street railway company by a passenger injured by catching her foot in a ring in the floor of the car that the ring was standing erect immediately after the accident, and, on being pushed down, would rise and remain upright on the starting of the car, as such evidence tends to show that the ring was in such condition and operated in such manner when the car left the barn, some time before, which would charge the company with notice of the defect, or show negligence on the part of the conductor in failing to discover its condition.

2. Where the testimony of a witness on cross-examination is inconsistent with his testimony in chief, his testimony should not be stricken out, but should be submitted to the jury, with instructions that it is inconsistent with itself.

3. A street car company is negligent in allowing a ring in the floor of its car to get into and remain in such a condition that it rises when the car starts, and remains standing unless replaced, even though the builder of the car is reputable, and the ring is a usual device.—(Kingman vs. Lynn & B. R. Co., 64 N. E. Rep., 79.)

MICHIGAN—Street Railroads—Action for Injuries—Persons on Track—Contributory Negligence.

In an action against an electric railroad company for injuries to a pedestrian it appeared that, after one of defendant's regular passenger cars passed him, plaintiff walked in the same direction about 200 ft., and went upon defendant's track, and continued his way for 200 ft. further, when he was struck by a gravel train approaching from behind. Plaintiff did not look back after the passenger car passed, but the motorman testified that he saw plaintiff when within about 200 ft. of him, and that he at once rang the gong, and tried to stop. The evidence as to whether the gong was sounded and as to the distance the car ran after striking plaintiff was conflicting. Held, that the question whether the accident was due to plaintiff's contributory negligence was for the jury.—(Quirk vs. Rapid Ry., 90 N. W. Rep., 673.)

MISSOURI.—Contracts — Fraud — Action — Equity — Jurisdiction—Parol Evidence—Trial—Non-suit.

1. Plaintiff was injured by collision with a street car, and brought action at law against the company on its failure to perform an alleged agreement by which it was to furnish a physician to treat and cure plaintiff's broken leg so as to make it well and sound, so that plaintiff could walk and perform manual labor. Defendant produced a written agreement, signed by plaintiff, by which defendant merely agreed to pay plaintiff's expenses, doctor and board bills, until he was able to get home. Held, that plaintiff was not entitled to show that he signed the agreement under a mistake as to its contents, produced by misrepresentations made to him by the agents of the railroad company when he was too weak to read, with the dishonest intention of securing his signature to an agreement different from the one agreed to verbally; as the fraud which renders a contract void at law relates to the execution, and not misrepresentations as to the subject matter.

2. The evidence was not admissible under Rev. St. 1899, Sec. 654, providing that, when a release or settlement is pleaded in bar of plaintiff's action, plaintiff may show fraud in its procurement; as plaintiff's action was not founded on the injury from the collision.

3. Plaintiff, who had been injured by collision with a car, sued the railroad company for failure to fulfil an alleged agreement to furnish him a physician who would treat and cure his leg until he could walk and perform manual labor, and defendant produced a written agreement, signed by plaintiff, by which defendant had merely agreed to furnish a physician, and, on refusal to permit plaintiff to show that such writing was procured by certain misrepresentations as to its contents, he suffered a non-suit. Held that in view of the voluntary non-suit, plaintiff could not urge that, as there was evidence that defendant actually furnished a physician, who treated plaintiff carelessly, he was entitled to go to the jury on the question of an implied undertaking to furnish proper treatment.—(Koffman vs. Southwest Missouri Electric Ry. Co., 68 S. W. Rep., 212.)

MISSOURI—Carriers of Passengers—Personal Injuries—Amount of Damages—Former Verdict.

1. Where, in an action against a street railway for personal injuries, plaintiff's evidence tended to show that her right arm was broken, her spine and nose injured, her ankle sprained, and her injuries permanent, and it appeared that a former jury had awarded her $2500, the court will not interfere with a second verdict for substantially the same amount.

2. Where, in an action for personal injuries, defendant introduced a witness who testified that he had dressed plaintiff's arm the night of the accident, and had waited on her from four to six weeks afterwards, refusal to allow him to testify as to the nature of the injury was not reversible error, in the absence of any statement of the object of the testimony, so as to enable the court to determine its materiality.—(Loker vs. Southwestern Missouri Electric Ry. Co., 68 S. W. Rep., 373.)

NEW YORK—Street Railroads—Failure to Stop—Boarding Moving Car—Instructions.

Where plaintiff was injured by the premature starting of a street car, which he had attempted to board while it was moving "at a snail's pace," on instruction, in an action for his injuries, that the usual invitation to board a public vehicle is that it stops, and, in all ordinary cases, to get aboard a moving public vehicle is imprudent, was erroneous, as applying to street railroads the law applicable to steam railroads; it not being contributory negligence per se for a person to board a moving street car.—(Lobsenz vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 411.)

NEW YORK—Privileged Communications—Statements to Physician.

Where a physician acquired his information as to how an accident happened from the injured party while attending him as a surgeon, he is not rendered incompetent to testify thereto by Code Civ. Proc., Sec. 834, unless the information was "necessary to enable him to act in that capacity;" and, in the absence of evidence of that fact, exclusion of such evidence on the ground that it was privileged was error.—(Green vs. Metropolitan St. Ry. Co., 63 N. E. Rep., 958.)

NEW YORK—Street Car—Injury to Passenger—Instructions.

In an action to recover for injuries received in attempting to board a street car, an instruction that, if the jury believed the evidence of the witnesses for plaintiff, the act of the conductor in starting the car was negligent, and constituted a cause of action in favor of plaintiff against defendant, was reversible error, because submitting only the question of the credibility of plaintiff's witnesses, and withdrawing the question of defendant's negligence and of plaintiff's contributory negligence, both of which questions should have been submitted, even though the evidence of plaintiff's witnesses was believed.—(Kellegher vs. Forty-Second St. M. & St. N. Ave. R. Co., 63 N. E. Rep., 1096.)

NEW YORK—Appeal—Review—Sufficiency of Evidence—Collision with Street Car—Remote and Proximate Cause—Negligence of Driver

1. On appeal from a judgment entered on a verdict unanimously affirmed by the appellate division, the sufficiency of the evidence cannot be considered, but only questions raised by the exceptions to the instructions or refusal to charge as requested.

2. Plaintiff's decedent drove in front of an electric car approaching from six to nine miles an hour, and was fatally injured. The wagon was carried some distance along the track before it was overturned. Held that the motorman did not act willfully or carelessly, since the act of the driver and the conduct of the motorman were so substantially concurrent that it would be impossible to separate the conduct of the injured person from the injury itself, so that the doctrine that the remote negligent act of the injured party would not bar recovery is not applicable.

3. The same test must be applied to the conduct of both parties in determining whether the cause of an action is proximate or remote.

Where a driver negligently drove on the track of a rapidly approaching electric car, the accident may properly be attributed to his negligence, though the vehicle was carried some distance along the track before it was overturned and the injuries inflicted.

5. Where a driver attempts to cross the track of an electric railway diagonally when an approaching car is so near as to render attempt dangerous, the rule that a railway car may not run into a person though he is on the track through his own negligence is not applicable.—(Rider vs. Syracuse Rapid Transit Ry. Co., 63 N. E. Rep., 836.)

NEW YORK—Privileged Communications—Testimony of Physician.

The burden rests on plaintiff in an action to recover for personal injuries to show, when he seeks to exclude the testimony of a physician under Code Civ. Proc., Sec. 834, prohibiting a physician from disclosing any information acquired while attending a patient in a professional character, necessary to enable him to act as a physician, to show that the relation existed; and where there is no evidence of that fact, or that the testimony had any relation to professional treatment, it is improperly excluded.—(Griffiths vs. Metropolitan St. Ry. Co., 63 N. E. Rep., 808.)

CHARTERS, FRANCHISES AND ORDINANCES.

ILLINOIS—Eminent Domain—Supplementary Proceedings—Collateral Attack—Statutes.

1. Where a judgment of condemnation has been entered it cannot be objected, on collateral attack, in a supplementary petition to pay the judgment, that the condemnation was not within the power of the city because only a part of the land for the condemnation of which the ordinance provided was actually proceeded against.

2. There is jurisdiction to render a condemnation judgment, though only a part of the lands for the condemnation of which the ordinance provided is proceeded against.

3. City and Village Act 1872, Sec. 53, providing for supplementary proceedings to pay condemnation judgments, enacts that every such cause shall be considered as pending in the court where commenced until all the lands sought to be taken are paid for, or until the proceedings are dismissed where the lands are not taken. Laws 1897, relative to condemntion, enacted that proceedings pending when the act took effect should be governed by the laws under which they were commenced. A condemnation judgment was entered as to part of the land provided for in the ordinance, prior to the act of 1897, and, subsequent to the taking effect of such act, proceedings as to the balance of the lands were dismissed. Held, that supplementary proceedings to pay the judgment, commenced prior to the dismissal, were not governed by the act of 1897.

4. The question whether part of the land embraced in a condemnation judgment was public property cannot be litigated in supplementary proceedings to pay the judgment.

5. Property assessed to a railroad company for a special assessment was described as "right of way, right of occupancy, franchise, and interest of the South Chicago City Railway Company in and upon Ontario Avenue from Seventy-Ninth Street to Eighty-Third Street." Held, that the description was sufficient.—(South Chicago City Ry. Co. et al vs. City of Chicago, 63 N. E. Rep., 1046.)

INDIANA—Street Railroads—Franchises—Contract—Constitutional Law—Special Privileges—Carriers—Ejection of Passengers—Evidence—Presumptions.

1. Where the complaint in an action against a street railroad company, in a city of over 100,000 population, for the ejection of

a passenger for the non-payment of fare, does not allege that the company was not acting under a contract with the city, made in pursuance of 2 Burns' Rev. St. 1901, Sec. 5458c et seq., authorizing and relating to such contracts, which would authorize the charge of an increased fare, it will be presumed that the requirement of the conductor as to the payment of the increased fare was lawful.

2. Acts 1899, p. 260 (2 Burns' Rev. St. 1901, Sec. 5458c et seq.), authorizes cities of over 100,000 to contract with an existing or future street railroad corporation, and to grant such corporation a franchise not exceeding thirty-four years; one of the conditions of such contract being the company's surrender of all franchises or rights to use the streets. Section 8 provides that, if no extension of the franchise of existing street railroad corporations is granted between the enactment of the statute and nine months of the expiration of the franchise, the company may remove its tracks, but that the Board of Public Works shall open to free competition the right to so occupy the streets not less than nine months before the expiration of such franchise, and authorizes the successful bidder, if not the former occupant of the streets, to condemn the property. Section 9 provides that the contractual powers of the Board of Public Works with reference to the use of streets are not taken away by the statute, except by contracts under it. Section 10 requires companies operating under the statute to charge certain fixed rates, which are higher than those fixed by former statutes. Two Burns' Rev. St. 1901, Sec. 3830, gives the Indianapolis Board of Public Works power to grant franchises to street railroads for such terms and on such conditions as it sees fit. Held, that the act of 1899 is not a grant of a right to an existing Indianapolis street railway company, denied to others, by which it may charge a higher fare than other companies, in violation of Const. Art. 1, Sec. 23, prohibiting the granting of special privileges or immunities, as the benefits of the act are not confined to existing corporations.

3. The statute is not in violation of Const. Art. 11, Sec. 13, requiring corporations other than banking corporations to be formed under general laws, as it does not relate to the creation of corporations, but to the granting of franchises.

4. It will be presumed, in an action against a street railroad corporation, that it was incorporated under Rev. St. 1881, Sec. 4143 et seq., constituting a general law for the incorporation of such companies.

5. Acts 1899, p. 260 (2 Burns' Rev. St. 1901, Sec. 5458c et seq.), relating to the granting of franchises to street railroad companies in cities of over 100,000, is not a local or special law, where a general law may be made applicable, in violation of Const. Art. 4, Sec. 22, requiring general laws in all cases where they are applicable, as the determination of the Legislature that a general law is not applicable cannot be reviewed.—(Smith vs. Indianapolis St. Ry. Co., 63 N. E. Rep., 849.)

MICHIGAN—Municipal Corporations—Water Works—Water Commissioners—Water for Municipal Sprinkling—Compensation.

Pub. Acts 1853, p. 182, under which the Board of Water Commissioners of Detroit was organized, gave the control of the city water works to such board, which, at Section 7, made it the duty of the board to equip itself, lay pipes, etc., and to furnish a full water supply for public and private use in the city. The act authorized the board to fix the rate of furnishing water to private consumers, but contained no provision for the payment of water used for public purposes. Section 8 gave the Commissioners power to construct fire and public-use hydrants at such locations as they deemed expedient. The act of 1873 provided for a loan of \$1,000,000, and an annual tax of \$75,000 for the waterworks. Held, that the city could not be charged for water used for sprinkling the streets, the discretion of the board in the control of the hydrants, pipes, etc., being one to be reasonably exercised in the furtherance of the general design of the law, which, in providing public aid, contemplated a return of services to the public.—(Board of Water Com'rs of City of Detroit vs. Detroit Citizens' St. Ry. Co., 90 N. W. Rep., 657.)

MICHIGAN.—Village Ordinance — Construction — Railroads — Crossings.

A village ordinance authorizing a railway in a street provided that the track should be laid in the center of the street, and between certain points the space between the rails should be planked, and two planks placed outside the rail, and that on the remainder of the street the company should maintain public and private crossings, constructed in the same manner as therein provided for planking. In another section the ordinance provided that the company should maintain pine plank crossings at all cross and intersecting roads and highways, and private crossings where they then existed, or should become necessary. Held, that the latter section did not require the construction of crossings from sidewalk line to sidewalk line, but merely designated the location of the crossings required by the former section.—(Village of Dearborn vs. Detroit, Y., A. A. & J. Ry., 90 N. W. Rep., 688.)

MISSOURI.—Street Railroads—Construction of Road—Ordinance—Fraud in Passage—Rights of Abutting Property Owner—Damage — Injunction — Petition — Sufficiency — Allegation of Fraud.

1. A petition in a suit against three street railroad companies to enjoin them from laying their tracks in a street, which alleges that the ordinance authorizing the construction of the road was obtained by fraud of the defendants, their agents, servants and attorneys, in bribing aldermen, councilmen and members of the municipal assembly by paying or promising to pay money, stocks, bonds or privileges to such officers, is uncertain and insufficient in failing to specifically state the acts constituting the fraud.

2. A demurrer to the petition does not admit the truth of such allegation, as the allegation does not state a traversible fact, and a demurrer only admits facts which are well pleaded.

3. An allegation in a petition to restrain a street railway company from laying double tracks in a street that it is a narrow street and that such tracks will greatly impair its usefulness in not leaving room between the tracks and curb for wagons to pass is a mere conclusion and insufficient to show a use of the street which will practically destroy it as a highway and authorize an injunction to restrain the railroad's construction.

4. Revised Statutes, 1889, section 1825, requiring street railroad corporations, before taking or damaging any property in the construction of their railroads, to determine and pay all damages caused to the owners of real or personal property, does not give a right to damages not existing before the passage of the act, and a property owner is only entitled to damages which are peculiar to his property and not common to all abutting owners.

5. The act of a street railroad company in tearing up the street preparatory to building its road and piling ties and rails in the street, being a necessary incident to the construction of the road, is not such a damage to an abutting property owner as will authorize an injunction to restrain the construction of the road. (Nagel et al. vs. Lindell Ry. Co. et al., 66 S. W. Rep., 1090.)

NEW YORK.—Elevated Railroads—Abutter's Action for Damages — Injunction—Misjoinder—Costs—Infant Plaintiff—Injunction—Infant Plaintiffs—Failure to Plead Infancy in Answer—Appeal—Injunction—Lessor and Lessee of Railroad.

1. In an action for rental and fee damages to abutting property from the building of an elevated railroad, instituted by executors and decedent's widow and children, wherein it appeared that the damages belonged solely to the widow and children, in the absence of any harm resulting to defendants from the misjoinder, the complaint should be dismissed as to the executors, without costs.

2. In an abutter's action for rental and fee damages from the building of an elevated railroad, wherein one plaintiff was an infant suing by guardian ad litem, an injunction was granted not to become operative for thirty days and providing that, if during that period defendants should pay or tender to plaintiffs the fee damages they should be entitled to operate their railroad and receive from plaintiffs a proper grant of such right, "to be executed by the person having any title to or lien upon" the abutting premises. Held, that defendants were not aggrieved by the judgment because one plaintiff was an infant, since the judgment did not pass upon the title to be granted, and defendants, after making tender, could continue to operate their road and could withhold payment until a proper grant was made to them, whether it was procured by proceedings under Code of Civil Procedure, section 2348, to sell the infant's interest in the premises or by waiting until the infant became of age.

3. Defendants having failed to raise in their answer the defense that one plaintiff was an infant such defense could not be relied on in the Appellate Court.

4. Although one of the defendants was lessor and the other lessee of the railroad in question, and the claim for damages covered both the period during which the lessor operated the road and that during which the lessee operated it, the judgment was correct in enjoining them both, unless the total fee damages assessed were paid. (Walsh et al. vs. Brooklyn Union Elevated R. Co. et al., 74 N. Y. Supp., 1019.)

NEW YORK.—Street Railroads — Operation — Mandamus—Powers of Directors—Parallel Lines.

1. Mandamus to compel a railroad company to do a particular act in constructing its road or in running its trains can be issued only when there is a specific legal duty to do the act and clear proof of a breach of such duty.

2. General corporation law (Laws 1892, chapter 687), section 29, provides that the affairs of every corporation shall be managed by its directors. Railroad law (Laws 1890, chapter 565), section 4, directs that every railroad corporation may regulate the time and manner in which passengers and property shall be trans-

ported, and section 34 requires every railroad corporation to run its cars at regular times, to be fixed by public notice, and furnish sufficient accommodations for passengers. Held, that a lessee of systems of elevated railroads, discontinuing parallel lines and operating only one of them, and then only during certain hours of the day, but transferring its passengers to its surface road without charge, cannot be compelled by mandamus to operate such parallel lines, in the absence of allegations that it had not furnished a reasonable service, since a company may operate its trains on a fixed schedule at any hour of the day or night which best subserves its purposes. (People ex rel. Linton vs. Brooklyn Heights R. Co., 75 N. Y. Supp., 202.)

NEW YORK.—Street Railways—Fee in Street—Condemnation. Laws 1890, c. 565, art. 1, section 2, authorizes the incorporation of both steam and street railways. Sections 4 and 7 declare that every railroad corporation may acquire necessary real estate by condemnation, etc. Section 90, after providing that every street railway corporation, on complying with section 91, shall have power to construct and operate its roads on and along the streets, avenues, etc., described in its certificate of incorporation, and to acquire title by condemnation, adds, "Nothing in this section shall be deemed to authorize a street railroad corporation to acquire real property within a city by condemnation." Section 91, as required by Const. art. 3, section 17, provides that, before a railway is constructed in a street, the consent of the local authorities and of the owners of one-half in value of the abutting property must be obtained. Held, that the last clause of section 90 does not prohibit the acquiring an easement to construct and operate a street railway on a city street by condemnation, the fee in which belongs to abutting owners.—(Adee vs. Nassau Electric R. Co. et al., Lott et al. vs. Same, 76 N. Y. Supp., 589.)

NEW YORK.—Street Railroads—Connections with Steam Railroads—Statutes—Construction—Right to Connect—Necessity.

1. Laws 1884, c. 252, providing for the construction, maintenance, and operation of street surface railways, declares that they shall have all the privileges granted, and be subject to all the liabilities imposed, by Act 1850, authorizing the formation of railroad corporations. Act 1850, c. 140, re-enacted in Railroad Law 1890, section 4, subd. 5, conferred on every steam railroad the right to cross, join, or unite its railroad with any other railroad before constructed, at any point on its route, and on the grounds of such other railroad company, with the necessary conveniences in furtherance of the object of its connection. Railroad Law 1890, section 12, provides that every railroad corporation whose road is or shall be intersected by any new railroad shall unite with the corporation owning such new railroad in forming necessary intersections and connections, and grant the requisite facilities therefor. Held, that such provisions do not confer on street railway companies the right to join and unite with steam railroads so as to facilitate a free interchange of cars between them.

2. Under Railroad Law 1890, section 12, providing that every railroad corporation whose road is or shall be intersected by any new railroad shall unite with the corporation owning such road in forming the necessary connections, where a street railway company seeking to compel a steam railroad company to interchange cars with it is operated for its entire length parallel with the steam railroad, and does not transport any freight destined to any point on such railroad line, there is no necessity entitling it to such connection and interchange of cars, even if it be conceded the right to make application to the court therefor.—(Stillwater & M. St. Ry. Co. vs. Boston & M. R. R., 76 N. Y. Supp., 69.)

NEW YORK.—Res Judicata.

Where a firm recovered a judgment against a street railroad company for damages to the firm horse and wagon, caused by the negligence of the street railroad company, and the question of the company's negligence and the contributory negligence of one of the firm who was driving the team had been litigated in that action, the judgment rendered therein in favor of the firm is admissible in the driver's favor, in an action brought by him alone to recover for personal injuries received.—(Cahnmann vs. Metropolitan St. Ry. Co., 75 N. Y. Supp. 970.)

PENNSYLVANIA.—Amendment—Changing Cause of Action—Limitations—Street Railways—Notice to Pave.

1. An amendment to a complaint in an action by a city against a street railway company for the cost of paving between its tracks changes the cause of action, and therefore can not be made after the lapse of the period of limitations; the original complaint seeking to recover by virtue of defendant's charter and certain ordinances, and the amendment seeking it under charters of companies which made leases to, or were merged with, defendant.

2. Under an ordinance requiring a street railway company to pave after notice by the highway commissioner, and providing that, if it fails to comply with the notice, he shall do the paving—the cost to be collected of it by the city—the city cannot, without notice to the company to pave, itself do the paving, and recover therefor from the company.—(City of Philadelphia vs. Hestonville, M. & F. Pass. Ry. Co., Same vs. People's Pass. Ry. Co., 52 Atlantic Rep., 184.)

PENNSYLVANIA.—Street Railway Company—Liability for Paving Street—Estoppel—Ratification.

1. A street railway company, which, under its charter, is not liable for any paving or re-paving of streets, but only for repairing between its tracks, is not liable for paving, though, when informed that the city has made a contract for a company to pave the street, said company to look to the street railway company alone for the cost of the paving between the tracks, it in no way repudiates the contract.

2. One, by making a payment for work done under a contract, does not make or ratify any contract making it liable thereunder, it at the time being stated that this is not to be regarded as an admission of liability for anything more.—(City of Williamsport, to Use of Sicilian Asphalt Pav. Co. of New York, vs. Williamsport Pass. Ry. Co., 52 Atlantic Rep., 51.)

SOUTH CAROLINA.—Continuance—Absent Witnesses—Affidavit Admitted—Impeachment.

1. An exception based on a point not raised below will not be considered on appeal.

2. Where, on motion for continuance because of an absent witness, the statements of the witness made in writing are admitted as his evidence, if present, it is competent to contradict them by an affidavit made by such witness at another time and place, when at the time of the hearing on the motion for continuance opposing counsel went to trial with the understanding that he could contradict the statement, after stating that he would do so in that way.—(Hutmacher vs. Charleston Consol. Ry., Gas & Electric Co., 40 S. E. Rep., 1029.)

TEXAS.—Municipal Corporations—Taxation of Street Railroads—Franchises—Ordinances—Power to Exempt from Taxation—Appeal—Failure to Assign Error—Waiver.

1. The charter of the city of Dallas (section 118) authorized the Council to levy taxes upon the franchises and all other property of street railroads; section 135 authorized them to regulate the making of tax lists for taxation of all property within the city limits, and to collect taxes thereupon; while section 134 authorizes them to assess the property and shares of "corporations, companies, banks and such other institutions" as the same were assessed by the State law in such cases provided. Held that, construing section 134 in the light of the statutes in force when it was adopted relating to assessment of banking corporations, together with the course of legislation on that subject providing for a special method of taxing banking corporations, it was not intended to limit the power conferred by sections 118 and 135 to tax street railway company franchises to the manner in which they were taxed by the State, but merely to give the Council power, if they wished to do so, to adopt the special State laws as to taxation of banking and like corporations.

2. Where a city, by ordinances, imposed upon a street railway company, as a condition for the granting of its city franchises, annual payments called "bonus," "franchise tax," etc., which were not based on any property valuation, its power to impose an ad valorem tax upon such franchises as authorized by its charter was not thereby taken away, since, even granting that the ordinances imported a contract of exemption from taxation, there being no legislative authority for such exemption, such contract would be void.

3. Any error in a ruling of the trial court cannot be reviewed in Supreme Court when not assigned as error in the Appellate Court.—(City of Dallas et al. Dallas Consol. Electric St. Ry. Co., 66 S. W. Rep., 835.)

VERMONT.—Eminent Domain—Railroad Right of Way—Vermont Statute—Same—Right of Action of Landowner.

1. Under the laws of Vermont (V. S. Secs. 3814, 3826) a landowner who permits a railroad company to enter upon his land to construct its road without requiring the prepayment or deposit of the damages waives the right to exclude the company from the land for non-payment of the damages, and the company has two years within which to have the damages appraised and pay the same, after which, if not paid, the landowner may sue. Held, that where the question of damages was submitted to arbitration, an award was made, and the company took possession and constructed its road, but did not pay the damages, the remedy of the landowner was limited to an action upon the award.

2. Under such statute, where a company has entered upon and used land, either under an agreement with the owner, which it has failed to keep, or without any agreement, the landowner cannot maintain a suit or proceeding in equity to enforce a lien upon the road for the damages before the expiration of two years.—(Bibber-White vs. White River Val. Electric R. Co., 111 Fed. Rep., 36.)

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Aug. 27, 1902.

At the present writing the money market is feeling the good effects of last Saturday's favorable bank return. The increase of over $2,500,000 in surplus reserve then reported, resulted entirely from the decrease of over $10,000,000 in loans. This in turn reflected the offerings of funds from out-of-town centers and from local trust companies, which were attracted by the comparatively high-money rates prevailing here at that time. Apparently this lending of outside capital has ceased with the decline in rates this week, and a further contraction in the loan account is uncertain, the more so after the resumption of active speculation on the Stock Exchange. Meanwhile the expected outflow of cash to the interior has already begun in some quantity, and the probablities are that cash holdings of the New York banks will sink considerably lower during the next few weeks. In view of this practical certainty, the 4 per cent call money rate now quoted is not likely to last very long. We shall doubtless see a more or less stable figure of 6 per cent after another fortnight or so. This condition, in fact, must arrive before the various counteracting influences to the harvest currency demands are set in operation. The higher rate will, in all probability, induce a renewal of the foreign credit advances which were such a feature ten days ago, and it is even possible that in the end some gold will be imported from Europe. The fresh weakness developed in the exchange market this week is unquestionably significant in this connection. Beyond the accommodations from the markets abroad, and the casual gold arrivals at the Pacific ports, the only chance of relief for the local banks lies in some extraordinary action by the Treasury Department. Secretary Shaw has announced that while he will buy no more bonds, he is prepared to increase government bank deposits, if necessary, twenty or thirty millions. Provided there is no trouble in obtaining the requisite bond security, this will afford a very important assistance. The main point in the situation is, however, that while no actual stringency may develop, money market rates will have to go up and stay up in order to avert it.

The Stock Market

The buoyancy of the general stock market during the week has been rather of a surprise to the rank and file of Wall Street observers. There has been only one day on which prices have not advanced, while the upward movement has been accompanied, if not by a broadening of interest, at least by a steady increase in the volume of transactions. The public is not in the market any more than it has been at any time this season, but as a speculative factor the absence of a large demand is fully offset by the scarcity of the supply of securities offered for sale. Investors are not selling, in the first place, because the general outlook for continued prosperity is inconsistent with the idea of any important decline in prices, and, in the second place, because there is no other field of investment which promises any better returns were capital withdrawn from the security market. Consequently we have the peculiar, if not unique situation, where the supply of stocks does not increase with the progress of the advance. Presumably there is some limit to this sort of movement, for market quotations cannot, in the laws of natural events, exceed indefinitely the standard of real values. But even the most skeptical critics cannot as yet point to any definite sign that the end is at hand. The uncertainty of what next month's money market may have in store, is the most formidable check, both actually and potentially, upon present operations for the rise. If the experience of the past is worth anything at all, it is well to recall that September has never proved a "bull" month in the stock market. It is possible that the solution of the money problem will be easier than is now apprehended. Should the Treasury come to the rescue in the manner suggested, or should the West and South draw less heavily than usual upon Eastern bank reserves, it is conceivable that the money market may not prove the check it has in former years. There is still enough uncertainty, however, to make the conservative class in Wall Street willing to leave the stock market in the hands of the more venturesome speculators who now control it.

Manhattan has been the only member of the local traction group to show any life in the week's trading. Some covering of short contracts put out at the time of the threatened strike, has been noticed, but no attempts have been made to advance the price by any interests, speculative or otherwise associated with the property. If the general speculative movement keeps up long enough, the tractions will doubtless have their turn, but at the moment they are being left alone by the talent who are devoting their energy and resources to the more active railroad issues.

Philadelphia

Traction stocks in Philadelphia have, as a rule, continued very strong during the past week. Philadelphia Rapid Transit rose to 15, the highest on record, under heavy buying. At that figure heavy realizing sales appeared, and the stock lost part of its advance. Union Traction remained steady around 48, and Philadelphia Traction on investment purchases rose to 100. American Railways advanced again from 50 to 51, the latter figure being the highest the stock ever sold. The talk in connection with this movement is that the dividend will be increased at the next quarterly meeting from an annual 5, to a 6 per cent rate. Lack of confirmation for the reported sale of the road caused a reaction in Fairmount Park Transportation to 31½. Railways General was bid up from 5⅛ to 5½, Consolidated of New Jersey sold at 69, Easton Electric at 19¾, and United Traction of Pittsburgh preferred at 52. The week's bond sales comprised American Railways 5s at 103¾ to 103½, Electric People's Traction 4s at 99¾, Indianapolis Railway 4s at 87½ and United Railways 4s at 87.

Chicago

The Chicago stocks have, as a rule, been dull but firm during the week. Union Traction common sold up from 16 to 16½, and the preferred from 50 to 50½, while City Railway dipped to 211, and then raillied to 215. West Chicago fluctuated between 94¾ and 95. Trading was too light in these stocks, however, to possess any significance. Among the elevated securities fair activity developed in Northwestern common at 36½, and in Lake Street, the latter moving up a fraction to 10⅞. Metropolitan common sold at 39, and later at 38½, with sales of the preferred at 90. Plans for extensions on all these lines are maturing, but no definite announcements are expected in the fall. Metropolitan will then be at work on its new downtown terminal. Financing of the Metropolitan and Northwestern improvements has been arranged, but considerable interest as well as uncertainty is expressed as to the similar arrangements on the South Side Elevated. The last-named company is to build 13 miles of new single track, and this, with the other additions and changes, is expected to cost several million dollars.

Other Traction Securities

Boston traction stocks have been rather depressed during the week, without any definite reason, apart from its being an ordinary speculation reaction. Boston Elevated, after rallying from 159 to 160 declined again to 158. Massachusetts Electric showed the effects of further liquidation, selling down to 38⅞, which is the lowest reached in a long time. The preferred yielded a half point to 97½. In Baltimore there has scarcely anything been doing outside of United Railways and Nashville Railway issues. The United Railway incomes touched top on the present movement at 71⅞, but later reacted to 71¼. The general 4 per cents, after selling at 98½, went back to 98. The stock was steady around 16. Speculative circles are inclined to regard the operations in Nashville Railway as purely speculative manipulation. The 5 per cent trust certificates rose as high as 76⅜ during the week, but ended at 76. The stock sold between 6 and 6¼. The only other traction sales in Baltimore were Newport News and Old Point 5s at 109½, and Norfolk Railway & Lighting 5s at 96. On the New York curb American Lighting and Traction (800 shares) sold up ¾ to 40¾, and 1000 American Elevated sold at 1⅛. A few hundred New Orleans common sold at 17¾ to 17½, with sales of the 4½ per cent bonds at 88 and 87½. San Francisco common was weak at 22½. Toledo Railways changed hands at 33¾ to 33⅞, and a single lot of Camden & Trenton went at 4. The rise in Columbus Street Railway in the Western markets continued, the common getting up as high as 58 and the preferred to 108. Traction sales on the Cleveland stock exchange last week numbered 3970 shares, compared with 3107 shares for the week before. Cleveland Electric Railway, which has been comparatively quiet for some time, because of lack of offers, lead with sales of 1260 shares. The price advanced from 87 to 92½ during the week. A hint as to the probable terms of consolidation was responsible. It is thought the stock will soon reach par. Northern Ohio Traction common made a sensational leap from 45 to 55 in two days, the big advance bringing out only 1129 shares. It reacted later to 54. The preferred also advanced, sales being 927 shares from 91 to 94¾. The opinion is gaining ground that the common of this road is being somewhat inflated since it is not yet on a dividend-paying basis. Cincinnati, Dayton & Toledo, the star issue of previous weeks, was comparatively inactive, 100 shares selling at 27. Western Ohio strengthened, from 24½ to 25,260 shares selling. The bonds of this company have been in considerable demand at 82. Elgin, Aurora & Southern, which has been inactive for some time, is again attracting interest, largely due to the fact that the

Aurora, Elgin & Chicago, a connecting line, has just been placed in operation and will greatly increase the earnings of the other road. Lake Shore Electric, which dropped somewhat last week, advanced from 17¼ to 18 for small lots. Monday there was a sale of this at 18¼, and 23 is now asked. On the same day 235, Elgin, Aurora & Southern, sold at 41½. Twenty Northern Ohio Traction preferred went at 94½, and 25 Cleveland Electric at 91½. A sale of 100 shares of Cleveland City Railway was made at 114, the first of this stock to change hands in some time. Ten thousand Western Ohio bonds sold at 82 and 82¼.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Aug. 19	Aug. 26
American Railways Company	49¾	50½
Boston Elevated	159½	a158
Brooklyn R. T.	67	67⅛
Chicago City	210	210
Chicago Union Tr. (common)	16	16
Chicago Union Tr. (preferred)	48	48
Cleveland Electric	88	91¼
Columbus (common)	57	57
Columbus (preferred)	108	106
Consolidated Traction of N. J.	69½	69
Consolidated Traction of N. J. 5s	111	111
Detroit United	86	86
Electric People's Traction (Philadelphia) 4s	99¾	99¾
Elgin, Aurora & Southern	40¼	45
Indianapolis Street Railway 4s	87½	87¾
Lake Street Elevated	10½	10½
Manhattan Railway	135¼	135¼
Massachusetts Elec. Cos. (common)	40	39¾
Massachusetts Elec. Cos. (preferred)	97½	97
Metropolitan Elevated, Chicago (common)	38½	39
Metropolitan Elevated, Chicago	*89½	89
Metropolitan Street	147½	147½
North American	122¼	121¼
Northern Ohio Traction (common)	51	51½
Northern Ohio Traction (preferred)	91½	94
North Jersey	36	35½
Northwestern Elevated, Chicago (common)	..	36½
Philadelphia Rapid Transit	14	14⅝
Philadelphia Traction	99¾	99¾
St. Louis Transit Co. (common)	31⅝	32
South Side Elevated (Chicago)	110	110
Southern Ohio Traction	75	..
Syracuse Rapid Transit	27	..
Syracuse Rapid Transit (preferred)	70	a75
Third Avenue	130	131
Toledo Railway & Light	33¾	..
Twin City, Minneapolis (common)	127¼	127
United Railways, St. Louis (preferred)	84	84½
United Railways, St. Louis, 4s	87	87
Union Traction (Philadelphia)	48	47¾
Western Ohio Railway	24½	24
New Orleans Railways (common)	17¾	17¾
New Orleans Railways (preferred)	56¾	56¾

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

The feature of the iron market continues to be the shortage in domestic production of pig iron, and the consequent increasing applications for the necessary supplies in the foreign markets. Scarcity of fuel supply, and over-crowded transportation facilities are the causes for the deficiency in the home output. Steel is unchanged, the smaller demand for the lighter lines of finished products being evenly balanced by the larger demand for the heavy lines. Quotations are $21.75 to $22 for Bessemer pig, $32 for steel billets and $28 for steel rails.

Metals

Quotations for the leading metals are as follows: Copper, 11½ cents bid; tin, 28 cents bid; lead, 4⅛ cents, and spelter, 5.45 cents.

GADSDEN, ALA.—The Alabama City, Gadsden & Attalla Railroad has asked permission of the State to increase its capital stock from $100,000 to $[illegible].

CHICAGO, ILL.—The statement is made in Chicago that 75 per cent of the stock of the Lake Street Elevated Railway is opposed to any assessment in the proposed readjustment of the company's finances.

INDIANAPOLIS, IND.—The report that Philadelphia interests are planning a consolidation of the electric railways here will not down. It is said in some quarters that the Indianapolis Street Railway and the Union Traction are to be consolidated, while in other quarters the report that the deal will include all the Indianapolis street railways and the interurban lines is current.

BOSTON, MASS.—The Railroad Commissioners have approved the issue by the Boston Elevated Railway of 23,000 new shares of new stock, to be applied as follows: $806,500 to be applied to the payment of cost of construction and equipment of the elevated structure, including foundations, tracks and electric system; $296,800 to be applied to the payment of cost of construction and equipment of power stations; $471,000 to be applied to payment of construction and equipment of terminal and other stations, exclusive of land; $89,700 to be applied to the payment of the cost of equipment of subway; $500,000 to be applied to the cost of rolling stock and equipment of same; $161,300 for miscellaneous expenses incurred in construction of railway; $862,500 for real estate and payment of damages caused by railway construction; $51,000 for cost of machinery, tools and miscellaneous equipment of railway. Any surplus in proceeds of stock over and above the amount actually required to provide for the above payments as specifically named is to be held subject to the further order of the Board of Railroad Commissioners.

NATCHEZ, MISS.—All the stock of the Natchez Street Railway & Power Company except that held by J. W. Lambert, E. H. Ratcliff and S. H. Lowenberg, has been sold to Gen. S. S. Bullis, of Gulfport, Miss., former president of the Gulf & Ship Island Railroad, and W. B. Rogers, of New Orleans. The company operates 6 miles of track. New directors for the company have been elected as follows: W. B. Rogers, W. R. Moorman, J. H. Levy, of New Orleans; S. S. Bullis, E. H. Ratcliff, S. H. Lowenberg and J. W. Lambert, of Natchez. Mr. Rogers was elected president, Mr. Lambert, vice-president, and W. R. Moorman, secretary and treasurer. E. H. Jackson, who has been general manager and one of the largest stockholders, retires from the company.

LINCOLN, NEB.—Minority stockholders of the Lincoln Traction Company have called a meeting to protest against the action of directors in contracting with the Lincoln Heat & Power Company for heat and power at what they claim is a direct loss. Large stockholders of the Traction Company are said to have organized the Heat & Power Company.

BUFFALO, N. Y.—The International Railway Company reports earnings as follows

June	1902	1901	1900
Gross receipts	$266,067	$393,684	$213,823
Operating expenses	147,613	192,264	106,173
Earnings from operation	$118,451	$201,419	$107,649
Receipts from other sources	5,180	15,520	4,915
Gross income	$123,631	$216,940	$112,564
Fixed charges	97,042	94,098	65,348
Net earnings	$26,588	$122,842	$47,216
Quarter ending June 30	1902	1901	1900
Gross receipts	$772,384	$922,639	$615,306
Operating expenses	436,914	485,896	333,927
Earnings from operation	$335,469	$436,740	$281,379
Receipts from other sources	13,896	30,153	16,065
Gross income	$349,365	$466,893	$297,444
Fixed charges	289,062	272,863	221,843
Net earnings	$60,303	$194,030	$75,600

Comparison is made with the figures of 1900 because with those of 1901, including, as they do, the increased traffic consequent to the Pan-American Exposition, no equitable comparison between 1902 and 1901 can be made.

NEW YORK, N. Y.—The proposition to increase the capital stock of the Interborough Rapid Transit Company from $25,000,000 to $35,000,000 has been approved. It is said that the purpose of the increase is to raise funds to defray the expense of building the projected tunnel from Manhattan to Brooklyn, connecting with the Manhattan underground system; 100,000 shares of stock will be issued at $100 par value.

NEW YORK, N. Y.—The voting trust certificates representing stock of the Interborough Rapid Transit Company are now ready for delivery, on surrender of stock or subscriptions for stock of the Rapid Transit Subway Construction Company. Holders of subscription for stock of the Subway Operating Company will receive voting trust certificates representing the stock subscribed for, with 40 per cent already paid in indorsed upon the certificates.

CLEVELAND, OHIO.—Denison, Prior & Company, of Cleveland, have purchased from Townsend, Reed & Company, of Indianapolis, $500,000 of the first mortgage bonds of the Indianapolis, Shelbyville & Southeastern Traction Company.

CLEVELAND, OHIO.—At the time the Everett-Moore syndicate sold $600,000 of Northern Ohio Traction preferred to a Cleveland and Cincinnati syndicate certain outside stockholders agreed not to sell their stock at less than par before Oct. 15, 1902. Because of the great increase in the price of this stock, and the unusual demand for it, Trustee E. W. Moore has notified these stockholders that they have been released from their agreement. They are given the right to sell their stock at any time under certain conditions.

PHILADELPHIA, PA.—The directors of the American Railways Company have declared a dividend of 1¼ per cent, payable Sept. 16.

KNOXVILLE, TENN.—The Knoxville, Sevierville & Kimberlin Heights Electric Railway, incorporated in November, 1901, to build an electric railway from Knoxville to Sevierville, with a branch to Kimberlin Heights, has filed a mortgage to the Central Trust Company, as trustee, to secure $1,000,000 bonds. The preliminary capital stock of the company was $10,000, but on June 6 this was increased to $1,000,000.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., July '02	81,120	40,586	40,542		
	1 " " '01	69,868	33,464	33,414	......	......
	6 " June '02	318,537	185,062	133,575	77,556	56,019
	6 " " '01	258,267	151,426	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,166	130,162	130,004
	12 " " '00	515,722	* 317,473	196,249	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., July '02	140,200	89,013	51,197	23,866	27,331
	1 " " '01	134,370	79,598	54,772	......	......
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,076	......	......
	1 " " '01	15,678	9,311	6,367	......	......
	10 " " '02	187,058	103,986	83,072	......	......
	10 " " '01	169,756	94,355	75,401	......	......
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,969,496	7,836,587	3,532,809	2,896,350	636,519
	12 " " '00	10,230,994	6,828,110	3,402,884	2,932,839	470,041
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,131	3,915,496	1,862,648	897,206	965,442
	12 " " '00	5,518,857	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., June '02	1,165,298	* 732,152	433,136	......	......
	1 " " '01	1,151,028	* 732,740	418,288	......	......
	12 " " '02	12,780,705	*8952214	3,837,490	......	......
	12 " " '01	12,101,198	*7,970,635	4,130,563	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., June '02	271,215	147,614	123,632	97,043	26,589
	1 " " '01	409,306	192,265	216,941	94,008	122,812
	1 " " '00	218,738	106,174	112,565	65,348	47,217
	3 " " '02	796,280	490,915	319,366	260,053	60,313
	3 " " '01	952,102	485,809	466,894	272,904	191,090
	3 " " '00	651,377	393,987	257,444	221,814	75,601
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., July '02	48,567	30,508	18,060	13,617	4 142
	1 " " '01	46,067	27,021	19,040	13,632	5,407
	5 " " '02	313,767	172,009	141,758	67,716	74,061
	5 " " '01	200,064	131,849	66,115	68,922	† 2,807
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., July '02	23,591	7,586	16,005	......	......
	1 " " '01	23,437	7,666	15,770	......	......
	7 " " '02	102,531	45 039	56,902	......	......
	7 " " '01	88,821	42,001	46,820	......	......
Lake Street Elevated	12 m., Dec. '01	746,462	389,799	357,663	......	......
	12 " " '00	757,964	378,661	379,293	......	......
Union Traction Co.	12 m., June '02	7,942,468	1,570,719	3,371,749	3,619,277	† 247,528
	12 " " '01	8,158,493	3,942,104	4,216,615	4,108,040	158,575
CLEVELAND, O. Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	......	......
	1 " " '01	2,435	3,016	† 581	......	......
	12 " Dec. '01	47,976	* 32,002	15,974	13,023	2,951
	12 " " '00	49,646	* 33,272	16,374	13,294	3,080
Cleveland & Eastern Ohio Traction Co.	1 m., July '02	21,223	10,554	9,669	5,416	4,253
	1 " " '01	17,093	8,303	8,793	5,393	3,400
	7 " " '02	101,889	60,508	41,381	36,474	4,907
Cleveland El. Ry. Co.	1 m., May '02	217,563	......	......	......	......
	1 " " '01	187,049	......	......	......	......
	5 " " '02	962,800	......	......	......	......
	5 " " '01	854,596	......	......	......	......
	12 " Dec. '01	2,296,898	1,265,953	1,030,945	244,231	786,714
	12 " " '00	2,061,585	1,121,087	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., July '02	28,542	13,875	14,667	......	......
	1 " " '01	24,229	11,810	12,419	......	......
	7 " " '02	156 934	91,403	65,531	......	......
	7 " " '01	131,265	76,099	55,167	......	......
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,301	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., July '02	22,649	10,433	12,213	......	......
	1 " " '01	19,143	7,719	11,393	......	......
	7 " " '02	102,306	55,135	47,071	......	......
	7 " " '01	84,302	43,978	40,014	......	......
	12 " Dec. '01	164,971	* 87,102	77,869	72,000	5,869
	12 " " '00	141,112	* 69,592	71,520	72,500	† 980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.	1 m., June '02	77,546	* 42,671	34,875	15,614	19,261
	1 " " '01	72,201	* 42,147	30,054	15,746	14,308
	6 " " '02	422,150	*247,877	174,273	93,025	81,248
	6 " " '01	384,628	*235,852	148,766	94,105	54,661
DENVER, COL. Denver City Tramway Co.	1 m., Apl. '02	124,516	66,553	57,963	32,853	25,110
	1 " " '01	110,837	62,806	58,490	31,304	22,186
	4 " " '02	481,348	261,118	220,230	131,258	88,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,507,253	818,321	688,935	383,190	305,745
	12 " " '00	1,302,290	722,451	579,839	371,291	205,548
DETROIT, MICH. Detroit United Ry	1 m., July '02	335,908	192,848	143,050	......	......
	1 " " '01	303,988	149,812	154,176	......	......
	6 " June '02	1,600,675	* 907,044	693,631	396,739	297,892
	6 " " '01	1,384,181	* 775,847	608,334	345,119	263,715
	12 " Dec. '01	2,919,171	*1596763	1,322,040	652,277	670,129
	12 " " '00	2,573,277	*1430058	1,130,419	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " '01	26,577	16,062	10,515	9,392	1,124
DULUTH, MINN. Duluth-Superior Tr.	1 m., July '02	52,632	24,985	27,647	9,665	17,982
	1 " " '01	43,983	22,117	23,866	9,216	14,647
	7 " " '02	298,039	157,398	140,640	67,529	73,111
	7 " " '01	254,322	141,730	112,592	63,984	48,618
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., July '02	40,472	21,197	19,275	8,333	10,941
	1 " " '01	36,454	16,218	20,236	8,333	11,903
	7 " " '02	226,929	136,723	90,206	58,333	31,873
	7 " " '01	204,102	119,142	84,960	58,333	26,627
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., June '02	20,714	9,909	10,805	......	......
	1 " " '01	16,057	8,669	7,388	......	......
	6 " " '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O. Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	9,125	7,500	1,625
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	301,704	166,757	136,946	90,000	46,946
LONDON, ONT. London St. Ry. Co.	1 m., July '02	16,887	9,897	7,040	2,311	4,729
	1 " " '01	15,303	8,767	6,537	2,144	4,393
	7 " " '02	81,401	56,464	29,937	16,904	13,033
	7 " " '01	75,416	48,718	26,698	14,076	12,622
MILWAUKEE, WIS. Milwaukee El. Ry & Lt. Co.	1 m., July '02	287,876	110,988	166,448	67,840	98,628
	1 " " '01	239,043	102,096	136,948	67,942	69,006
	7 " " '02	1,512,005	732,232	779,773	457,948	321,829
	7 " " '01	1,303,857	668,559	674,248	433,313	240,964
	12 " Dec. '01	2,442,312	1,185,581	1,256,818	756,189	501,629
	12 " " '00	2,287,698	1,189,787	1,090,911	684,563	395,347
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., July '02	337,458	142,392	195,066	58,778	136,340
	1 " " '01	290,648	135,349	155,298	57,660	97,678
	7 " " '02	2,003,852	922,740	1,081,158	410,906	670,695
	7 " " '01	1,748,182	853,680	894,501	387,545	506,955
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., July '02	198,656	93,986	104,669	19,929	84,760
	1 " " '01	176,189	90,464	85,715	14,142	71,573
	10 " " '02	1,643,847	940,860	702,977	164,228	538,749
	10 " " '01	1,533,816	931,953	601,272	104,019	496,863
NEW YORK CITY. Manhattan Ry. Co.	3 m., Dec. '01	3,038,435	1,404,971	1,633,465	753,185	880,280
	3 " " '00	2,728,594	1,340,796	1,387,098	749 867	638,065
	12 " Sept. '01	10,456,872	5,329,649	5,127,[illegible]	2,[illegible]	2,444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,669,644	2,086,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,738,972	2,148,964	1,181,140	962,984
	3 " " '00	3,766,090	1,699,649	2,066,391	1,138,467	947,914
	12 " June '02	15,996,641	7,843,993	8,480,738	4,815,421	3,665,337
	12 " " '01	14,730,767	6,755,131	7,965,636	4,584,094	3,421,567
OLEAN, N. Y. Olean St. Ry. Co.	1 m., July '02	5,569	2,216	3,353	1,771	1,582
	1 " " '01	5,954	2,207	3,747	1,768	1,979
	12 m., June '02	56,055	29,118	26,937	16,818	10,619
	12 " " '01	54,018	28,228	25,790	16,735	9,055
PHILADELPHIA, PA. American Railways	1 m., July '02	119,870	......	......	......	......
	1 " " '01	99,65[illegible]	......	......	......	......
	12 " June '02	1,000,509	......	......	......	......
	12 " " '01	841,298	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., June '02	89,236	46,800	42,436	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	487,742	298,005	189,737	148,608	31,130
	6 " " '01	496,236	306,966	189,259	147,157	41,102
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., July '02	68,571	34,365	28,206	19,085	9,121
	1 " " '01	59,438	31,620	27,818	18,971	8,843
	12 " " '02	693,281	384,265	309,019	228,246	80,773
	12 " " '01	621,359	340,890	280,469	223,918	56,551
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., July '02	131,492	62,316	69,176	37,884	31,292
	1 " " '01	121,013	53,613	67,399	24,479	42,920
	7 " " '02	802,770	414,697	388,073	254,882	133,191
	7 " " '01	719,941	357,016	362,925	170,104	192,821
	12 " Dec. '01	1,321,084	* 696,407	674,677	415,168	259,509
	12 " " '00	1,182,517	* 616,945	565,572	408,051	156,521
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	† 3,986
	3 " " '01	56,930	35,600	22,330	25,000	† 2,663

Street Railway Journal

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THE TRAMWAY SYSTEM OF HALIFAX, ENGLAND

The corporation of the city of Halifax in Yorkshire has owned its electric-lighting system since 1894, but about three or four years ago the city acquired its tramway system, and steps had to be taken to provide the necessary power from the existing stations. Several 500-volt direct-current units were installed, but the extent of the tramway system soon made it evident that a more economical method of transmitting power for the outlying lines would have to be adopted, and power is now being transmitted by means of high voltage, three-phase generators and rotary converters in the sub-stations. This portion of the plant has just been completed, and as it is said to be the first in England to be equipped in this way with apparatus of purely British manufacture, it possesses a peculiar interest. In view of the fact that the system itself has never been described in these pages, some particulars of it will also be given in the following article.

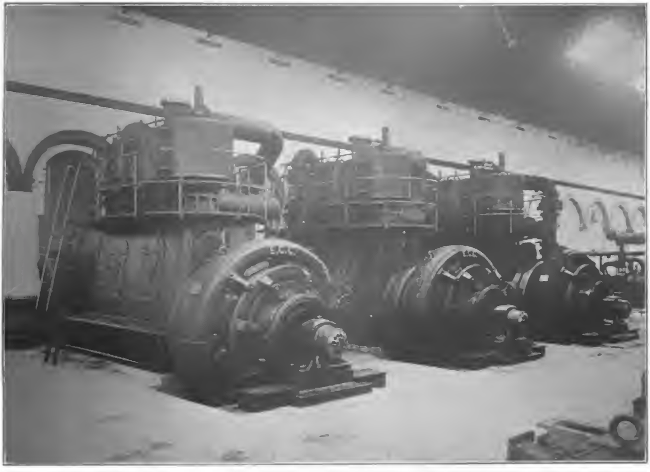


FIG. 1.—PORTION OF HALIFAX POWER STATION, SHOWING THREE 1000-HP DIRECT-CURRENT UNITS.

The power-house building is of gray stone and extremely substantial. The boiler house is a separate building with its own roof, and is equipped with four Lancashire boilers, 7 ft. 6 ins. diameter by 30 ft. long, with two 3 ft. flues in each, three being by Yates & Thom, of Blackburn, and one by Heaton, of Manchester. All the furnaces are equipped with patent self-cleaning furnaces and mechanical stokers by Thomas Henderson, of Liverpool. There are also six boilers supplied by Babcock & Wilcox, most of which are fitted with the B. & W. chain grate stokers. Superheaters are used, 100 degs. of superheat being obtained, and the boiler pressure used is 130 lbs. per square inch.

Adjoining the boiler house is the pump room, in which are four steam-feed pumps, two by G. & J. Weir, of Glasgow, and two by W. H. Bailey & Co., of Manchester, while a Tyler electric pump is also installed for use in case of emergency. The Weir pumps are of that company's patent direct-acting single type, 8 ins. diameter by 10½ ins. steam cylinder by 24 ins. stroke, each capable of delivering 6100 gallons per hour at 12 double strokes per minute.

Should occasion demand it, however, the pumps can easily be run up to a much higher speed to make up any abnormal deficiency in the feed supply. The pumps are of cast-iron, fitted with gun-metal liners, gun-metal buckets with special ebonite packing rings, manganese bronze rods, and valves of the Weir group type in gun-metal seats.

The Bailey's pumps have 8-in. steam cylinders, 5-in. pump cylinder by 7-in. stroke. The suction inlet is below and the delivery can be taken from either side. The valves, seatings and glands are of gun metal. The water pistons are packed with gun-metal rings and the steam pistons with broad cast-iron rings. A Bailey's compound duplex circulating pump is also installed, having a capacity of 60,000 gallons per hour. The steam piping is by Stewart & Menzies, of Glasgow; Lloyd & Lloyd, of Birmingham, and Babcock & Wilcox.

FIG. 2.—GENERAL VIEW OF INTERIOR OF POWER STATION, HALIFAX

The engine room, a general view of which is shown in Fig. 2, is 210 ft. long by 57 ft. wide, and is light and airy, and well adapted for the purpose. Various types of engines are used, though all the electric machinery (with the exception of the Parsons turbo-generator) has been manufactured by the Electric Construction Company. Nearest the main entrance door, and well shown in the illustration, Fig. 1, are three sets of engines and direct-current generators, consisting of Belliss patent self-lubricating triple-expansion engines working multipolar generators of the Electric Construction Company's make. The engines are designed to exert 1080 brake horse-power at 240 r. p. m. as an ordinary full load, and also 1296 brake horse-power as an overload for short periods of time, with a steam pressure of 150 lbs. per square inch, exhausting into a condenser. The sets have been running now for upward of twelve months, and have given great satisfaction in working, both as regards smooth running, governing and economical performance.

On a test, carried out at the makers' works before the sets were delivered, a steam consumption was registered of 15¼ lbs. per brake horse-power, equivalent to approximately 22 lbs. per kw. The engines are of very simple design and construction, and may be described as being of the ordinary triple-expansion marine pattern, with the working parts enclosed to permit of the application of forced lubrication to all the bearings.

There are three cylinders, high, intermediate, and low-pressure, working on cranks set at equal angles, the pistons being made of equal weight for smooth running, and so as to reduce vibration. Piston slide valves are fitted to all three cylinders worked by a single-eccentric valve gear direct from the crankshaft, and extremely simple in action. The lubrication starts and stops with the engine, and beyond an occasional glance at the oil pressure gage, requires no attention from the attendant. Each engine has a separate surface condensing plant, manufactured and supplied by Isaac Storey, of Manchester, and operated by electric motors, together with an Edwards air pump, also operated by E. C. C. geared motor. Fletcher automatic valves are also installed for automatically changing the exhaust into the atmosphere should anything go wrong with the condensing apparatus.

Each of the three Belliss engines is direct-coupled to one E. C. C. continuous-current generator, each capable of a normal output of 750 kw at 550 volts, which are used both for tramway and lighting purposes, when running compound for tramway work, giving 580 volts, and when running shunt for lighting work, 480 volts.

The generators are the standard E. C. C. high-speed type, 8-polar, with high permeability steel magnets set in a massive cast-iron yoke ring, the latter being divided horizontally. The armature is the usual slotted and barrel-wound type, arranged with the E. C. C. system of ventilation by ducts in the armature communicating with air-way through the centre of the shaft. The armature spider terminates in a massive flange-coupling which bolts directly to a heavy fly-wheel on the engine shaft. In view of the comparatively high speed for the output involved, these machines run with a low-temperature rise, the armature windings being under 60 degs. F. after a six-hour run. The field windings are alternately both compound and shunt-wound, in order that they may be available for use on the lighting circuits, if required. The outer bearings are of the usual E. C. C. construction, white metal lined, and provided with oil rings, with extra large allowance of bearing surface.

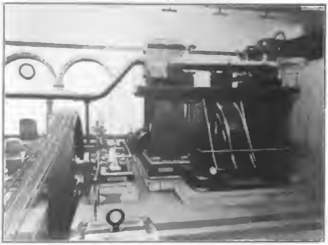


FIG. 3.—VERTICAL ENGINE AND 2200-VOLT ALTERNATOR

At the extreme end of the station is a vertical cross-compound condensing engine (Fig. 3), by Pallitt & Wig-

sell, of Sowerby Bridge, of 600 ihp, with cylinders 18 ins. and 35 ins. diameter by 30 ins. stroke, running at 127 r. p. m., and direct-coupled to an E. C. C. 2200-volt alternator. This engine is fitted with Corliss valves and patent trip gear to each cylinder, and is equipped with horizontal single-acting air pumps, made by the engine makers, but as this unit is now being converted, no further description is necessary. In addition, there is one rope-driven, direct-current, E. C. C. generator and one rope-driven, E. C. C. alternator (Fig. 4), driven by two Pallitt & Wigsell horizontal cross-compound condensing engines of 200 ihp, with cylinders 12 ins. and 27 ins. diameter, 24 ins. stroke, 110 r. p. m., and with fly-wheels 11 ft. diameter, grooved for ten ropes 1¼ ins. diameter.

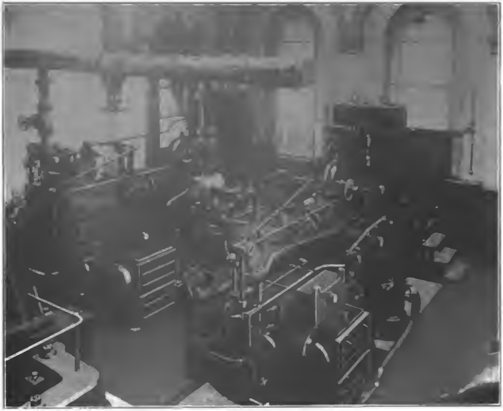


FIG. 5.—PARSONS TURBO-GENERATORS

The cylinders of both these engines are fitted with slide valves and cut-off valves, those of the high-pressure being automatically controlled by the governors. Pallitt & Wigsell patent single-acting air pumps are also attached to each engine, and each of these engines, including the two described later, are equipped with Hartnell's patent governors.

Besides the above units, situated in the far corner of the

FIG. 4.—ROPE-DRIVEN DIRECT-CURRENT GENERATOR AND ALTERNATORS WITH HORIZONTAL ENGINES

building, and shown in Fig. 5, are two turbo-generators supplied by C. A. Parsons & Co., of Newcastle-on-Tyne, and which are used both for tramway and lighting purposes. Each unit consists of a steam turbine coupled direct to a dynamo of 200-kw output, the whole mounted on a surface condenser which forms the bedplate for the turbo-generator. The air and circulating pumps are erected on the same level as the condenser, and are driven by worm-gearing from the turbine shaft, making the whole plant self-contained.

The normal voltage is 500 volts, and the machines are fitted with the Parsons electrical solenoid governor, which maintains a constant voltage on the supply mains. Mechanical safety governors are also fitted for the purpose of coming into action when the speed rises to a certain height and entirely cut off the steam. The plants are designed for a steam pressure, at the stop valve, of 135 lbs., and are complete with oil coolers, oil trays, etc.

We now come to the most important part of the new work which the Halifax Corporation has been carrying out, referred to at the beginning of the article, namely, the installation of the new three-phase generators for the suburban tramway service. Two of these generators, of 300-kw capacity each, have been installed, and these are driven by two Pallitt & Wigsell engines, one unit being clearly shown in an illustration, Fig. 6. The engines are horizontal cross-compound condensing, of 570 ihp, with cylinders 17 ins. and 34 ins. diameter, 3 ft stroke, 100 r. p. m., with Corliss valves, and patent trip gear to the high-pressure cylinder, and slide-valve and cut-off valve to the low-pressure cylinder, and patent single-acting air pump. Each engine has separate condensing plant, one having a jet condenser and the other a surface condenser.

These two three-phase generators are used for supplying current to sub-stations, described later, at a pressure of 5000-5500 volts, this being transformed down to 320 volts, and then being transformed by rotary converters to continuous current at 500-550 volts for tramway purposes and the supply of current in bulk.

FIG. 6.—5500-VOLT THREE-PHASE GENERATORS AND ENGINES, HALIFAX

The two generators are of the Electric Construction Company's standard slow-speed type, each giving 350 kw at 6000 volts as three-phase current of 25 periods, at 100 r. p. m. One machine was built entirely new, while the other was converted from a single-phase alternator working at 80 periods into a three-phase machine at 25 periods. The armature coils are former wound, thoroughly insulated before fixing in the core slots. The windings were tested with 12,000 volts, between the separate phases and to frame. The steel magnet poles are bolted to a steel shaft, which is further bolted to the rim of the cast-iron flywheel, which, together with the magnet, weighs 26 tons. The efficiency of the alternator is 95 per cent, while the exciting energy is only 1½ per cent, although the regulation is 95 per cent from no load to full inductive load. The tested temperature rise was less than 25 degs. C. after eight hours' working at full load.

In a suitable room adjoining the engine room are the various switchboards for controlling the current, both for the tramways and the lighting. The switchboard for the new high-tension, three-phase work has been supplied by Messrs. Ferranti, Ltd., and is shown in Fig. 7; the remaining boards, as shown in Fig. 8, for the direct-current supply, having been manufactured by the electric department of the Halifax Corporation in the workshops adjoining the electricity works. The lighting network is fed from several sub-stations, and the mains are laid partly on the solid system run in with bitumen, and partly armoured cable laid direct in the ground; some portion is also pulled into

FIG. 7.—THREE-PHASE SWITCHBOARD IN POWER STATION

conduits. The cable is chiefly Callender and British Insulated Wire Company's makes.

The general construction of the Ferranti board, which is of the cellular type, consists of a set of 2-in. slates fixed in a horizontal position and solidly grouted into the wall. Between these slates vertical divisions are provided to divide the whole framework into a set of pigeon-hole recesses. Each of these recesses contains individual apparatus, the whole being assembled in such a way that parts of opposite potential are absolutely divided from one another by insulating material which serves not only to prevent the chances of fire and consequent damage to the gear, but also renders accidental contact with two parts of opposite potential practically impossible. Fig. 7 shows a general view of the gear, which contains generator panels to the right and feeder panels to the left, with a connection in between for a wattmeter, which is made to read the total energy generated by all the machines.

The generator panels are of the Ferranti standard pattern, suitable for dealing with a capacity of 600 kw per phase. Each three-phase panel contains section of bus-bar, bus-bar plugs, 1 ammeter, 3 oil break switches coupled together, 3 oil break fuses arranged with duplicate contacts, a cable receiver for receiving and sealing the ends of a three-core cable and complete regulating table equipped with the Ferranti well-known open type regulating resistances and carbon break field switches. The feeder panels contain similar fittings to the machine panels, but are minus the regulating table.

The synchronizing instruments and voltmeters are conveniently placed at the top of the board, and make contact by resting on metallic fittings insulated from the framework. Thus, there are no screws or bolts to adjust or disconnect for the purpose of removing instruments from the board.

The only sub-station for long-distance transmission at present erected is at Hebden Bridge, over 7 miles from the generating station, a view of which is shown in Fig. 9. Two single high-tension cables are laid to this station, consisting of three-core 19-17 cable made by the Land-und Seekabelwerke, Cöln, Nippes, Germany. The plant in this sub-station consists of three 100-kw rotary converters, manufactured by the Electric Construction Company, of Wolverhampton, the static transformers having been made by the British Electric Transformer Company (Berry patents), of London. The high-tension switchboard is also by the Electric Construction Company, the low-tension board being made by the electrical department of the corporation. The three rotary converters, which are seen in Fig. 9, showing the sub-station, are each rated to give 100-kw direct-current output at 550 volts when supplied with three-phase current at 350 volts, 25 periods, the speed being 500 r. p. m. These machines work well in parallel with each other. The efficiency, as tested, is over 94 per cent, and the temperature rise is less than 25 degs. C. after working for eight hours at full load. Each rotary is started by means of a direct-coupled 4-pole induction motor, speed being adjusted for synchronizing by applying a variable voltage from an auto-transformer. There are voltage regulators in the secondary circuit of the static transformers varying the direct-current voltage from 500 to 550 volts; these regulations consist of variable ratio transformers connected to a rheostat of the battery type. The rotaries have a series-winding, which enables them to give a further increase in voltage with increase of load due to the leading current re-acting upon the ten miles of transmission line.

The switchboard (Fig. 9) in connection with the incoming high-tension three-phase current, and the low-tension supply to the rotary converters, consists of six

FIG. 9.—SUB-STATION AT HEBDEN BRIDGE

panels of enameled slate carried on a fireproof framing, and was manufactured by the Electric Construction Company. The two panels on the left-hand are for the two high-tension feeders, 40 amps. each. Each panel is fitted with an ammeter, three-pole double-break switch and three fuses of the expulsion type, the latter being placed above all the other gear. They are plugged in circuit and can be renewed with safety. The whole of the high-tension gear being at the back of the board, it is impossible for an attendant to come into contact with any high-tension circuit from the front. All the instruments are low-tension, each having its own reducing transformer. The main switches, each of which are operated by a handle, passing through to the front of the board, have six arms shielded from one another by substantial slate diaphragms; the quick break on each phase being 2 ft. 4 ins., gives a total, on the three phases, of 7 ft.; the final break is on carbon contacts. Between the above panels and those for the converters is the synchronizing panel. The synchronizing, which is done on the low-tension side, and on all three phases, is so arranged that the lamps, which are in duplicate, indicate whether the in-coming machine is running too fast or slow. There are the usual voltmeters, plugs, switches and fuses.

FIG. 8.—DIRECT CURRENT SWITCHBOARD AT MAIN STATION

Coming to the three rotary-converter panels, the current is delivered from the bus-bars through fuses and switches, similar to those on the feeder panels, to step-down transformers; the low-tension current returning to the three-pole switches, fuses and ammeter on the front of the lower portion of the panels, and thence to the converters. A battery of 270 cells is installed by the Chloride Electrical Syndicate, the output being 200 ampere-hours. At present this sub-station will feed into the tramway network which extends out to Hebden Bridge.

Having described the power house and the sub-station, a few words about the outside construction may be interesting. Halifax is a very hilly town, and the cars which run outside the town have many long and heavy grades to overcome. One of the views (Fig. 10) shows one of the routes along the valley, and a car can be seen ascending the long grade.

The overhead equipment of the tramways is under the control of the electricity department, a workshop being erected close by the generating station. The workshop contains the usual machine tools, and most of the overhead fittings are made here.

At present there are about 30 miles of tramway single track, and all the overhead equipment for the last two years has been done by the electricity department. All the feeder boxes and section boxes are fitted up in the workshops, the box castings being obtained locally. Aluminum cross-overs have been used in several cases, and have been found to give great satisfaction, and are a great convenience, owing to their small weight. Owing to the hilly nature of the town, the demand for tramway current is exceedingly variable, the maximum current per car being 30 amps. with sixty cars running. In other towns, where the gradients are small, this does not exceed 15 amps. per car. There are grades of 1 in 9, and the sharpest curve is 30 ft.

The trolley wire is of 00 sectional area, and the ears are hammered over this, no solder being used. The poles are quite tasteful, as can be seen by reference to Figs. 11 and 12. The various insulators have been supplied by Estler Brothers.; Macartney, McElroy & Company, and the Electric Tramways Equipment Company. Section boxes have been fitted at half-mile intervals, and feeder boxes where needed. These sectional and feeder boxes have been fitted up by the tramways department, and contain the necessary switches to divide each section of the line, lightning arresters, etc. Guard wire has been erected to the requirements of the Postmaster-General, and is bonded to every fifth pole, itself being bonded by copper bonds to the rail. Every section box and feeder box is also bonded to the rails. The guard wire in use is of No. 8 iron wire galvanized. The aluminum wire has been used as a trail, but did not give satisfaction.

FIG. 11.—VIEW SHOWING OVERHEAD CONSTRUCTION

The rails were laid under the supervision of James Lord, A.M.I.C.E., borough engineer, and are of the steel girder type in 30 ft., 45 ft. and 60 ft. lengths, the weight per lineal yard is 95 lbs. The rails are laid on a bed of concrete 6 ins. thick, and are connected by tie-rods 2 ins. x $\frac{1}{2}$ in. every 10 ft. The angle-plates are six-holed and 60 lbs. in

weight per pair. Anchor patent sole plates are also used, riveted to the bottom of each rail and let into concrete. The bonds are Columbia bonds.

Spencer's patent slipper brake is used on the cars in addition to the ordinary hand brake.

There are seventy cars at present in use, the equipments being by the Westinghouse and British Thomson-Houston Company, and single-truck cars only are used. The car bodies were made by Milnes & Co., of Birkenhead and Hadley. The motors are the G. E.-800 of the British Thomson-Houston Company, and the No. 49 Westinghouse. The cars will hold about 45 passengers and weigh complete with truck about 8 tons.

For the foregoing particulars, this paper is much indebted to Mr. Rogerson, the electrical engineer of the corporation; Mr. Spencer, the tramways manager; Mr. Baldwin, chairman of the tramways committee, and the various contractors.

FIG. 10.—VIEW OUTSIDE HALIFAX, SHOWING HEAVY GRADES

FIG. 12.—VIEW ON NORTH BRIDGE

An Electric Railway to Connect Washington, Baltimore and Annapolis

The work of preparing the roadway of the Washington, Baltimore & Annapolis Electric Railway, which is to connect Washington, Baltimore and Annapolis, is progressing satisfactorily, and arrangements are being made for beginning track laying at once. The road will extend from the District line at Chesapeake Junction to the Baltimore city limits, connecting at Westport with the lines of the United Railway & Electric Company, of Baltimore. The distance between these points is about thirty-one miles, and the route to be followed is practically an air line. The line between Washington and Baltimore is graded for double track, but for the present a single track only will be laid. From Chesapeake Junction to Washington the tracks of the Washington Railway & Electric Company will be used to the terminus of the latter line at Fifteenth and H Streets. Here the Baltimore, Washington & Annapolis Electric Railway will erect a terminal station that will probably be used jointly by that company and the Chesapeake Beach Railway Company, which is to run its trains into Washington to this point.

The line to Annapolis will practically be a branch, for it will extend from Odenton, about eighteen miles from Washington, to Annapolis, a distance of fourteen miles. Together with the line to Annapolis, the road will be about forty-five miles long. The work of preparing for the line to Annapolis has not progressed as far as that for the through line between Washington and Baltimore, and it is probable that the Annapolis line will not be built until the Washington-Baltimore line is completed.

About two acres of land have been purchased at Hyattsville for a power house, and work on the plant will be begun at once. It is said that the power house and sub-stations which it is proposed to build will cost $350,-000.

New Power Station and Car House at Manchester, England

About a year ago an outline was given in the STREET RAILWAY JOURNAL of the plans of the Manchester City Corporation for the erection of an immense power station to supply power for the lighting and tramway systems of the city, both of which are owned by the municipality. Manchester has had, for some time, one of the most extensive electric power systems in the United Kingdom, but most of the distribution has been by direct current, and the lighting system has been on either the five or three-wire system. The demand for power, however, especially for tramway service, has for a long time exceeded the capacity of the two existing stations, although additional equipment has been installed in them, so that they now have an aggregate capacity of about 31,000 hp.

The old stations are two in number, both situated on the Rochdale Canal and connected by an overhead walk. One of the stations, the Dickinson Street works, contains two 3000-hp Musgrave engines, two 1200-hp Ferranti engines, two Parsons 3500-hp turbines and seven 400-hp Goodfellow engines. The four latter are connected with their dynamos by belts or rope-drive. All the others are direct-connected to their respective machines. Part of the power distribution from this station is accomplished at 1500 volts by means of direct-current step-up transformers, by which the pressure is increased from 400 volts. Direct-current step-down transformers are used in the two sub-stations to which this current is supplied. There is also a temporary plant of three-phase inverted rotary converters for power distribution at the Dickinson Street station. The Bloom Street station contains four 3500-hp Musgrave compound engines direct connected to Westinghouse generators. The engine plant at this station is extremely compact, having a total of 14,000 hp contained in a room of 6600 sq. ft.

The new power plant which the corporation is building is known as the Stuart Street works. The work on this station was commenced in March, 1901, under the supervision of Prof. A. B. W. Kennedy, and the engines were put in service during the end of May of this year. Before the station was put in operation, however, the corporation realized that the future needs of the city for power would be greatly in excess of the ultimate power capacity of the plant, and steps were immediately taken to increase greatly the output of the plant. The plans for this addition were drawn up at the request of the Council, by E. F. Metzger, who had recently been appointed chief engineer of the city, so that the station now being completed at Stuart Street combines under one roof two complete stations of considerably different design. The work on the new part of this station is not sufficiently advanced to allow the publication of a complete illustrated article about it at the present time, but, in view of the importance of the work and the fact that the plans call for larger engines than are now being used for electric work in Europe, viz., of 6000 hp each, some particulars of this plant will be of interest.

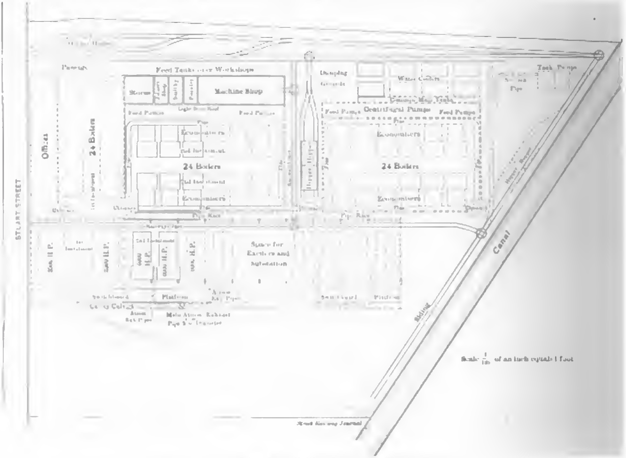


FIG. 1.—PLAN OF NEW POWER STATION AT MANCHESTER

The accompanying engraving shows a plan of the complete power station. The portion at the left of the plan indicates the first instalment designed by Prof. Kennedy, that of Mr. Metzger being at the right. In the Kennedy, or first, instalment the steam raising plant consists of twenty-four B. & W. water-tube boilers, built in pairs and arranged in two rows, one in each of the side bays of the boilers. These boilers generate steam at a pressure of 170 lbs. to the square inch, and each boiler is connected to each of two main steam pipes which run down the middle of the center bay and are connected in the engine house to a complete ring main with a branch to each en-

gine. The engine room contains two 2500-ihp vertical cross-compound engines built by Yates & Thom, running at 94 r. p. m., and each directly connected to a 1500-kw, three-phase alternator built by the Allgemeine Elektricitäts-Gesellschaft. These machines generate current at 6500 volts and 60 cycles per second. The high and low-pressure cylinders of the engines are 36 ins. and 71 ins. in diameter, respectively, by 42 ins. stroke, and they are steam jacketed. Each exciter set consists of a three-phase induction motor driven direct by current supplied by the main generators at 6500 volts, and coupled to low-tension shunt-wound generators. The auxiliary engine sets consist each of a 300-hp Willans compound engine, direct-coupled to a 200-kw direct-current generator built by the Allgemeine Company, and are used for supplying current for lighting and for the various motors about the power house, as well as an alternative source of exciting current for the main generators. Willans condensers are used in connection with water from the canal. There are also four Klein cooling towers.

FIG. 2.—INTERIOR OF NEW QUEEN'S ROAD CAR HOUSE

The Stuart Street first extension, as it is officially called, or the portion on the right of the original station, as shown in the plan, is patterned more after American practice, in that the center bay of the boiler room is parallel to the engine-room wall, while the engines themselves are more in keeping with the projected size of the plant, being of 6000-hp each. The ultimate capacity of this portion of the system, as shown in the plan, is eight of these 6000-hp units, but two only are to be installed at first, together with six batteries of boilers, making an available capacity of 12,000 hp. Running over the whole length of the house will be a coal bunker of about 5000 tons' capacity. This will be equipped with electrically-driven Hunt coal conveyors. The boilers will be of the Babcock & Wilcox type and will be equipped with Babcock superheaters, which will give a superheat of not less than 120 degs. F. at 200 lbs. pressure. Each boiler will be capable of evaporating not less than 20,000 lbs. of water with 5700 sq. ft. of heating surface and will be the largest boilers that the Babcock & Wilcox Company has so far built. Green economizers will be used.

The engines will be of the vertical triple-expansion type arranged with four cylinders and four cranks, and will run at 75 r. p. m. with 190 lbs. pressure superheated steam at the stop valve. They will be supplied by the Wallsend Slipway & Engineering Company, Ltd., of Newcastle. Corliss valve gear will be used.

The leading dimensions of these engines are as follows:

H. P. cylinder, diameter	37 ins.
M. P. cylinder, diameter	59 ins.
L. P. cylinder, diameter	72 ins.
Stroke	60 ins.
Diameter of shafting at engine journals	21 ins.
Diameter of generator shaft through boss	31 ins.

The generators are being built by the Allgemeine Elecktricitäts-Gesellschaft and will supply three-phase current at

6500 volts and 50 cycles. Two surface condensers, each of 11,000 sq. ft. of cooling surface and capable of dealing with 32,000 lbs. of steam, are being supplied by Mather & Platt. There will be two batteries of three cooling towers each, to deal with the hot circulating water. Each will be capable of cooling 90,000 lbs. of water and will guarantee to reduce the temperature from 125 degs. to 85 degs each. One battery of towers is being supplied by the Wheeler Condenser Company, and the other by Arthur Koppel.

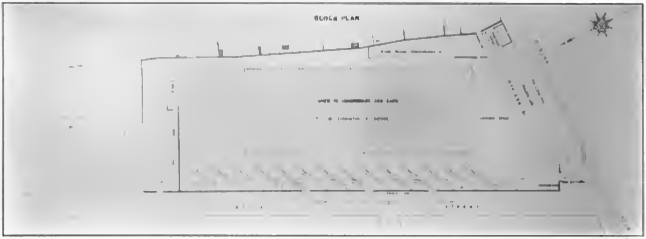


FIG. 3.—PLAN OF QUEEN'S ROAD CAR HOUSE

The main switchboards, which are being manufactured by Messrs. Ferranti, are arranged on three galleries which extend down one side of the engine room. There is to be one main switchboard situated on the middle gallery, and at the same level as the switchboards in the existing station, which controls the two main 3750-kw units, fourteen high-tension feeders, and the two 200-kw exciter sets. On the top platform are the main bus-bars for lighting and traction, and the change-over switches for enabling a machine to be run on either set of bars, while on the bottom platform the main fuses are placed in duplicate. Further along, on the middle or main platform, are the auxiliary lighting and power boards, each controlling twenty circuits, and fed from the existing continuous-current sets or from the sub-station at Stuart Street. Immediately beneath the auxiliary boards and on the lower platform are the switchboards for controlling the sub-station plant, which consists of four 150-kw synchronous motor generators, and one 100-kw induction motor balancer. These units are all situated down one side of the new engine room and constitute the Stuart Street sub-station.

An additional gallery will be placed below the level of the engine-room floor, for the purpose of carrying all the necessary starting, regulating and feeder-charging rheostats and resistances, which are to be worked by gearing and extended spindles carried up through the floor to suitable pillars and hand wheels, thus enabling each to be worked from its own switchboard level. Normally, the traction and lighting bus-bars will be kept separate, but arrangements are made for coupling them together if necessary, but they will also be connected, respectively, to the traction and lighting bus-bars in the existing portion of the station.

FIGS. 4 AND 5 — STANDARD SINGLE TRUCK CARS, MANCHESTER CORPORATION

Fifty-five ft. from the ground level there will be two 50-ton electric overhead travelers, made by Messrs. Higginbottom & Mannock, each having a span of 84 ft. Separate motors of the B. T. H. type are provided for hoisting, traversing, and cross-traversing, each worked by a special B. T. H. controller.

Two electrically-driven coal and ash elevators and conveyors are being provided by Babcock & Wilcox. Each conveyor will be capable of dealing with 40 tons of coal per hour. The conveyor is automatically fed from the hoppers under the railway sidings. It thence travels under

the boiler-house floor and, rising at the end boiler-house wall, automatically tips the coal into the large bunkers overhead. On its return trip it will pick up the ashes and deposit them in a separate bunker from which the railway cars on the high or low level can be filled.

The purpose of this article being simply to give a general outline of the proposed work at Manchester, no attempt will be made in this issue to describe the interesting sub-stations, the motor generators of which are being supplied by the Allgemeine Elektricitäts-Gesellschaft, and the switch gear by Ferranti; or the important distribution system which is being carried out by W. T. Glover & Company, the well-known cable manufacturers, and which will probably be the most complete of any in the United Kingdom. The work of construction is being carried rapidly forward, however, under the supervision of Mr. Metzger, and in a later article an opportunity will be offered for views of the work itself, with fuller particulars of the machinery being installed.

A description of the recent work in Manchester would

FIG. 6.—STANDARD DOUBLE TRUCK CAR

be incomplete in this paper without at least a reference to the tramway system, which is one of the largest, as well as one of the latest, in Great Britain. The tramways in Manchester are also owned and operated by the corporation, and the first section was put in operation in June, 1901. The system is not confined to the county lines, but extends beyond the city of Manchester in a number of directions, except in the direction of Salford which has its own roads. The tramway system in Manchester was originally leased by the city to private operators for a term of years, but as the leases expired the lines have been taken back by the municipality and equipped with electricity. The system is now almost entirely under the control of the city and has been transformed to electric power. As it stands, it comprises about 150 miles of track.

One of the principal features of the system is the Queen's Road car house, capable of accommodating 262 standard cars of the company, and said to be the largest car house in Europe. A plan of this building is presented in Fig. 3, and an interior view is given in Fig. 2. The car house consists of fourteen bays with three tracks in each bay. A pit having an area of 6500 sq. yds. is provided under eleven of the bays. The tracks over the pit are supported on old tramway rails which rest on steel pillars, providing free access over the whole area of the pit and allowing for the inspection of 200 cars at once. Running the entire length of the pit and at right angles to the tracks is a passageway deep enough so that the repairs foreman or chief inspector can walk the entire distance from one end of the pit to the other under the cars, and thus inspect the work in hand. In this trench are located the main hot-water pipes for heating the building. The pit and floor of the building are of concrete, while the walls themselves are of brick.

The cars usually enter and leave the building by the main entrance, which is 16 ft. wide at the front of the building, but three additional entrances are provided in the side of the building in cases of emergency, such as fire, a breakdown at the main entrance, etc.

The corporation is using both single and double-truck cars, and views of the standard cars are presented herewith. Single-truck cars are considered more desirable for most of the lines, but double-truck cars are used on the long-distance lines, especially during the morning and evening runs; the peak speed allowed it ten miles per hour. The cars were built by the G. F. Milnes Company and the Brush Company. The wages paid for a working week of sixty hours are as follows: First-class motormen, 31*s* 2*d*; second-class motormen, 28*s* 9*d*; first-class conductors, 27*s* 6*d*; second-class conductors, 25*s*; motor inspectors, 36*s* 3*d* to 38*s* 9*d*; washers and cleaners, 21*s* 3*d* to 25*s*; time-keepers, 27*s* 6*d* to 30*s*; ticket and night inspectors, 28*s* to 35*s*. The manager of the tramways is J. M. McElroy.

A Graphical Method of Making Time-Speed Curves

BY WALTER S. VALENTINE, M. E.

In the preliminary calculations for proposed electric railway systems, the time-speed curve is an important factor. By its use the engineer is enabled to compare the performance of various possible electric equipments for the service, and is the basis upon which a series of important determinations are made.

It is the object of this paper to describe a graphical method devised by the writer, which greatly facilitates the construction of these curves.

There are several factors which enter in to affect the velocity of the train, and which make the construction of the time-speed curve somewhat complicated. The factors which directly affect the nature of the curve are: Tractive effort of the motor; train resistance due to air resistance, friction, etc.; grade resistance, and finally resistance due to curves in the road.

The acceleration of the train is directly proportional to the algebraic sum of these forces, or:

$$A \propto T.E. - Tr. \pm Gr. - Cr. \qquad (1)$$

where A equals acceleration; $T.\ E.$ equals tractive effort due to motor; $Tr.$ equals the train resistance due to air resistance and friction; $Gr.$ equals grade resistance and may be either positive or negative; $Cr.$ equals resistance due to curves in the road. This last factor is expressed in pounds per ton per degree of curvature, and to simplify the above proportion, may be combined with $Gr.$ and expressed as equivalent grade.

The factors ($T.\ E. - Tr.$) will be referred to as net tractive effort.

The tractive effort ($T.\ E.$) varies in an inverse ratio with the speed, and its values with corresponding speeds for any particular motor equipment are obtainable from characteristic curves furnished by the manufacturer.

The train resistance ($Tr.$) in general varies with the train speed and may be found from some standard formula such as the Baldwin Locomotiove Works formula.

The weight of train being known, the successive accelerations of the train's velocity starting from rest may be com-

puted by use of the above proportion put in the form of an equation:

$$Acc. = \frac{1}{M}(T.E. - Tr.) \pm Gr. \qquad (2)$$

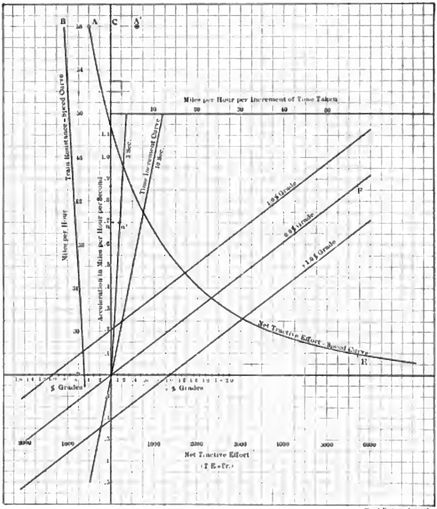


FIG. 1.—CHART FOR PLOTTING TIME-SPEED CURVES

where M represents the mass of train, including the equivalent mass of rotating parts.

The initial acceleration is considered as acting uniformly up to the point when the full line pressure is impressed on the motors. From this point on, the acceleration decreases because of the decrease in the $T. E.$ of motors. In order to obviate the necessity of computing the acceleration for each successive change in tractive effort, the writer has made use of a chart from which the increments of velocity may be transferred by means of dividers directly to the time-speed curve.

This chart, Fig. 1, is constructed as follows:

The net tractive effort is taken as abscissæ for both positive and negative values, and speed in miles per hour is taken for ordinates. The train resistance speed curve is drawn first and in case the B. L. W.'s formula is used, it is a straight line. Then having at hand a table of motor tractive efforts with corresponding speeds in miles per hour, the net tractive effort speed curve is plotted by making use of the train resistance curve; to illustrate, A' C is value of motor tractive effort for the particular equipment for a speed of 58 m. p. h. Now, by aid of dividers, the point A' is moved to the left to the position A by an amount B C, the train resistance for that speed. In the same way from each value of motor tractive effort the corresponding value of train resistance is subtracted "graphically" and the net tractive effort speed curve is the result.

The inclined straight line curves, marked "%. Grade," are plotted between net tractive effort and acceleration in m. p. h. p. s. for the several grades of the road. These net tractive effort acceleration curves are right line curves and have the same inclination for all grades. This will be readily seen to be the case if equation (2) is compared with the general equation of a right line curve,

$$y = mx \pm c$$

In case there should be a number of grades and consequently a number of grade lines or acceleration curves to be drawn, the writer has found that it greatly simplifies the chart to construct a scale of grade per cents along the horizontal axis, and then draw one grade line with vertical and horizontal axis upon a thin piece of celluloid, and place this over the chart in the proper position for the grades line required.

A second set of right line curves called "time increment curves" are drawn in chart, which serve to give the gain in velocity for any desired time increment to be used in the construction of the time-speed curve.

The use of the chart can best be explained by taking an example:

In Fig. 2 is shown a time-speed curve constructed for the equipment and conditions represented in the chart, using two grades—a zero and a + 1.0% grade. Assume that motors receive full line pressure at a speed of 28 m.

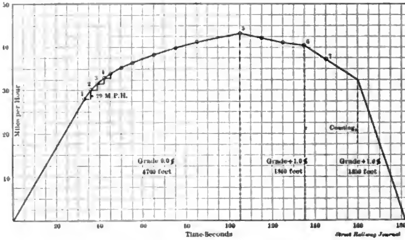


FIG. 2.—SAMPLE TIME-SPEED CURVE

p. h., then the initial acceleration will be uniform up to speed. Referring to the chart, the point E on the net tractive effort speed curve corresponds to this speed of 28

m. p. h.; from *E* follow a vertical line intersecting with 0% grade line at *F;* from *F* follow a horizontal line intersecting the vertical axis, which point gives a value of .87 m. p. h. p. s. acceleration and is the initial acceleration of the train. A straight line is now drawn on time-speed curve from origin to point "1" at 28 m. p. h. with an inclination representing an acceleration of .87 m. p. h. p. s. Point "2" is now obtained by selecting a speed about midway between points "1" and "2," in this case 29 m. p. h., and in the same manner as before find the acceleration corresponding to a speed of 29 m. p. h. This acceleration may be considered as an average between the accelerations at "1" and "2," and in this part of the curve where the acceleration is high should be considered as acting for about 3 seconds. Now, instead of taking the acceleration from the vertical scale on the chart as m. p. h. p. s., the 3-second time increment line is made use of and with dividers set for the distance mn', the gain in velocity for 3 seconds may be transferred to the time-speed curve directly, locating the point "2." In this way the time-speed curve is built up until the area included between it and horizontal axis represents the length of grade. It will be noted that as the acceleration falls off larger time increments may be taken.

By referring to the + 1.0% grade line, instead of the 0.0% line, the curve may be continued for the 1.0% grade. In this case, however, the train having reached a speed which exceeds what would have been the ultimate speed had the first grade been + 1.0% instead of 0.0%, is retarded due to the fact that the train resistance plus grade resistance in this case exceeds the tractive effort due to motor. This fact is taken care of by the chart, for upon looking for the acceleration at 43 m. p. h. on + 1.0 %. grade it will be found on the vertical scale below the horizontal axis, which means that the acceleration is negative; or, in other words, the train will be retarded.

At the point "6" the power is assumed to be cut off and train allowed to coast. Retardation will, of course, take place, the rate of which may be ascertained from the chart by reference to the train resistance speed curve in the same manner that the accelerations were found from the net tractive speed curve at first.

In the chart are shown only two-time increment lines in order to make it as simple for presentation as possible. In practice, however, a number of these lines are used, they can generally be made for 3, 5, 10, 20 and even 40 second increments.

This method has been used in plotting a considerable number of time-speed curves and has been found to be a very efficient time saver.

Recent Improvements on the Metropolitan Railway of Paris

The Metropolitan Railway of Paris, which, as will be remembered, is an underground electric road running approximately east and west through the center of the city, has proved to be one of the most successful traction enterprises inaugurated during recent years in France. The road was put into operation in July, 1900, and important extensions are now under construction which, when completed, will bring the road into connection with nearly every important traffic center in the city north of the Seine.

MOTOR CAR ON METROPOLITAN RAILWAY, PARIS

As will be remembered from the description of the road which appeared in the STREET RAILWAY JOURNAL for September, 1900, the original line extended from the Porte de Vincennes to the Porte Maillot and was a double track tunnel, the rails in which were located at an average depth below the surface of the street of only about 15 ft. to 20 ft.

EIGHT CAR TRAIN, METROPOLITAN RAILWAY

The tunnel is 14 ft. 9 ins. high above the rails and between stations is about 23 ft. 4 in. wide. On curves the side walls are carried out to give an additional clearance of about 7 ins. The greater part of the rolling stock consists of 4-wheel cars, following in this respect the usual French steam railroad practice, and the cars themselves are similar in general design to the French railroad cars.

The original train service was conducted by trains of four cars each, of which the leading car only was a motor car, and was equipped with one controller and two motors. The popularity of the road as a means of transit through Paris made it soon evident, however, that an increase in carrying capacity was necessary. This could not be secured, however, by the addition of more trains, because, owing to the block signal system used, the frequency of the trains could not well be reduced below 2½ minutes service, which was in force. The company's engineers, therefore, decided to adopt during the rush hours an eight-car train corresponding to the greatest length allowed by the existing platforms. It was considered out of the question, owing to the limitations imposed by the size of the tunnel and the sharpness of the curves, to use single motor cars as locomotives for this service, and equip them with four motors to secure traction. Moreover, locomotives of this kind would have many drawbacks from the exploitation point of view.

FOUR-CAR MOTOR TRAIN, METROPOLITAN RAILWAY

VIEW OF MOTORMAN'S CAB

The company, therefore, considered only the multiple unit system and the two-motor car train method, that is a train with one motor car at each end, operated by a single controller.

Based on the acceleration required (a maximum of about 2 feet per second), the latter plan was found to be cheaper and better suited to the particular conditions of the service. As this was one of the systems considered for the equipment of the Manhattan Elevated Company of New York, an extended description of the method adopted, which was proposed and installed by the French Thomson-Houston Company of Paris, and which in some respects differs from that employed in the New York equipments, may be of interest.

The problem presented to the French Thomson - Houston Company was as follows: A minimum frequency being imposed, say two and one-half minutes, which is to be kept during the whole day independently of any fluctuation of traffic, to adopt a system of traction allowing of a combination of an eight-car train with two-car trains coupled at will together, said four-car trains being completely independent when it is necessary to let them run alone at the hours of feeble traffic, and being coupled together and operated both from the front platform by a single motorman at rush hours.

END VIEW OF METROPOLITAN CAR, SHOWING END ENTRANCE

This, as will be seen from the diagrams herewith, has been accomplished by using a single large train cable for carrying the current necessary for two motors, and in addition, a very much smaller cable with twin conductors, that is, two wires, for an electromagnetic reverse switch. As above-stated, only one controller per motor car is used, making a total of four motors and two L-3 controllers per train, each motor car being provided with one L-3 con-

troller, one special "2 motors-4 motors" switch, one DB-16 magnetic reverse switch (which is the same as used in the General Electric train control system) and necessary number of rheostats for four motors, and finally two TH-4 motors of 125-hp each.

The combinations possible with this apparatus are shown in Figs. 1 to 8, in which Fig. 1 represents two cars with their equipment connected in series; Fig. 2, two cars with their equipments connected in parallel; Fig. 3, two cars in which the motors of the first car have been cut out of circuit; Fig. 4, two cars in which the motors of the second car have been cut out of circuit; Fig. 5, one car with motors in series; Fig. 6, one car with motors in parallel; Fig. 7, one car with the first motor cut out of circuit, and Fig. 8, one car with the second motor cut out. A schematic diagram of the connections by which these combinations are effected from one point is presented in Fig. 9.

In Fig. 9, T represents the third rail and F^1 and F^2, the current collectors; A, B and C are three conductors extending the entire length of the train, with couplings between the cars at a, a. D^1 and D^2, and P^1 and P^2 represent schematically the ordinary controller cylinders by which the resistances R^1 and R^2 can be connected in series with the motors and cut out, and the motors coupled in series parallel control.

E^1 and E^2 represent the special switches, called "2 motors-4 motors" switches, by which the motor car connections are disposed for four-car trains or eight-car trains. At the same time, the steps of resistances are changed in order to suit exactly the two-motor or four-motor equip-

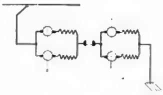


FIG. 1

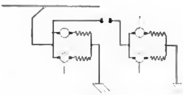


FIG. 2

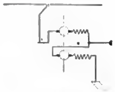


FIG. 5

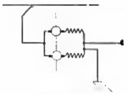


FIG. 6

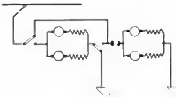


FIG. 3

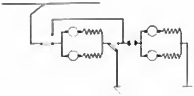


FIG. 4

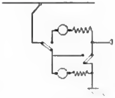


FIG. 7

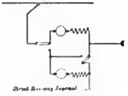


FIG. 8

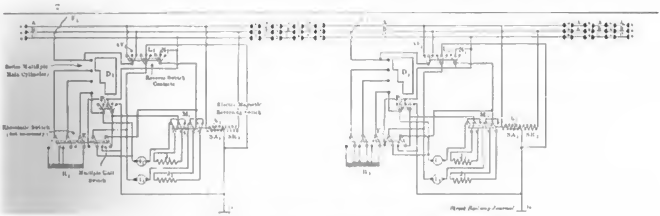


FIG. 9.—SCHEMATIC DIAGRAM OF METROPOLITAN CONNECTIONS

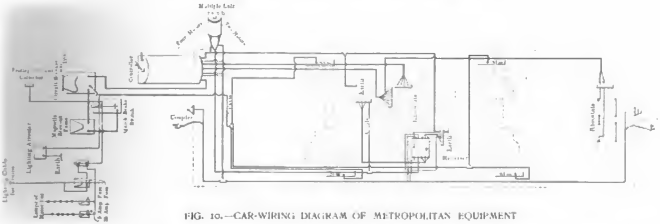


FIG. 10.—CAR-WIRING DIAGRAM OF METROPOLITAN EQUIPMENT

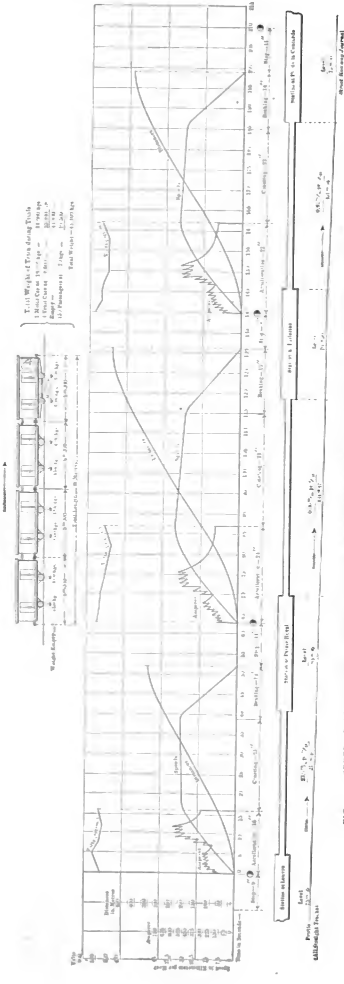


FIG. 11.—SPEED, DISTANCE AND CURRENT CURVES ON METROPOLITAN RAILWAY WITH FOUR-CAR TRAIN AND ONE MOTOR CAR

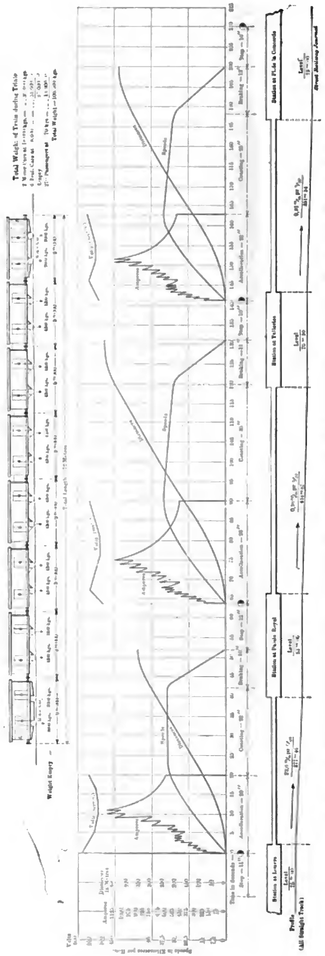
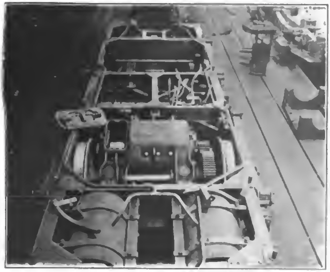


FIG. 12.—SPEED, DISTANCE AND CURRENT CURVES ON METROPOLITAN RAILWAY WITH EIGHT-CAR TRAIN AND TWO MOTOR CARS

ment conditions. It was found in practice, however, that this latter disposition was not necessary on the Metropolitan cars, and in the actual controllers this refinement was omitted.

I^1 and I^2 are the armatures, and J^1 and J^2 are the fields of the motors. M^1 and M^2 are the reversing switches for reversing the direction of rotation. SA^1, SR^1, SA^2 and SR^2

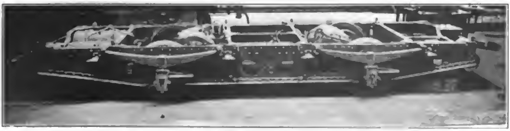


VIEW OF TRUCK

are solenoids which act on plungers b^1 and b^2, and which, by means of the levers t^1 and t^2 operate the switches M^1 and M^2 mentioned above.

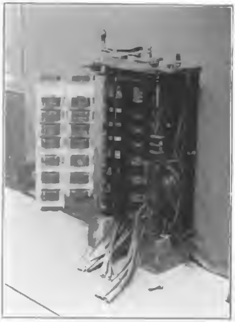
The three switches AV^1, AV^2, L^1, L^2, N^1 and N^2 are operated by the ordinary reversing handle, and serve to control the direction of running of the entire train. The same reversing handle serves to operate the E^1 and E^2 "2 motors-4 motors" switches.

The operation of the system is then as follows: To control the "double unit" train from one point, say from car 1,



LATEST TYPE OF MOTOR TRUCK, METROPOLITAN RAILWAY

the two switches E^1 and E^2 are put in the position "4 motors" shown in the diagram. The switch AV^2 being open, the current passes by the switch AV^1 either to wire A, or wire B. It then passes through the solenoids SA^1, SA^2 or SR^1, SR^2, according to the position of switch AV^1, throwing to the right or to the left the plungers b^1 and b^2, which, by the levers t^1 and t^2 throw the switches M^1 and M^2, and thus determine the direction of running of the train. The switches L^1 and N^1 being open do not allow any current to pass, while switches L^2 and N^2 being closed connect the motors I^2 and J^2 with the earth and the train cable C. The controller cylinder D^1 allows the current to pass through the resistance R^1, and then through the motors I^1 and J^1 and the controller switch P^1 connects the two groups of motors up in series or in parallel. To operate with a single unit, as, for instance, with unit No. 1, it is necessary only to change E^1 to the "2 motors" position. The terminals of the two motors I^1 and J^1 are then so connected that the movement of controller switch P^1 can put them either in series or in parallel. Fig. 10 is a car wiring diagram of the system.



CONTROLLER USED IN NEW METROPOLITAN EQUIPMENT

Figs. 11 and 12 show respectively the acceleration obtained by the Metropolitan Company with a four-car train, with one motor car, and an eight-car train with two motor cars equipped as above. They were obtained under ordinary service conditions and indicate very nearly as good acceleration with the eight-car train as with the four-car train. With expert control probably a slightly better showing could have been made.

The Metropolitan Company has now forty-one new two-axle motor cars with two TH-4 motors, which correspond very closely to the G.E-66, and which are equipped with the present double-unit system. In addition, the company has forty more cars under construction to be equipped with the TH-4 motors, and to be used on the new line through the Boulevards Extérieurs.

The number of motor cars equipped with the system described above allows of eight-car trains being run alternately with four-car trains during the rush hours in the morning and evening; at other times, four-car trains are sufficient to care for the traffic.

This new service was inaugurated in November, 1901, and the very important increase in receipts since that time show the success of the system.

A method employed on one of the San Francisco street railways for holding the motor pinion on the shaft is as follows. The ordinary lock-nut washer is not put on the shaft, but the nut is screwed up tight to the pinion. A blunt, round-nosed chisel is then employed to swell out a little the end of the pinion over the nut holding the latter in place. This method is found more desirable than the use of a lock-nut washer.

Failure of Municipal Ownership in England

BY HON. ROBERT P. PORTER

PART II., AND CONCLUSION

The general outline of the arrangement, mentioned last month, by which the British government in 1892 took over part of the telephone business of the country was that the trunk wires which connect large towns should be worked by the postmaster-general, and that business inside of towns, which in England is generally called "exchange business," should be left in the hands of private companies. This dual arrangement had its disadvantages, and, as those who understand the business will realize, its inconveniences; but the telephone company could do nothing but go ahead along the line mapped out by the government. Having no control over the entire system, and being more or less hampered by municipalities in the matter of laying wires, moreover being compelled to pay over a large royalty to the government, the inducement was not great to invest additional capital. The government and the company seemed to have got along fairly well, giving an indifferent service for a rather high price, until the municipal traders, looking around for new fields to conquer, took up the matter. The telegraph act of 1899 gives the municipalities the right to establish and work local systems within their own area in competition not with the government trunk lines, but with the telephone company. Now, as everybody knows, the telephone service is not one which lends itself to competition, because it is obviously very inconvenient for a telephone subscriber to find that people with whom he wishes to speak are not on his system, but on the system of some other company. What with the government absorbing the trunk lines and municipalities reaching out after the local business the company which originally undertook the exploitation of the telephone in England is becoming discouraged, and some of the officers openly say that rather than still further complicate and obstruct the business by municipal trading it would be wiser for the government to take it all over and run it, with the telegraph, as a State monopoly.

There are several reasons why this plan is just now not agreeable to the British Government. In the first place, public sentiment is murmuring against increasing State undertakings. Then the government has made a mess of the telegraph business, which does not even pay. Up to 1899 the British Government has lost the enormous sum of \$35,000,000 in the management of the telegraph business. This has become alarming, because the loss is continually increasing, and last year it was \$3,000,000. It is generally conceded that a private company, or two private companies, as we have in the United States, would do the business far better and make it profitable. Then again, in Victoria, where the railways have been worked for a considerable time by the State, the loss has been \$35,000,000. In South Australia the loss has been \$10,000,000. A commission appointed to investigate this shockingly bad management of undertakings on the part of the State reports "the service is disorganized and the political influence is noticeable throughout." It recommends the complete separation of the railways from the State and the placing of them under a board of five trustees, with a general manager. If this is done, the report states than an annual saving of \$1,825,000 is indicated.

From India comes the same gloomy story in a report made by Mr. Bell, who is in the Department of India Railways. Mr. Bell expressed a strong opinion that the effect of the government having taken up the Indian railways had been to check the progress of Indian railways, and Sir Julian Danvers, who has so very much experience in the same direction, expressed the same opinion. Mr. Bell, in his report, said: "I have laid stress on what I should call the pernicious element in the present policy of the government, i. e., the retention of the idea that the State must continue to exercise direct action in both the construction and working of railways. I have implied that this cannot co-exist with really vigorous life in private enterprise, and that it is the latter to which we should look as the ultimate and sole agency for such operations." Lord Avebury, in his testimony before the select committee, brought out the fact of the great development of railways in the Argentine Republic by private enterprise, while there had been little of the same kind in India. Sir Julian Danvers said "that he had come to the conclusion that the agency of companies was upon the whole the most satisfactory mode of carrying out railway enterprise; that seemed to be now the opinion of the government; railways, being commercial concerns, were better in the hands of those who could manage them on commercial principles." The private investor in India, as he does elsewhere, takes the ground that if a railway was likely to pay it would be made by the government, and if it is left to a private individual to make it must be because it is not likely to pay. The result has been that there has been very little private enterprise in the matter of Indian railways. For these reasons, or because of the great loss in connection with the telegraph business, the British Government has hesitated to take over the entire telephone business of the country; but by taking the trunk lines and exacting too high a royalty and by letting the municipalities into the business it has spoiled it for private enterprise.

COST OF MUNICIPAL UNDERTAKINGS

The comparisons between public and private undertakings which are set afloat in the United States and appear in the newspapers advocating municipal ownership and operation of public utilities are valueless, because the real cost of municipal enterprise is never given. To make a fair comparison, these items should be charged as follows:

First—All the cost of all direct and indirect salaries and wages. (Indirect wages and salaries are not always charged in the case of municipal undertakings, such as, for example, a fair proportion of the salaries of the town clerk, borough surveyor, high-priced officials and others.)

Second—The full and fair cost of all materials consumed for the purpose of the undertakings. (Coal and many other materials are often charged in a haphazard way; it ought to be done accurately, from an accountant's point of view.)

Third—It should include the cost of insurance against loss by accidents of all kinds.

Fourth—The cost of adequate maintenance and up-keep.

Fifth—Provision should be made for depreciation, wear and tear and possible obloescence to meet the ease of its becoming obsolete. (There is a great risk in municipal undertakings of something better presenting itself, and the undertaking, though it may be fully maintained and be in very good working condition, may be superseded by some new invention. This happened on a colossal scale recently in New York when the Metropolitan Street Railway Company scrap-heaped a \$6,000,000 cable plant to put in an underground trolley system.)

Sixth—It should cover the value of municipal taxes relinquished by reason of municipal ownership. (This is never done by those who advocate municipal ownership. As yet it is impossible to make a fair comparison between municipal and company working if the municipality is taxed or rated lower than the company would be for the same undertaking.)

Seventh—State taxes paid or chargeable in respect of the undertaking should be included for the same reason as above.

Eighth—The interest on the entire investment.

Ninth—A sinking fund for redemption of capital within the period approved by the ratepayers and by the local government board or other government department.

These are the nine heads of cost which Emile Garcke, editor of the Manual of Electrical Undertakings and director of the British Electric Traction Company, thinks should be included in such comparisons. In nine cases out of ten they are not. If those debating the question would insist on this form being complied with and accept no comparisons between the working of municipal and private undertakings unless these rules have been followed out, the whole fabric of municipal ownership would fall to the ground of its own weight. The comparison would be overwhelmingly in favor of the private company enterprise.

LONDON CHAMBER OF COMMERCE

A good deal of effective work has been done against the extension of municipal socialism by the various chambers of commerce of Great Britain, and in this the London Chamber of Commerce has properly taken the lead. A municipal trading committee has been appointed by that influential commercial body and a number of meetings have been held. Last October the writer was invited to deliver an address in London under the auspices of the committee of the London Chamber of Commerce, and in the course of this address said:

"Within the last few years a change seems to have come over this municipal dream of yours. While we, as I have said, have been obliged to argue our case in the United States on a demurrer so far as England's experiences were concerned, there has arisen within the very shadow of Spring Gardens a perverse generation which has set about the demolition of the idols we have been told to bow down to and worship. The attack on the temple of municipal trading has been sharp and decisive, and the edifice is almost rent in twain. Having accomplished its partial destruction yourselves, aided as you have been by your own chambers of commerce, by the Society of Arts debate, by the Royal Statistical Society's investigations of the financial side of the question, by the Parliamentary committee, by numerous able pamphlets, and more recently by that powerful ally the London Times, you must not ask us foreigners to gaze upon what is left of the edifice and pronounce it complete and satisfactory. We are more likely to enter the sacred precincts through the aperture you have made in it and endeavor to solve the mystery of its departed power. We may even be encouraged to compare the cost of some of these boasted achievements with similar undertakings of our own. We might be tempted to ascertain if under a different method we have been able, by utilizing individual effort and private capital, to give the public as cheap and as efficient service. You, gentlemen, are too familiar with the shortcomings of municipal trading to need even a recapitulation to-night. You found it did not fit in with the extension of modern enterprise. You wanted to distribute your electrical power and sell it cheaply for all sorts of purposes and you were blocked by a combination of town clerks. There was a demand for cheap producers, gas for use in the gas engine, the latest and cheapest invention for motor power, and you were held up by municipalities whose business interest prompted them to oppose cheap power. So it was with light—electric and gas—and with the extension of tramways and light railways. Then it was that you discovered that these towns and cities, with their retinue of officials, had been merely nibbling at the electrical industry. Private enterprise was being dampened and dwarfed by hold-ups in the shape of provisional orders. Meantime England was behind even Italy in an industry in which she should, by rights of priority of practical application, have led Europe and been side by side with the United States. When these facts were fully established your British ire was thoroughly aroused. Whatever may be the final outcome, and whether you ever come to any understanding with these authorities as to boundary lines or not, you have weakened their power. If they still, as is probable, cling tenaciously to that which they have, they will have to fight harder for that which they may in future wish to appropriate. The municipal trader may preach 'no finality to municipal trading,' but Parliament, the limitation of the debt-creating power, the patience of the ratepayer and the necessity of encouraging British industry, will prevent its being carried out. Still more disastrous will be the trap which Mr. Garcke has set for the municipalists and into which Mr. Donald, editor of the Municipal Journal, recently precipitated himself.

"As I have said, until the severe attacks on municipal trading referred to above we had been given to understand in America that in England wonderful success had attended the efforts of municipalities to monopolize individual endeavor or enterprise. The appeal, however, was chiefly made on the exceedingly fallacious ground that the 'profits' thus extracted from the pockets of the capable and enterprising, the energetic and far-sighted, the ingenious and the inventive were enabling the rest of the community to live free of taxation. Herein lay its chief attraction. Mr. Donald disposes of this point himself, and thus denudes the whole theory of 'no finality to municipal enterprise' of its principal charm to American municipalities by the following declaration: 'It would be preferable in all cases that municipalities ceased to make profits from their undertakings, whether water, gas, electricity or tramways.' Here we have an advocate of municipal trading in England abandoning the very essence of the argument of his co-laborers across the Atlantic. The bait of lower taxation is the luscious morsel which the Bryanite orator and American college professor have been dangling before our taxpayers. Without it the subject will not prove permanently attractive and hardly command respectful attention."

Strong speeches were made at that meeting by well-known and influential Englishmen and by Charles T. Yerkes, of the United States, who has undertaken extensive enterprises in connection with London rapid transit. Sydney Morse, the chairman of the committee, among other things said that "when a few years ago it was found that the municipalities and local authorities throughout the kingdom were anxious to enter into the arena of trade in competition with their ratepayers—with money raised on the security of the rates these traders paid—it was felt that a time had arrived when a special committee of the chamber should be appointed to endeavor to deal with the question. The committee had been doing what it could in a small and unpretentious way; it even ventured to risk a general battle with the representatives of the municipal traders by getting the government to appoint a joint committee of both houses, and although that joint committee made no report and came to no definite decision it collected a great deal of valuable evidence, which has now been published. He had the authority of their guest for saying that that report had been of great value to our friends in America. The question was really of immense importance. Few of them realized fully the extent to which municipal trading, if it was allowed to have its full sway, would interfere not only with traders, but with the comfort of everyone in the country, if it did not in the end interfere with the government of the country in a disastrous manner."

Sir Charles Rivers Wilson said: "The Chamber of Commerce had done gallant service and put themselves in the

forefront of the battle, but it was not to be expected they would conquer in the fight unless they received more support from the government, the public generally and Parliament; and it is in that direction that all the efforts of those interested in this question should be applied. He urged them to try and form popular opinion on this subject, and it could be done by disseminating information and arguments such as they had listened to that night. He hoped that the interesting and important document contributed by Mr. Porter would be printed and circulated and given the widest publicity."

Dixon H. Davies, commenting on the speeches of the evening, said "he was struck by the figures that were mentioned of the vast stock which the railway companies of this country had charge of. Even in these bad times, under the commercial management of the railway directors, that great property produced a profit of £40,000,000 sterling per annum. Compare that with the figure which was mentioned in the Times that morning regarding only a portion of the railways of France (instituted under government auspices and dependent for their returns on the aid of the State), on account of which a deficit of 40,000,000 francs would be charged in the budget of France next year. Let them compare the two—in this country £40,000,000 sterling profit, in France 48,000,000 francs deficit. That was only one indication of the failure of enterprise when it was subjected to governmental interference. Railway men knew of many expansions of their systems which would be desirable from every point of view and which were forbidden by the municipalities. He could mention towns where great railway companies had for years been projecting important extensions and which they had been prevented from carrying out because those towns have started municipal tramways and because they believed the railways would take away the trade from those tramways."

INDUSTRIAL FREEDOM LEAGUE

The outcome of this agitation, which has been carried on in various ways in England for nearly five years, as I have said, has been the formation of the Industrial Freedom League, an association formed to free private enterprise from undue interference and from rate-aided competition. Membership of the Industrial Freedom League is open to all persons or companies who are in sympathy with its objects, and the membership charge is nominal. The need of such an organization is abundantly proved by the facts and data I have above submitted. The constitution sets forth that "the rapid encroachment of local governing bodies upon the legitimate functions of manufacturers, merchants and tradesmen is injurious to the commercial interests of the nation and of the municipality and the piling up of an enormous debt, now amounting to several millions, has tne effect of increasing the burden of local taxation and diverting the stream of investment capital from its most useful channels." Again it says: "The disastrous tendency of the new municipalism is not a capitalist's question nor a trader's question merely. It is pre-eminently a poor man's question. The expenditure of a municipality inevitably increases in proportion as its trading increases. Toward this it has to levy rates which fall entirely upon the rental value of the property in the town. In the more ambitious boroughs the rates are already approaching 10s. in the pound, which means that for every pound per year you pay as rent you have half that amount to pay as local taxes. The result is, of course, that houses become dear and scarce. When the eyes of the people are open to the true bearing of these abuses, as it will be the business of the league to open them, an economic reform which promises to the poor man the boon of a cheap house is sure to command general popularity."

The work the league maps out for itself is as follows: "It is the aim of the Industrial Freedom League to provide the machinery for systematic and sustained opposition to a policy which threatens the extinction of private trade. A fuller statement of the damaging effects already produced by municipal trading and of the direction in which the league may most usefully exert its influence will be found in a pamphlet entitled 'The Industrial Freedom League; Its Purposes and Programme," which may be had from the secretary."

In short, the league's plan of campaign may be briefly summarized as follows:

1. To prepare and publish statistics bearing upon municipal trading and its injurious effects.
2. To arrange lectures, addresses and debates throughout the country.
3. To keep the press well informed of the trend of municipal socialism.
4. To extend assistance to local traders unfairly hampered by restrictive by-laws.
5. To distribute literature and otherwise take part in municipal elections.
6. To assist ratepayers' associations in opposing want and extravagance on the part of the councils.
7. To watch cases giving rise to suspicion of municipal corruption.
8. To urge action on the part of ministers and private members of Parliament.
9. Generally to arouse public opinion and secure the revival of that spirit of industrial toleration to which the past commercial success of the nation was so largely due.

CONCLUSIONS

The fundamental idea of this league is the preservation of that "freedom for the play of all the talents, all the energies, all the force of human initiative for the subjugation of the powers of nature and their direction in the service of mankind" which has enabled both England and the United States to lead the world in all great modern enterprises.

To check this individual effort means the destruction of industrial progress and the reversion to commercial impotence. In one of his exceedingly able addresses Lord Avesbury (Sir John Lubbock) recently said: "The country is now at the parting of the ways in the matter of great commercial undertakings being carried on by municipalities or by individual enterprise. Government and municipal competition are fatal to private enterprise." To combat this fatal competition the Industrial Freedom League has been formed.

The attendance and character of the speeches at the first meeting of the league were well calculated to arouse public opinion. There were present some of the strongest and most influential men in England. Nearly all the great railway enterprises of the kingdom were represented; the building trades, great electrical interests and various associations of manufacturers and a fairly representative number of economists and scientific men. It might be added here that not only has the London Society of Arts taken up the subject actively, but likewise the Royal Statistical Society. Sir Henry Fowler, the retiring president, two years ago contributed the most valuable statistical paper on the subject, and this year the present president, Lord Avebury, made it the chief topic of his annual address. Alexander Henderson, M. P., presided at the inaugural meeting of the Industrial Freedom League, and his address was a valuable contribution to the literature opposed to the growing evils of municipal trading. He called attention to the stupendous increase of local indebtedness in the United Kingdom,

which he said had doubled in twenty years and now exceeded $1,500,000,000. A large part of this debt had been created for industrial enterprises to be managed by town clerks. As Sir Henry Fowler had previously shown that the dividends earned on the debt thus created was about one-half of 1 per cent per annum it is easy to imagine that much of this will become a heavy burden for the ratepayer to bear. The proportion of this huge total which has been invested in trading concerns would have been supplied by private enterprise but for the fear that councils would render capital so expended unproductive. There was no disposition to complain of much of the good work done by the British municipalities within their proper sphere—sanitation, water, markets, streets and other strictly municipal undertakings were all right in the hands of these public bodies. On the other hand, tramways, gas, electric light and power and many other trading enterprises in which corporations are or contemplate being engaged should not be handled by them. "Workmen's dwellings," said Mr. Henderson, "about which there is so much talk at the present time, would to a large extent have been provided by private enterprise but for the fear that councils would render capital so expended unproductive." I happen to know from another well-informed source that since the London County Council has entered the "workmen's dwelling" field private capital has retired. Public-spirited men were venturing considerable capital in these enterprises, giving excellent results but getting very small returns on their investments. They have now left the field entirely. The local debts of some of the English towns compared with the relative taxable value is enormous. Compared with the United States, I find in the aggregate the municipal debt is fully double. This ought not to be, for our population is more than double that of England and our ability to pay greater. The actual increase in municipal debt in the United States between 1880 and 1890 was only $60,000,000, which was very small when we remember that in that period the value of taxable property doubled. In the United Kingdom the total increase in the ratable value of the country in twenty-five years has been less than 30 per cent, while its local debt has trebled. Our returns for the last ten years are not yet published, but I think it may be safely asserted that the inverse of this proposition is true, namely, that our local indebtedness has increased, say in thirty years, 30 per cent and the value of taxable property has trebled. The reason for this happier condition of affairs is largely due to the State constitutional limitations placed upon municipal indebtedness and to the fact that up to the present our municipalities have kept out of industrial enterprises. Think what it would be to-day if we owned, as England does, say half our municipal tramways and half our gas plants. Here we have $3,000,000,000 in all, half of which would be $1,500,000,000, plus say $800,000,000 existing debt, and the total burden comes to $2,300,000,000. If we take them all over as some advocate we have a total debt of $3,800,000,000, and if electric lighting, power plants and other businesses in which British towns dabble be included we could easily make it $5,000,000,000.

But right here the wisdom of the State constitutions come in and prohibit this reckless expenditure and debt of the taxable value of property. Two per cent in Indiana, 5 per cent in Illinois and many other States, 7 per cent in Pennsylvania and 10 per cent in New York are the legal limits of municipal indebtedness. The effort to repeal these constitutional provisions, even when advocated by reputable men like Bird S. Coler (see Municipal Affairs, September, 1901), should be strongly combatted. It is but the entering wedge of municipal trading, for the programme of its advocates cannot be carried out so long as these wise limitations on the debt-creating power of municipalities continue in force. A careful study, covering several years, of the gradual movement against municipal trading in England leads me to make the following observations: The men acting in opposition to the socialistic experiments are not merely those whose industries have been taken up by the municipal corporations and who feel themselves aggrieved in consequence. The opposition is rather from the conservative financial people who look with alarm upon the growth of local indebtedness and the increase of local taxation. The railway interests are keenly alive to this movement by reason of the heavy and increasing burden of local rates upon the revenue of railway companies. Lord Claude Hamilton, chairman of the Great Eastern Company, who was an interesting speaker at both the important meetings referred to above, said in one town his company paid $150,000 taxes, and that had it not been for the formation of a ratepayers' association to combat the industrial tendency of the council the burden of taxation would have become unbearable. There are also indications in the British world of finance that municipal corporation credit has suffered a check. For example, the corporation of Leeds recently issued $10,000,000 of 3 per cent stock at the price of 94 cents on the dollar. The prospectus of this stock was advertised March 5 of this year. It resulted in a subscription by the public of about $1,100,000, leaving about 90 per cent upon the hands of the syndicate. It may be news to some in the United States to learn that London County Council 2½ per cents sell at 85 cents on the dollar. The prices of most of these securities indicate, at least to my mind, that the limit of local indebtedness has been reached in England, if it has not crossed the danger line. In our own country, where debt is incurred for purely administrative purposes —sanitation, police, municipal buildings, streets, parks and waterworks—something like finality is obtainable. Added to this we have our constitutional limitations, and, as a rule, a twenty-year retirement clause instead of sixty years, as in England. The advocates of municipal trading practically say there is no finality to their enterprises, hence there seems to be no limit to the capital account in respect of undertakings of a reproductive character, such as gas, electricity, water and tramways. This feature is menacing to the future of municipal finance in England. Hitherto local bodies have been able to get their money very easily, but it is by no means certain that this will continue, because of the impossibility of predicting a limit to their expenditure. A successful undertaking of a remunerative character is inevitably one that requires more and more capital, and the financier who studies municipal finance is faced with this alternative—either the corporation works are a failure and the money invested therein is wholly or partially lost, or, if successful, large additional sums will be required to carry them on. In either case there is room for grave concern. Trading concerns, as every business man knows, are often obliged to spend money owing to the universal demands of the public and not necessarily in extension of their undertakings. Mr. Henderson, in his address, takes the London & North-Western Railway as an example. Its length in 1891 was 2,021 miles and its capital expended $507,025,000; in 1901 its length was 2,094 miles and its capital expended $654,215,000, an insignificant increase in length of line equal to only 73 miles (3.6 per cent) against an increase in capital expenditure of $146,690,000, or 29 per cent. The same rule must apply to corporation trading undertakings. If they are successful there may be no desire to extend them, but public requirements and progress will demand the expenditure of capital for improvements.

This brings us to the very essence of the financial danger. The figures of the gas undertakings and electric light plants

and the tramways of certain cities will be cited as proving that some corporations have traded wisely. The answer to all this is contained in the above illustration of the London & North-Western Railway, or, if you please, in the Metropolitan Street Railway, of New York, when that company threw out its valuable cable plant and put in electric traction. Gas has been a profitable commodity in the past, and may be in the future, if its manufacture is kept up to the standard of the United Gas Improvement Company, of Philadelphia, for example. No example of a municipal corporation managing gas undertakings as that company manages its business can be given. For absolutely the inverse of the proposition read the history of the Philadelphia municipal gas works. Examine municipal corporation accounts in gas as the STREET RAILWAY JOURNAL has done in tramways and you will find that the sum set apart for depreciation is altogether insufficient to meet losses that must inevitably be realized in connection with all these classes of risks.

In conclusion let me call attention to two or three points made by Lord Avebury in his address which seem well worth considering. Lord Avebury cited the traveler in China who came across a building in a remote up-country town on which was inscribed "All kinds of business in this building carried on with invariable success." That appears to be a good motto for some of the British town halls. The effect of municipalities carrying on so many industries in England is lowering the standard of the aldermen and councilors—something greatly to be regretted. I happen to know that Lord Avebury was obliged to give up his work on the London County Council because it required all his time to master the details of the various business proposals constantly before that board. Experienced and capable business men are gradually giving way to the professional politicians who are willing to give their entire time for the influence it gives them.

The labor question is also giving the municipal traders a good deal of trouble. The British workman, it has been found, is not half so energetic when he is working for the municipal corporations as when employed by individual firms. In consequence, everything costs more. The workman argues that he helps to elect the municipal body and to some extent they are his servants, and he "goes to his work," said one of the speakers, "with the idea that he is the proprietor of the whole show, and it is generally known in the trade that a man once employed on the County Council is likely to be unsatisfactory to others." Added to this, municipal trading in England has undoubtedly proved a great check to private enterprise. It will be a matter of interest to note what effect this awakening to the failure of municipal ownership of public utilities in England will have upon the spirits of those of our own countrymen who are so vigorously trying to entail upon our municipalities burdens similar to those from which a considerable body of thinking men in England are anxious to be relieved.

The current issue of Harper's Weekly contains, as a frontispiece, a full-page portrait of Herbert H. Vreeland, president of the Interurban Street Railway Company, of New York. The portrait appears as one in a series entitled "Americans of To-morrow," and is the fifth of the portraits in this series published by Harper's Weekly. In speaking of Mr. Vreeland, the paper recites many of the successes which he has already secured, and refers to him as being as big and broad mentally as he is physically. It gives his age as forty-five, and predicts that unless he is deluded by admiring friends into the notion that he has reached the top, he will be a very important and useful factor in American development during the next twenty years.

STREET RAILWAY ACCOUNTING

CONDUCTED BY J. F. CALDERWOOD, ASSISTANT TO THE PRESIDENT BROOKLYN RAPID TRANSIT COMPANY, AND MEMBER INSTITUTE OF SECRETARIES OF LONDON.

Coupons

BY E. S. PATTER

The best method of handling coupons is a subject of more or less interest to accountants in connection with corporations having a large funded debt and correspondingly large numbers of coupons to be accounted for. We herewith outline a simple plan that may be of interest. As an illustration, we will assume that the bonded indebtedness of the corporation is $5,000,000; $3,000,000 first mortgage bonds due Jan. 1, 1912, at 5 per cent and $2,000,000 second mortgage bonds due same date at 6 per cent interest, payable semi-annually January 1 and July 1, at a trust company in New York. It being necessary for each month's statement to carry its proportion of all fixed charges, including interest on funded debt, the following journal entry is made each month and posted to the corresponding ledger account:

Interest on funded debt apportioned..................... $22,500
Dr. to
Interest accrued for July on
$3,000,000 first mortgage bonds due 1912 at 5 per cent.... $12,500
$2,000,000 second mortgage bonds due 1912 at 6 per cent.. 10,000

As the operating accounts, together with all fixed charges apportioned for the month, are written off at the close of each month and charged against earnings, the interest on funded debt apportioned is also written off, but the interest accrued remains as a liability on the books of the company until balanced by the semi-annual payment of interest January 1. The journal entry is as follows:

Interest accrued for 6 months, due Jan. 1, 1903, on
$3,000,000 first mortgage bonds at 5 per cent............. $75,000
$2,000,000 second mortgage bonds at 6 per cent.......... 60,000

Treasurer $135,000

An entry is then made and posted to coupon accounts as follows:

Trust Company, coupon account........................$135,000
Dr. to
Coupons, first mortgage bonds due July 1, 1902.......... $75,000
Coupons, second mortgage bonds due July 1, 1902....... 60,000

Upon the return of paid coupons from the trust company, and after being checked against the statement to verify the number returned, they are then arranged numerically and the reverse of the former entry is made and posted for all coupons returned. It seldom occurs that all the coupons of any one payment of interest are returned at one time. This necessarily leaves a debit balance against the trust company's coupon account and a credit balance to various coupon accounts.

In making up the balance sheet, the accounts "Trust Company's Coupon Account" and the total of the various "Coupon Accounts" balance (debits and credits) and therefore do not necessarily have to appear on the balance sheet.

The coupons arranged numerically are pasted in a specially ruled and printed book, the folio of which corresponds with number of bond, the right-hand page being spaced and numbered to correspond with the number of each coupon to maturity of the bond. The left-hand page is reserved for the pasting in of the paid bond, thus making the record complete. By this plan it is a simple matter to ascertain quickly from the balance of the trust company's coupon account the value of the coupons unredeemed, and also determine from the individual coupon accounts the value, series and number of coupons outstanding. You can also determine the number of the bond to which outstanding coupons belong.

The Distribution of Accounts

BY H. D. EMERSON

The elements which enter into and which are combined to make up a report on which to base the value of securities are very numerous. Primarily the property itself is the consideration, and a careful investigation of its location and physical condition with relation to both operating and traffic possibilities is considered. The earning power of the property is based upon the report of operations; that is, the income account, which, to use a race-horse term, might be called "the past performance." It is generally assumed that the figures as given are correct; that is, that the totals are accurate, and that on the operating side the distribution of accounts of the various classes had been properly made. If there is any question as to the distribution it is of course necessary that the statement in hand be revised and be readjusted along the lines which experience has proved is proper. This brings up the question of proper bookkeeping and goes back further than simply a question of proper audit. There can be no question at all but that every corporation owes to itself, and the management of every corporation should, for individual record, as well as for individual protection, keep the books and accounts of the corporation in the most perfect and at the same time simplest manner. Bookkeeping and the forms thereof are often considered a mystery and handled as though accounting was a separate and distinct profession like the law, to be used only at certain intervals, or when the occasion demands, whereas it is, perhaps, the most vital part of every business enterprise, and no one who is not competent to keep and understand the books of his business is competent to be placed in charge of that business. Bookkeeping is simply a record of the business done by the corporation, and as the goal of any business enterprise is profit, so the cash handled and the cash accumulated is the measure of success of the business. Therefore, it may be said that the essence of bookkeeping is, and should be, a record of the cash handled.

With this proposition as a basis it is very easy to understand the system and forms which show accurately when and how the cash is received, and when and how it was paid out. Stockholders desire to know how much cash has been saved as the result of the operations of the corporation, as this cash is the measure of their profit. But in addition they desire to know for what cash was received, and for what it was paid out, in order that they may judge of the competency of the management. The officers composing the management of the corporation desire to know from time to time the elements which go to make up their receipts and expenses. In order that this statement may be comparative, all receipts and expenses are classified and the totals of these classes can be compared from month to month, and from year to year. The assigning of the various individual items to the various classes constitutes the distribution of accounts. This distribution calls for more judgment, and the exercise of sterling integrity than any other part of accounting. As a result of many years of experience in the handling and accounting of the funds of corporations, a system has been developed which is accurate, and because accurate, satisfactory to security holders. This system, sometimes called the voucher system, which is a system of single entry bookkeeping with various items thrown into classes, and classes totalized into a small number of general accounts, is the basis of the systems used by the steam railroads of the United States, as approved by the Interstate Commerce Commission, and it is the basis of the system advocated by the Street Railway Accountants' Association. Where these systems are in use we do not have to question the income account, as we know the system of distribution. The individual who fools himself is the simplest fool, and that management which attempts to fool others by a manipulation of accounts in the end destroys itself and the credit and integrity of the corporation.

Securities are based upon the earning power of the property against which they are issued, and the value of any security depends upon the amount and probability of continuous income for that security. The marketing of a new security depends upon the ability of those in charge of the corporation to demonstrate to prospective investors that the corporation can earn or has earned a certain amount, and will continue to do so. An instance which recently came under the writer's observation, might be cited as showing the importance of this fact.

A trolley road had been built extending from a large city to a very small country town. The reported earnings, both gross and net, were much larger than would normally be expected from the population tributary to the line. The gentlemen who owned the property; that is, who had furnished the money for construction, were of the highest integrity in banking and business circles, so that when they submitted figures to the bank on which to predicate a sale of the bonds, the question of dishonesty in bookkeeping was not considered. The amount of the bonds and their price, based upon earnings as reported was very satisfactory, and on the face of the papers it was assumed that a trade would be made. But the bank has a rule that before purchasing any securities, or before offering them for sale to the public, the property must be investigated by its own representative. The figures as presented showed that the net earnings amounted to 60 per cent of the gross receipts, and interest charges on the bonds came to less than half the net earnings. The impressions of the physical conditions of the property from riding over it were excellent. The track and overhead work were in excellent condition, and being lately constructed was modern and up to date. The equipment was new and all that could be desired, and the power station was well constructed and ample for the requirements of the property. Everything seemed all right. On returning to headquarters and asking for the books, it was found that no books had been kept, except a cash account showing daily receipts and expenditures. The receipts appeared all right, so it became necessary to investigate the expenditures. It took some time to audit this part of the accounts, and the audit was particularly disagreeable, because the assistance which was furnished was unintelligent, and in addition was grudgingly given. After an audit had been made it was found that the expenses as reported covered only the labor and fuel cost of operating the cars and the power station. When to this were added extremely low amounts covering cost of maintenance of track, equipment and power station, the net earnings were materially reduced. When from this taxes and interest were deducted, net earnings approached the vanishing point. When in addition a sum was figured which when set aside and capitalized at the same rate of interest as paid by the bonds would retire the bonds within the limits of the franchise under which the property was built a deficit was shown. The final result was that the bonds were not sold, and I believe the owners, the gentlemen who first furnished the money, still have them. If, in this case, the financial backers of the enterprise had been as careful in having the accounts of their electric road properly kept, as they are the accounts of their banks, they would have been in better position to have placed securities and would not have destroyed their individual reputation as good business men with a large New York bank.

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It is very curious that a tunnel third-rail contact carrying a heavy current requires to be used under heavy electric load, in order to operate sparklessly. Such is the undoubted fact. A third-rail unused for forty-eight hours sparks and sputters for the first few trips, and then settles down to satisfactory operation. This would naturally be accounted for by the presumption that rust and foreign material had accumulated and was thus removed, and even if the rail appeared bright, at the beginning of the experiment, one would be still inclined to adhere to this idea. A third-rail engineer, however, contributes this piece of information, which certainly gives rise to some further speculation: A tunnel is equipped with two tracks and two third-rails. Regular service demands that the locomotives pull heavy trains over one track and return light over the other. Both third rails obviously get equal mechanical cleaning. In fact, they look clean and exactly alike, yet when, through some exigency of traffic, the locomotive is required to pull a load over the tracks on which it commonly operates light, the attempt is accompanied by most formidable sparks and arcs which do not cease till repeated heavy trips have been made. It is not a matter of shoes, because the locomotive in question has ample opportunity, in its regular work, to use all of its shoes under heavy load. This would seem to indicate some curious virtue imparted to the third-rail by the heavy current-carrying shoe and not by an idle shoe. Simple inspection does not suffice to explain the phenomenon, and complex investigation is yet to be heard from.

The Aurora, Elgin & Chicago Railway opened for traffic Aug. 25, an event which is believed by many to mark the beginning of a new epoch in electric railway history, because of the high-schedule speeds that will be made, which are far in excess of anything of the kind heretofore attempted by either electric or steam roads, number of stops being considered. Owing to the newness of the roadbed and the necessity of letting it settle thoroughly before attempting high speeds, the officers have wisely decided to work up to fast schedules gradually, and the 34.5 miles between Fifty-Second Avenue in Chicago and Aurora, including all stops, and the entrance of Aurora, is made in the modest (?) time of 1¼ hours, or 27.6 miles per hour. To be sure, this is faster than any other steam or electric road schedule in existence to-day, all things considered, but the management has purchased the equipment and built the road for much faster time than this. From the preliminary runs, before the opening of the road, the reports of those connected with the company are all enthusiastic as to the ability of the road to make the fastest schedules contemplated. Later it is hoped and expected that experiments will be conducted on the line to determine what factors enter into electric railroading at speeds of 80 miles per hour and over. Tests of these kinds and on a roadbed so good as that possessed by the Aurora, Elgin & Chicago, would go far toward settling many of the knotty points in the present problem of high-speed railroading. However, the real point of interest in the new road is the fact of its being the first of a class of roads different from previous attempts to give suburban rapid transit service in the neighborhood of a great city, a type which it is to be hoped will multiply in the next five years, until the suburbs are set free from the necessity of patronizing infrequent steam trains, and another important victory for electric traction shall have been secured.

In the early days of electric railroading the motor was undeniably rather a frail machine, and was liable to develop weakness in its winding or commutator or some mechanical trouble that put the car out of service until the trouble was repaired. Modern methods of insulation and construction have pretty nearly overcome all of these early defects, and, with the exception of the commutator, there is nothing, so far as the motor itself is concerned, to prevent an increase of the normal working voltage on trolley lines considerably above the 500-volt limit, where it has so continuously stuck. The fact, however, that while

commutator troubles have not entirely disappeared, they are at least now under reasonable control, marks the present as a date when it is interesting to speculate whether higher pressures at the car motors, or certainly on the line, are not going to find favor.

The trolley wheel and controller contacts have done nobly. Indeed, it is marvelous how much current they seem to be able to collect and transmit without material injury, but in these days of heavy interurban railroading, and even trunk-line traction, these overworked and faithful auxiliaries are going to join hands with the copper market, and call a halt to the cry for more current. The natural solution is current at more pressure, but how? Are we to use motors in series and 1000 volts on the trolley wire? The difficulties in the way are certainly serious enough to make one hesitate about saying "yes" without thinking seriously what this plan involves. To be sure, this arrangement enables the present dynamo-electric equipment, both on the car and at the power house, to be used; in fact, they must be used until some ingenious designer produces 1000-volt commutators of large current capacity. But how about the controller and the car wiring? The present controller, with a 1000-volt service, would need reinforced insulation and a stiffer blow-out. A new design would be very much better, perhaps absolutely necessary. Then the fuse, the wooden fuse box and lightning arrester, the soft rubber motor bushings, the motor windings, the mud and water, all combine to make one incline to draw aside and let the other fellow try first. Not only this, but four motors would always be necessary for double equipment, for to run home with one motor on 1000 volts when disaster overtakes the other seems impractical, to say the least. The outlook is not encouraging, and yet those who would preserve the direct-current system, and we venture to believe there are many such, must consider this problem of higher-pressure equipments, for our alternating-current friends have solved this part of the problem better than the direct-current engineer can ever hope to do. There are some expedients, however, which will be very helpful to anyone who is bold enough to tackle the problem. One of these is to put both armatures to line and insulate them for it, reserving the adjacent ground circuit position for the fields which will then be very unlikely to ground against the motor casing. The rheostat and controller could also come on the ground side, and an automatic hood switch worked by the controller could cut the armatures clear when a stop was made. These little devices would render the controller, the fields, rheostat and 90 per cent of the car wiring less than 500 volts above the ground at all times, and therefore practically as secure as at present. Multiplying two series of motors might call for some more automatic work to confine the high voltage wiring to a system of small extent. Finally, the transfer of the car wiring above the floor would probably be advisable. In fact, we believe that the technical staff of any of the large companies could get together and accomplish the results, not only practically, but commercially. It comprises a general reinforcement of the entire car equipment, evading the high pressure where possible and insulating against it when not. The reward is a 75 per cent saving in the copper line, and that saving in these days of interurban and trunk-line work means much; in fact, so much that the problem is worthy of serious consideration.

A Study of Train Resistances

Owing to the practice of the British Institution of Civil Engineers, the official report of a paper presented before that important body, with the accompanying discussion, is not issued for a number of months after the meeting. It is through this custom that the complete treatise of J. A. F. Aspinall, on the subject of train resistance, and the accompanying discussion, which was presented before that association, some time ago, have just become available. Dealing, as the paper does, with English track and rolling stock, it inevitably leads to results not rigidly comparable with those obtained under American conditions, but it is singularly rich in experimental results obtained at high speeds—from 60 miles to 80 miles per hour—and it is, therefore, peculiarly valuable in dealing with modern conditions. Particular attention was paid to the subject of air resistances, and in the discussion which followed, a large amount of valuable information was added to the original paper. For many years the train-resistance formulæ of Searles and of Wellington were held to represent the sum of human knowledge of the subject, and subsequent experiments were adjudged good or bad according as they did or did not agree with one or the other of these authorities. They could not well agree with both! Occasionally, Clark's formulæ were also cited, but, as they apply to the track and rolling stock of more than half a century ago, even the most conservative and hide-bound of engineers would hardly look upon them as final. As we have, heretofore, flatly stated, Searles and Wellington to-day have long stood discredited upon the facts, at least above the most moderate way train speeds, and we must look for guidance to later experiments, dealing with modern equipments and high speeds. From this point of view the results obtained by the Baldwin Locomotive Company, Barnes, and Sinclair, are of primary value as based upon recent American conditions, and now comes Aspinall substantially confirming these, and, what is of still greater importance, indicating something of the causes which produce variations in the resistances found by various experimenters.

The vital point in the matter of train resistance is not whether the formula that is written around the experimental results contains the first, second, or some fractional power of the speed, but whether the total resistance of a train at, say, 80 miles per hour, is twenty-odd or forty-odd pounds per ton. We need not squabble over variations of 10 or 20 per cent, when the question really at stake is the possibility or impossibility of operating at very high speeds with practicable amounts of power at the driving wheels.

On this point, the experiments of Aspinall should be regarded as decisive, irrespective of what others have done. His final results indicate a resistance of from 28 lbs. to 22 lbs. per ton for 80 miles per hour, as the train was lengthened from 6 to 21 cars. These were, of course, English cars, shorter and lighter than our own, but mounted on bogie trucks in the manner customary here. His formula for the general train, its length being taken into consideration, was

$$R = 2.5 + \frac{V^{\frac{5}{3}}}{50.8 + .0278\ L}$$

This is a little out of the ordinary in containing a fractional power of V, and the constant term is notably small. The effect of air pressure was investigated with most unusual care, by means of recording ammeters and pressure gages, and the value finally reached was $r = 0.003 V^2$, which was considered rather too large by several of the distinguished engineers who participated in the discussion. It is, however, in wonderfully close agreement with the results reached in the Zossen tests and contributed to the discussion by Mr. Siemens, who was present. Aspinall's formula gives results materially larger than those of Barnes, Vaulain and Sinclair, but, on the other hand, very much smaller than those of the older and some more recent investigators. It is notable, in this connection, that every one of the tests at speeds of 70 miles per hour and upward has given relatively small values of the train resistance, while the large ones have uniformly been derived by a process of extrapolation from experiments never carried up to the speeds now under discussion. Every time a careful series of runs has been made at 70 miles to 80 miles per hour, it has shown less tractive resistances than had been foretold for it, and, even in these experiments of Aspinall's, it is curious to note that while the formula seems correctly to represent the curve of averages as a whole, ten out of the fourteen runs made above 70 miles per hour give results materially less than the formula. In fact, above 75 miles per hour two runs agree with the formula, and the only other two fall to 20 lbs. per ton, in spite of a rising gradient.

We do not believe that any regular curve can satisfy the experiments in a matter involving so many variables as train resistance. It would be far sounder policy to use one formula up to, say, 50 miles per hour and another at the higher speeds. In Aspinall's experiments the failure of a formula representing single curvature is very noticeable, and there are strong indications of a lessened slope at the higher speeds. This, of course, does not show anything of the shape of the curve beyond the limits of the experiments, but it lends weight to a contention which we have more than once expressed, that tractive resistance is not a smoothly increasing quantity, but is subject, like the resistance of ships, to maxima and minima following no law yet discovered. But to follow up Aspinall's paper —it is remarkable that even at 80 miles per hour he finds that half the total resistance is due to miscellaneous causes other than air pressure and axle friction. The composition of this miscellaneous resistance is very uncertain, but it is assuredly a matter of the greatest importance. During the discussion, two factors of this resistance were disclosed with great clearness. First came the familiar matter of rail flexure, by which the wheels are, as it were, on a perpetual rising gradient. This gradient was estimated roughly by Mr. Mallock as between 1 in 250 and 1 in 400. In this country, Dr. Dudley has found a considerable decrease in tractive effort due to the use of stiffer rails, and there seems little doubt that the flexure effect is considerable. Sir Frederick Bramwell added the important observation that this effect would be considerably modified by the resilience of the rail and the speed of the train, so that at high speed the effect would be lessened.

An even more suggestive point was raised by Prof. Carus-Wilson, in the imperfect guiding of the bogie trucks producing large flange friction and a constant effort to pull the trucks back into line. He added that the weight of the bogie was not an unimportant factor in this resistance, and suggested that perhaps the large tractive resistance obtained from some electrically-driven trains might well be due to the large added weight carried on the trucks. In such case, and, in fact, in all tractive experiments, there would be a factor of resistance depending not on the weight of the cars, as a whole, but upon the weight of the trucks alone and upon their wheel-base. We may add that the speed would also enter this particular question probably in a rather complicated manner. Flange friction due to cross wind must also be taken into account among the miscellaneous resistances, and this may help to account for some of the discrepancies always found in experiments on traction. Whatever may be the various factors that go to make up these miscellaneous resistances, their aggregate amount is great enough to cut no small figure in the total, and to give an important opportunity for making improvements. As to other resistances, Aspinall made a thorough study of the direction of the air currents about the train, and reached the interesting result that the air envelope carried by the train was very thin, and that of the surrounding air currents, even that on the leeward side of the train, showed a strong swirl inward, while the reduction of pressure at the rear of the train is rather less than is generally supposed. Altogether this research of Mr. Aspinall's is a most valuable addition to our knowledge of a very complicated and troublesome subject. The work of the past few years has done much to throw light upon it, but there is still great uncertainty about some of the details. We may now feel tolerably sure that the total of train resistance at 80 miles per hour or so is for trains of moderate length, materially less than 30 lbs. per ton, with our heavy vestibuled cars probably not over two-thirds of that amount. The value of air resistance seems, likewise, to be pretty thoroughly settled as not exceeding $0.003 V^2$, and probably nearer $0.0026 V^2$, the theoretical value. The axle friction, according to Mr. Aspinall's results, is nearly uniform, but has a weak minimum at about 40 miles per hour, and then slowly rises. The miscellaneous elements of resistance seem to rise slowly with the speed, and are probably capable of considerable reduction by proper attention to the track and the trucks. All the recent experiments show the desirability of giving the train a smooth surface, and pointing at least the front in a roughly parabolic form, whatever the driving power adopted. We shall be greatly interested in the results obtained from the special locomotive and train now under construction in Germany, as showing the capabilities of steam when skilfully applied, as against the electric cars tested at Zossen. But whatever the issue of this particular competitive struggle, the fact remains that, taking into account the work of the last few years, of which this research of Mr. Aspinall's is an admirable example, it has been, in our opinion, effectively demonstrated that very high railway speeds are entirely practicable, so far as the engineering side of the problem is concerned. High speed, like high voltage, is little to be feared on the score of practicability. The difficulties are far more commercial than technical, and when the public really wants to ride at a hundred miles an hour there is little doubt that it can readily be accommodated, and that at short notice.

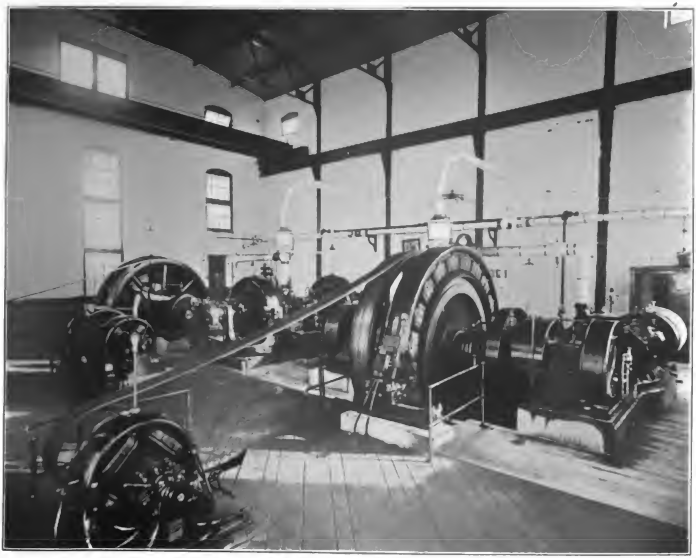
An Important Interurban Road in Southern Ohio

The Dayton & Northern Traction Company's interurban road connects Dayton and Greenville, Ohio, and is 39.5 miles long. At the present time, cars do not operate into the business center of Dayton, as the bridge across the Miami River is not sufficiently strong for interurban cars, but a new and stronger one is about to be constructed, and the interurban cars will then pass through the business portion to a central point, where connection will be made with all the electric interurban lines radiating from Dayton.

The towns and villages, exclusive of the terminal points, through which the road passes, are Salem, Brookville, Dodson, Bachman, Wengerlawn, West Baltimore, Gordon, Ithaca, Arcanum and Jaysville. None of these towns is large, but a satisfactory return is secured from the passenger service, and an exceptional and unexpectedly large package freight business has been developed. They are mainly agricultural centers, and the country tributary to them is rich and highly cultivated.

The route selected, exclusive of the towns, is principally over private right of way and adjacent to the highway. In towns the greater portion is through the streets, but here, too, some portions are on private right of way. Owing to the contingencies of the case, resulting from the necessity of obtaining rights of way and the requirements of business, the road contains quite a number of curves; and, in the twelve miles nearest Dayton there are also several grades. The balance of the road, however, is comparatively level.

The rail is 70-lb., 30-ft. T-rail, except in Greenville, where 70-lb. girder rail is used. The ties are oak, 6 in. x 6 in. x 8 ft., and gravel ballast is used, 1500 yards to the mile. The grading and brickwork was started by a Dayton contractor, and was completed by the Chase Construction Company, of Detroit, which was also the contractor for the line work. The bridges are small and few in number. All are iron girders, and some of the culverts are quite large brick or stone arches.



ENGINE ROOM IN POWER PLANT AT BROOKVILLE, SHOWING BELTED EXCITER AND DIFFERENTIAL BOOSTER FOR STORAGE BATTERY

ROLLING STOCK

There are at present in operation six passenger and two combination passenger and express cars, built by the Barney & Smith Car Company, each seating forty-six passengers, and being 44½ ft. long over the vestibules. These cars are mounted on two four-wheel pivoted trucks having a wheel base of 6 ft. Each car is provided with four 50-hp Lorain Steel Company motors. The cars are heated by electricity, and are equipped with air brakes of the Christensen Engineering Company's storage air type. The seats are of the Barney & Smith standard make, reversible and covered with Pantasote. Wagenhall's arc headlights are used, and Providence fenders. As cars can

not, as yet, be turned at the Dayton end, it was necessary to make them double-ended. Later, one controller and trolley pole will be taken off.

In addition there are one motor freight car, 42 ft. over all, having the same motor equipment as the passenger cars, and a few flat cars. The freight car has a top platform for line repair work and a standard steam railway coupler for hauling steam-road cars. These features are shown clearly in the cut of the car house, before which a passenger and freight car are standing.

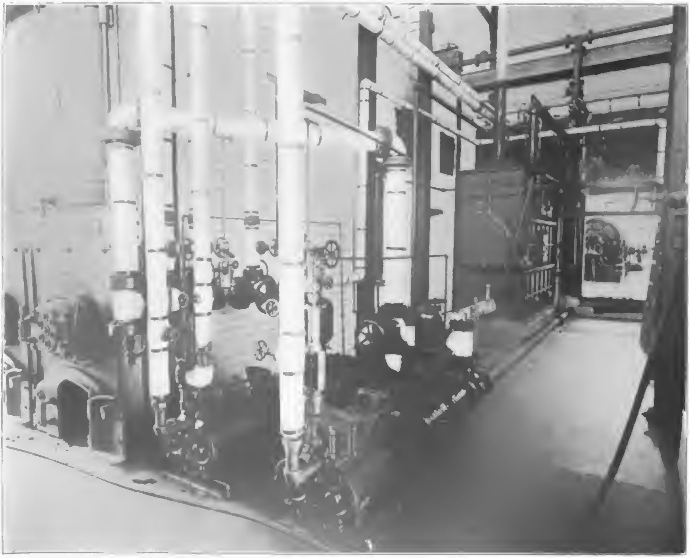
CAR SHEDS, SHOWING FREIGHT CAR WITH TOP PLATFORM FOR LINE REPAIR WORK

The passenger car schedule necessitates, on some portions of the road, a speed of from forty-five to fifty miles an hour.

POWER PLANT

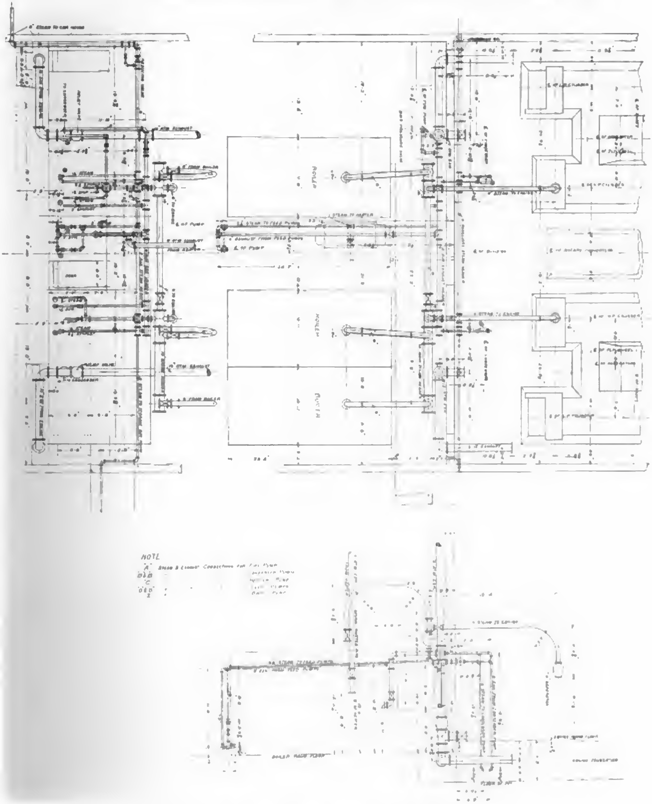
The power house is located in Brookville, approximately 13½ miles from the Dayton end of the road; and a sub-station is located at Arcanum, approximately 12 miles from the Greenville end of the road, three-phase transmission being used from the power house to the sub-station. The distances of the power house and sub-station respectively from the ends of the road are somewhat greater than would have been the case if it were not for local conditions, the power house location being fixed by the water supply, while the sub-station location was determined largely by the fact that at Arcanum it would be necessary, in any case, to have a freight and passenger station, and if the sub-station were not located at the same point, the additional salaries would more than offset the interest on the additional feeder required. This, therefore, is one of the numerous cases where the consideration of all the conditions materially affected a design based on purely engineering factors.

Steam is generated by three Caball horizontal water-



BOILER ROOM, SHOWING FEED PUMPS AND HEATER

tube boilers, of 260 hp each, with Tupper grates. There are two 14½ ins. x 28½ ins. x 30 ins. cross-compound condensing Buckeye engines, with reheating receivers, rated at 400 hp at 150 r. p. m., direct-connected to the generators. Sorge chemical purifying system, and with quartz filters, one 8 x 3½ x 8 compound Ingersoll-Sergeant air compressor, with duplex air cylinders, 8 ins. x 8 ins. The pumps and condensers are of Smith-Vaile make.



PLAN, SIDE AND END ELEVATIONS OF STEAM AND EXHAUST PIPING

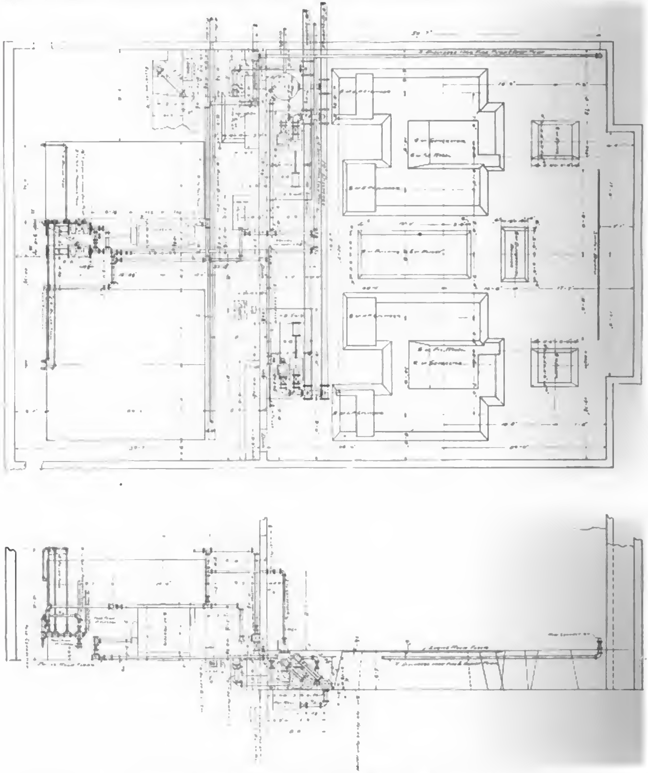
The auxiliary apparatus consists of two 9½ ins. x 16 ins. x 18 ins. jet condensers, one 6 ins. x 6 ins. x 10 ins. duplex heater pump, two 7 ins. x 4½ ins. x 10 ins. plunger type feed pumps, one automatic pump and receiver to drain live steam mains, one 16 ins. x 9 ins. x 12 ins. duplex fire pump, one 1200 hp Cochran feed-water heater, fitted with the

The piping and all auxiliary machinery, except the air compressor, was contracted for and installed by Ware & Moodie, of Dayton, Ohio. All live steam lines and high-pressure feed lines are of extra heavy pipe and fittings, and all of the large high-pressure gate valves are of the by-pass type.

Cross connections and valves are so placed that more than one piece of machinery would have to be disabled before the economical operation of the plant would be affected, and it would require a very serious mishap to cripple the plant to such an extent as to prevent the operation of cars.

Water is obtained mainly from wells, and, to a slight well, and enough is allowed to pass from the reservoir to the cold well to make up the deficiency of supply on the part of the well. When the plant is not in operation the water in the well is not far below the surface of the ground, and the amount which the well supplies varies with the seasons.

With the exception of the differential boosters for the



PLAN AND SIDE ELEVATIONS OF FEED WATER PIPING AND FOUNDATIONS

degree, from a stream. The latter is dammed and forms a reservoir, and there is also a deep well. Over a portion of the reservoir are placed cooling trays. The water from the condensers passes first to the cooling trays, next to the reservoir, and thence to the deep well, which is also a cold

batteries, the Westinghouse Electric & Manufacturing Company installed the complete electrical equipment in the power house and sub-station, consisting of two 250-kw three-phase alternators, revolving field type, direct-connected to the engines, and making 150 r. p. m. There

are two 22½-kw exciters belted to the engines, each having sufficient capacity for exciting both alternators, two 100-kw rotary converters, the direct-current voltage being 650, and each is equipped with an induction starting

BOILER ROOM WITH COAL BINS ENCLOSED

motor. There are also four 75-kw, step-up transformers, 10,000 to 11,000 volts, one of these being held as reserve.

Both the first sub-station, in the power house at Brookville, and the second one, on the line at Arcanum, are equipped with Chloride accumulators. The object of these

STORAGE BATTERY PLANT IN SUB-STATION

batteries is to take the fluctuations caused by the varying load of the cars, allowing a steady load to be supplied by the rotaries, and consequently by the generators. The equipment in each case consists of 312 cells, type G-11, of the standard Chloride accumulator, installed in lead-lined tanks of type G-13. Each battery is rated to discharge at 400 amps., in regulating the rapid fluctuations, and has a capacity of 800 ampere-hours when discharged at the normal rate. Each is controlled by a differentially-wound booster, designed to charge and discharge the battery automatically, as the demand increases or diminishes. By a special interlocking device, the motor circuit-breaker

POWER HOUSE AT BROOKVILLE

can not open without tripping the battery circuit-breaker, thus insuring the safety of the booster. By means of a special double-pole, double-throw rocker switch, the battery may be thrown directly across the line without the booster; or the booster may be connected up as a single-charging booster; or, again, the entire outfit may be thrown across the line for automatic regulation.

The power-house switchboard contains twelve panels. There are two alternating-current generator panels, two alternating-current and two direct-current rotary panels, a total output panel, one lighting panel, two feeder panels, and two storage-battery panels.

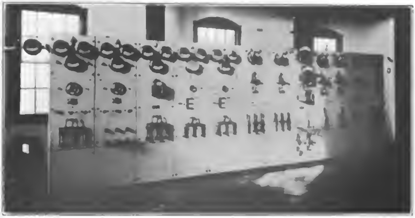
The machinery mentioned is placed in a power house 107 ft. long x 66 ft. wide, containing two rooms, a boiler room, 51 ft. x 60 ft., and an engine room, 50 ft. x 60 ft., each covered by a steel-trussed roof. There is a clear space of 29 ft. 3 ins. above the floor in the engine room. A 30-ton two-trolley traveling crane built by Chisholm & Moore, 48½ ft. long, is provided, and can be operated over the full width of the engine room. On one side of the engine room is built a static transformer room, 18 ft. x

18 ft., and on the same side stands the brick stack, 150 ft. high. The outside of the stack is square in section, tapering from 14 ft. at the base to 9 ft. at the top, and it provides a circular smoke passage 6 ft. in diameter. The

SUB-STATION, FREIGHT HOUSE AND AGENT'S RESIDENCE

power house is connected by a covered passage-way to a specially constructed storage-battery building, which contains a single well-ventilated and lighted room, 77 ft. x 29 ft. x 10 ft. high.

TYPICAL OVERHEAD CONSTRUCTION



12-PANEL SWITCHBOARD IN POWER PLANT

TRANSMISSION SYSTEM

As already mentioned, there are two sub-stations, one in the power house and one at Arcanum, 15 miles distant. Each contains two converters and a storage battery, delivering direct current at 650 volts. Three-phase current at 10,000 volts is transmitted to Arcanum over three bare aluminum wires of No. 00 B. & S. gage.

A bare aluminum feeder cable of 477,000 circ. mils extends the whole length of the line within 1 mile of each terminus. In addition, there is one 6-mile and one 12-mile cable, of the same size, extending from the power house toward Dayton,

SUB-STATIONS AND CAR HOUSES

The Arcanum sub-station equipment of rotary converters, static transformers and storage battery is a duplicate of that in the power house. One attendant looks after all the apparatus in this sub-station and attends to the ticket office and freight. The building at Arcanum is a handsome structure, the front being two stories high by 56 ft. wide, and containing a ticket office and waiting-room, and the living apartments of the station attendant and his family. The rear portion contains a static transformer room, a room for the two converters and switchboard, and a large storage-battery room, 44 ft. x 26 ft.

The car house, located near the power house, is 162 ft. x 76 ft., and is divided longitudinally into two sections by a brick wall. One section, 52 ft. wide, contains four tracks, and has a storage capacity for twelve cars. Each track is provided with an inspection pit. The other portion of the building, 20 ft. wide, contains a machine shop, repair pit and office room.

ROTARY AND SWITCHBOARD IN SUB-STATION

and one 6-mile cable from the Arcanum sub-station toward Greenville, making, in all, 61.5 miles of aluminum cable. Two figure 8, No. 00 trolley wires are used, thus avoiding all switches and crossovers, and providing a duplicate line, so that one can be used in case the other breaks. These wires are suspended from the Richmond type of bracket, except in towns where cross suspension is provided. Thirty-five ft. poles spaced 100 ft. carry the transmission system, and also two telephone wires supported one above the other on brackets. Each car is provided with a complete telephone set, so that communication with the power house or train despatcher is possible at any time from any point on the line.

FREIGHT AND EXPRESS

One freight car is constantly in use. It makes two round trips daily, but this is not now sufficient for the business. The minimum charge is 7 cents per cwt. For the convenience of patrons the company's agents are authorized to use the private telephone line in ordering goods of any kind from merchants in Dayton, thereby saving long-distance tolls, and insuring quick delivery.

DAYTON AND NORTHERN

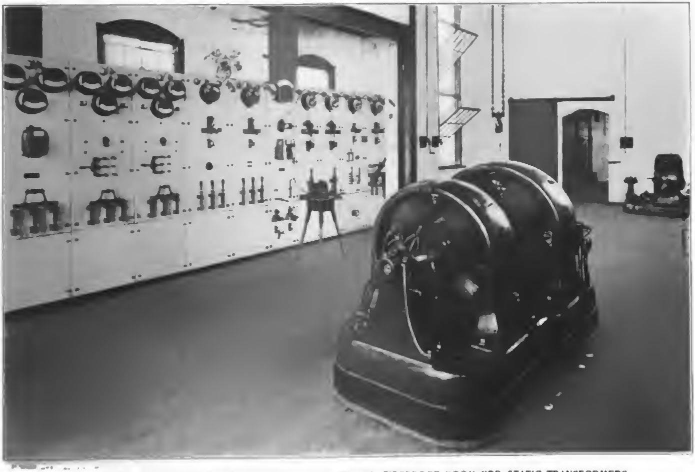
IN EFFECT APRIL 1, 1902

Cars leave Dayton Main Street River Bridge every hour from 6:00 a. m. till 11:00 p. m., making following points:

Miles	Stations	Single Fare	Round Trip
3	Fairview	$0.05	$0.10
8	Haines Station	.10	.20
10	Taylorsburgh	.10	.20
13	Salem	.15	.25
16	Brookville	.20	.35
18	Dodson	.25	.45
19	Bachman	.30	.50
20	Wengerlawn	.30	.50
22	W. Baltimore	.35	.60
25	Gordon	40	.65
27	Ithaca	.40	.70
31	Arcanum	.45	.75
35	Abbottsville	.50	.85
36	Jaysville	.55	.90
43	Greenville	.60	1.00

Freight car leaves at 7:30 a. m. and 1:30 p. m. All kinds of freight and express carried.

10.00 p. m. last car for Greenville.



INTERIOR OF SUB STATION, SWITCHBOARD, BOOSTER AND FIREPROOF ROOM FOR STATIC TRANSFORMERS

At Dayton, Brookville, Arcanum and Greenville, freight and passenger stations are provided, and at the other towns trucks are furnished for taking the freight to and from the road.

PASSENGER SERVICE

Cars are operated on hourly and at times during the summer on half-hourly schedule, and the run of approximately two miles in Dayton and 39.5 miles on the tracks of the Interurban Company, is made in 1 hr. 55 min. The schedule given. Owing to the curves and grades on some portions, it is necessary to make high speed wherever possible, in order to secure a fair average.

11:00 p. m. to Brookville only.

Connection made at Greenville with Panhandle and Cincinnati Northern.

Connection at Arcanum with Big 4.

9:00 p. m. last car from Greenville for Dayton.

10 and 11 p. m. from Greenville to Brookville only.

The entire length of road practically parallels the Dayton & Union steam road, on which is operated six trains each way every day, making a regular charge at the same rates as the Dayton & Northern, with special rates for special occasions. Nevertheless, the result has been most satisfactory to the electric road which, it is claimed, obtains 90 per cent of the business.

RECORDS OF TESTS OF PASSENGER CAR

A very complete test of the equipment has been made by E. P. Roberts & Co., of Cleveland, and the results have been tabulated, and are here presented in convenient form.

The records obtained were voltage and current at car, recording wattmeter readings between specified points on the road, and speed. Without a careful comparison of these with the map and profile, and stops, the individual figures have no value; therefore, only a few general results are given.

Oct. 6, 1901. Car number, 125.

Total weight, approximately, 25 tons.

Weather, clear and dry.

TABLE I

SUMMARY OF RESULTS

Location	Dist. Miles	Time Min.	Schedule Speed Mile per Hour	Watt Hrs.	Kw Hrs. per Car Mile
Powar house to Salem	3.79	11	20.7	8,400	2.21
Salem to Haines (R. R. crossing)	5.02	14	21.5	8,600	1.71
Haines (R. R. crossing) to Dayton circuit	4.95	16	18.5	11,400	2.30
St. Railway into Dayton depot	....	7	....	1,500	....
Dayton depot to D. & N. T. Co.'s power	....	6	....	5,100	....
D. & N. T. Co.'s Circuit to Haines (R. R. cross'g)	4.95	19	15.6	13,200	2.67
Haines (R. R. crossing) to Salem	5.02	16	18.8	13,800	2.75
Salem to Power House (Brookville)	3.79	11	20.7	9,600	2.53
P. H. (Brookville) to Wengerlawn	3.45	8	25.9	7,800	2.26
Wengerlawn to W. Baltimore	2.44	5	29.3	4,200	1.72
W. Baltimore to Gordon	2.35	7	20.1	4,200	1.79
Gordon to Sub-station (Arcanum)	6.20	17	21.8	12,000	1.91
Sub-station (Arcanum) to Fair Ground	9.87	27	21.9	22,800	2.28
Fair Ground to Greenville end	1.46	11	8.0	5,400	3.70
Greenville end to Sub-station (Arcanum)	11.39	29	23.4	24,600	2.17
Sub-station (Arcanum) to Gordon	6.20	19	19.6	10,500	1.70
Gordon to W. Baltimore	2.35	7	20.1	3,000	1.28
W. Baltimore to Wengerlawn	2.14	5	29.3	4,500	1.84
Wengerlawn to P. H. Brookville	3.45	8	25.9	6,900	2.00
Dayton to Greenville	39.53	121	19.6	93,000	2.35
Greenville to Dayton	39.53	109	21.8	78,000	1.97
Total run (on D. & N. T. Co.'s circuit)	79.06	230	20.6	171,000	2.16
Total in Dayton	....	13	....	....	....
Total lay overs	....	247	....	....	....
Total time out	....	490	....	....	....

The heaviest grades and sharpest curves are between Dayton and Brookville. Greenville is higher in elevation (260 ft.) than Dayton. The instruments used were a recording wattmeter, made by the General Electric Company especially for E. P. Roberts & Co., and a Weston voltmeter and a Weston ammeter.

TABLE II

PASSENGER CAR TESTS. HEATING AND LIGHTING NOT INCLUDED.

Location	Miles	Time Min.	Kw Hrs.	Schedule Speed Mi. per Hour	Kw Hrs. per Car Mile
Car House to Dayton, 1st trip	13.76	30	27.6	27.5	2.00
" " 2d "	13.76	35	26.4	23.6	1.92
" " 3d "	13.76	38	26.4	21.2	1.92
" " 4th "	13.76	43	25.2	19.2	1.83
" " 5th "	13.76	40	28.8	20.6	2.09
" " 6th "	13.76	33	24.0	25.0	1.74
" " Average	13.76	37	26.4	22.3	1.92
Dayton to Car House, 1st trip	13.76	37	31.2	22.3	2.27
" " 2d "	13.76	42	37.2	19.6	2.70
" " 3d "	13.76	42	33.0	19.6	2.40
" " 4th "	13.76	43	27.6	19.2	2.00
" " 5th "	13.76	37	28.8	22.3	2.10
" " 6th "	13.76	38	29.4	21.7	2.14
" " Average	13.76	40	31.3	20.7	2.27
Car House to Greenville, 1st trip	25.77	75	52.8	20.6	2.05
" " 2d "	25.77	65	43.2	23.8	1.68
" " 3d "	25.77	80	47.4	19.3	1.84
" " 4th "	25.77	85	50.4	18.2	1.96
" " 5th "	25.77	66	43.2	23.4	1.70
" " 6th "	25.77	65	51.0	23.8	1.98
" " Average	25.77	75	48.1	21.3	1.87
Greenville to Car House, 1st trip	25.77	70	50.4	22.0	1.96
" " 2d "	25.77	74	56.8	20.9	2.22
" " 3d "	25.77	81	43.8	19.1	1.70
" " 4th "	25.77	70	44.4	22.0	1.72
" " 5th "	25.77	75	51.0	20.6	2.10
" " 6th "	25.77	72	49.8	21.5	1.91
" " Average	25.77	74	50.2	21.0	1.95
Average Car House to Dayton and return	27.52	77	57.7	21.6	2.10
Aver. Car House to Greenville and return	51.54	146	95.2	21.1	1.91
Average Dayton to Greenville	39.53	113	79.1	21.0	2.01
Average Greenville to Dayton	39.53	110	76.6	21.6	1.94
Average round trip	79.06	224	156.0	21.3	1.96
Total test runs	474.36	1,337	936.0	21.3	1.98
Total run (in Dayton)	....	...	36.0	....	....

Current used for heating and lighting is not included in the car tests (Table II.) where measurements were made at the car.

Same car—Dec. 12 and 13, 1901.

Dec. 12—Average temperature was above freezing and track dry, but snow on ground.

Dec. 13—Temperature high, requiring no heat on cars during the day. Track dry, but ground soft from thaw of snow. Strong wind from southwest.

Total run of six round trips equals 474.36 miles.

TESTS OF FREIGHT CAR

Weight of car and equipment, 23.5 tons.

Gearing, same as passenger car, approximately 45 miles per hour on level, 500 volts.

Running speed slower than passenger car, because of long stops.

Dec. 14, Saturday—Snow storm, but snow not above rail.

Dec. 16, Monday—Very cold and snow not to top of rail.

Dec. 17, Tuesday—Very cold and snow not to top of rail.

Dec. 18, Wednesday—Very cold and snow not to top of rail.

TABLE III

SUMMARY OF RESULTS ON TEST OF FREIGHT CAR No. 105

No. of Run	Location	Miles	Kw Hours	Kw Hrs. per Car Mile
1	Car House to Dayton, 1st trip	13.76	26.4	1.92
7	" " 2d "	"	25.6	1.86
11	" " 3d "	"	20.4	1.48
15	" " 4th "	"	22.8	1.66
20	" " 5th "	"	22.2	1.62
A	" " Average trip	"	24.1	1.73
3	Dayton to Car House, 1st trip	13.76	31.6	2.31
8	" " 2d "	"	32.4	2.36
12	" " 3d "	"	28.3	2.07
16	" " 4th "	"	30.0	2.18
B	" " Average trip	"	30.6	2.23
9	Car House to Greenville, 1st trip	25.77	57.0	2.21
13	" " 2d "	"	43.6	1.77
17	" " 3d "	"	51.2	1.98
C	" " Average trip	"	51.3	1.99
10	Greenville to Car House, 1st trip	25.77	48.8	1.89
14	" " 2d "	"	50.4	1.95
18	" " 3d "	"	48.8	1.89
23	" " 4th "	"	40.8	1.58
D	" " Average trip	"	46.6	1.81
	Average Car House to Dayton and return	27.52	54.9	2.00
	" " Greenville "	51.54	97.9	1.90
	" Dayton to Greenville	39.53	85.7	2.07
	" Greenville to Dayton	39.53	70.7	1.79
	" Round trip	79.06	156.4	1.98
	Total test runs	384.10	774.8	2.03

The following records were kindly furnished by J. E. Feight, superintendent of the road:

TABLE IV

POWER OUTPUT IN REGULAR SERVICE IN KW HOURS

1902	A. C.	D. C.			Average per Hour			
					A. C.	D. C.		
		P. H.	S. S.	Total		P. H.	S. S.	Total
July 28	5,000	1,980	2,460	4,840	238	89.5	117.1	206.6
July 29	5,400	1,940	1,700	3,640	257	92.4	81.0	173.4
July 30	5,100	1,940	1,970	3,910	243	92.4	91.0	186.4
July 31	4,900	2,040	1,960	4,000	233	97.1	93.4	190.5
August 1	5,300	1,910	2,090	4,000	253	91.0	99.5	190.5
August 2	5,800	1,990	1,720	3,710	276	94.8	82.0	176.8
Average	5,250	1,950	1,983	3,933	250	92.0	94.4	187.3

This amount is somewhat less than the average of the results of the tests of E. P. Roberts & Co., and it is possible that the car-mileage, as given, is slightly high. On the other hand, the track was much better than at the time of E. P. Roberts & Co.'s tests, and also when their

tests were made the trucks and motors were new, and the friction may have been greater. The ratio of alternating current to direct current is practically as obtained by E. P. Roberts & Co., and as hereafter referred to.

POWER HOUSE AND SUB-STATION TESTS

Oct. 5, 1901, a complete efficiency test was made by E. P. Roberts & Company.

The steam plant tests gave no results of special interest. The engine operated at 10 per cent overload, the vacuum was low, as the cooling trays had not been installed, and the result obtained, corrected for moisture and low vacuum, was 16.3 lbs. of dry steam per indicated horse-power. The receiver reheater of the engine tested was not in satisfactory operation at the time of test. The friction of engine and generator, direct-connected, and of the exciter belted to the engine fly-wheel, was 9 per cent of the rated indicated horse-power.

In December, 1901, the following test was made for coal per kilowatt—alternating current—the kilowatts being as stated in Table VI.

The fuel was very wet and was high in volatile matter, and low in heat units, and the fireman did not handle it properly. This test showed that materially better results than were reported at the time of the efficiency test were readily obtainable by coking firing with the same coal, or by using better coal.

Reducing the results obtained to an equivalent of coal having 14,000 B. T. U., and boiler and furnace efficiency of 65 per cent, gives for coal (no reduction for ashes, etc.) 3.70 lbs. per kilowatt. Time of test, noon, Thursday, Dec. 12, 1901, to 1:00 a. m., Sunday, Dec. 15. The output in alternating current and direct current during the same period was as follows:

TABLE V.

AVERAGE OUTPUT OF MACHINES

Time	Power House						Sub-station		
	A. C. Output of Generator			D. C. Output of Station			D. C. Output of Station		
	Kw Hours	Hours	Ave. Kw	Kw Hours	Hours	Ave. Kw	Kw Hours	Hours	Ave. Kw
Thursday, Dec. 12—									
12.00 m. to 7.00 p. m....	2,100	7.0	300	848	7.0	121	521	7.0	74
7.00 p. m. to 12.00 p. m.	1,200	5.0	240	530	5.0	106	315	5.0	63
12.00 p. m. to 1.05 a. m..	100	1.0	100	45	1.0	45	0	..	0
12.00 m. to 1.05 a. m...	3,400	13.1	261	1,425	13.1	108	836 / 836	13.1 / *12.0	64 / 70
Friday, Dec. 13—									
1.05 a.m. to 4.30 a.m....	0	3.4	0	0	3.4	0	0	3.4	0
4.30 a.m. to 7.15 a.m....	400	2.8	143	143	2.8	51	377 / 377	2.8 / *1.5	135 / 252
7.15 a.m. to 12.00 m.....	1,600	4.7	340	668	4.7	142	429	4.7	91
12.00 m. to 6.17 p.m....	1,580	6.3	251	682	6.3	108	....		...
12.00 m. to 7.30 p.m....	....	....	...	...	....		947	7.5	126
6.17 p.m. to 12.45 a.m....	1,840	6.5	283	595	6.5	92	....	....	
7.30 p.m. to 12.00 p.m....	....	....	...	....	....	...	260	4.5	58
1.05 a.m. to 12.45 a.m.	5,420	23.3	232	2,088	23.3	90	2,013	24.0	84
Saturday, Dec. 14—									
12.45 a.m. to 5.45 a.m....	570	5.0	114	99	5.0	20	0	5.0	0
5.45 a.m. to 7.15 a.m....	510	1.5	340	132	1.5	88	....	....	...
5.45 a.m. to 12.00 m.....	1,310	6.2	201	809	6.2	135	272	6.2	44
7.15 a.m. to 12.00 m.....	1,100	4.8	229	707	4.8	147	....	....	..
12.00 m. to 12.40 a.m....	3,950	12.7	311	1,677	12.7	132	....	....	...
12.00 m. to 12.00 p.m....	....	....	...	....	....	...	1,441	12.0	120
12.45 a.m. to 12.00 a.m.	6,180	24.9	256	2,615	23.9	109	1,713	23.9 / *18.2	72 / 94
Total, Thursday 12 to 12.40 a. m. Sunday	14,980	60.7 / 57.3	247 / 251	6,125	60.7 / *57.3	101 / 107	4,602	60.7 / *49.2	75 / 93

* Times of actual run of generator or rotaries.

It should not be overlooked that this plant has storage batteries, and that the direct-current output is that given to the line; therefore, the comparison of alternating current and direct current for short periods should not be made, as the batteries are sometimes charging for an hour or more in excess of their output, and at other times far less. This even affects the totals for the day, but the average for the three days probably closely approximates the actual average

TABLE VI.

Efficiency from alternating-current generator ouptput to total direct-current output of both stations, including loss of storage batteries, rotaries, statics and transmission line.

	A. C. Kw Hours of Generator	Total D. C Kw Hours of Rotaries	Efficiency
Thursday, Dec. 12— 12.00 a. to 1.05 a. m.	3,400	2,250	66.4%
Friday, Dec. 13— 1.05 a. m. to 12.45 a. m.	5,420	4.101	75.7%
Saturday, Dec. 14— 12.45 a. m. to 12.40 a. m.	6,180	4,328	70.0%
Total— Thursday 12.00 noon to 12.40 a. m. Sunday	14,960	10,688	71.5%

for longer periods, although the first day's record was probably lower than the average. This is also indicated by the results previously noted, 74.9 for six days' run.

Considering the average efficiency as 74.9 per cent from alternating current to direct-current output of sub-station, the following *assumed* efficiencies would give this result. Possibly none of the assumptions is exactly correct.

The sub-station supplies practically one-half the direct current output, therefore, only one-half the alternating-current energy is transmitted over the high voltage line and through the statics, and at the load as recorded. For the greater portion of the time only one rotary in the sub-station was in operation at approximately its rated load, and the statics at one-half load. At times, however, both rotaries in the power house and in the sub-station were operated. Under these conditions consider the average efficiencies estimated by the engineers as follows:

Storage Battery.—Approximately 20 per cent of the energy was assumed to pass through the battery, and the efficiency was taken at 80 per cent. This gives for efficiency of battery relative to total output, 96 per cent.

Generators.—For short period, two at underload; for other short periods, one at underload; for other short periods, one at overload. Consider average efficiency as 91 per cent.

Rotaries.—Practically same condition as to operation at load and over and under loads, but somewhat longer times; two in either power house or sub-station, and one in the other location, and therefore a longer period of light load. Consider as average efficiency under these conditions 91 per cent.

Transformers.—Transmit one-half of the alternating-current energy, and if their efficiency is taken at 94 per cent, their effect on the total efficiency will be 97 per cent.

Line.—The efficiency of the line is 92 per cent when the load is equal to the rating of both rotaries, but 96 per cent at half load. If it is taken at 95 per cent, the effect on the total efficiency would be 97.5 per cent.

The above assumption then gives:

Battery, 96 per cent.
Generators, 91 per cent.
Rotaries, 91 per cent.
Statics, 97 per cent.
Line, 97 per cent.
Total efficiency, 74.7 per cent; call 75 per cent.

From an inspection of the measurements of voltage and current at the car it is probable that the average energy losses (not voltage losses) do not exceed 25 per cent; voltage losses, 20 per cent. On this basis the percentage of energy delivered to the car equals 75 per cent of 75 per cent, or 56 per cent.

STORAGE BATTERY

Both the first sub-station in the power house at Brookville, and the second one on the line at Arcanum, are

equipped with Chloride accumulators. This equipment has already been described in this article.

A curve taken March 30, 1902, at the Brookville power house, shows that the rotary load did not vary more than some 50 amps to 70 amps, whereas the total station output varied from about 40 amps up to almost 650 amps. The result of removing these fluctuations from the rotaries and generators is a great increase in the economy of operation at the station. Besides improving the economy, however, the battery serves to increase the capacity of the station, in that the average load may be increased to the full rating of the generators and rotaries, leaving the fluctuating load to be carried entirely by the accumulators.

Considerable use was made of these batteries in completing the road. At that time it was deemed inadvisable to operate the plant continuously, and for many days the work car was operated entirely from the two storage batteries.

The effect of the batteries in increasing the capacity of the station is shown by the following:

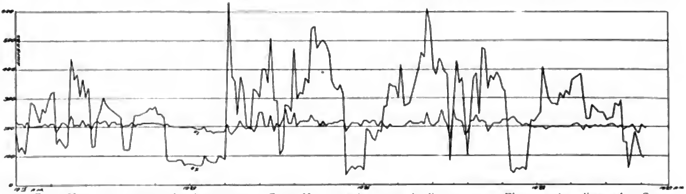
The operation of one engine, generator and one rotary in the power house and one in the sub-station, is sufficient for the operation of four passenger cars and one freight car. One generator is, as stated, 250 kw; each rotary is 100 kws, and the batteries are 400 amps on hourly rating. Therefore, the momentary load permissible without exceeding the rating of the rotaries is: Two rotaries, rating at 154 amps, 308; two batteries at 400 amps, 800; total, 1108. This is available at 650 volts, and equals 720 kws. To obtain the same momentary overload without batteries would require a rotary capacity, taken at 50 per cent momentary overload, equal to 480 kws rated, and generator capacity, at 75 per cent efficiency, between alternating current and direct current, and at 50 per cent over rating at the time of such momentary overload, equal to 640 kws.

Of course, if necessary, the generator and rotaries operating with storage batteries can also be run above rating momentarily, but the percentage increase is comparatively small, because of the preponderance of the battery.

When two generators are in use the difference in momentary capacity is less. For example, with two 250-kw generators, four 100-kw rotaries, at 154 amps, equals 616 amps, and two batteries 800 amps, making a total of 1416 amps, which, at 650 volts, equals 920 kws.

The two rotaries, previously estimated, if 480 kws would give at 50 per cent overload 720 kws, and four, to continue the comparison, 1440 kws, and therefore a greater momentary overload, but doubling the cars not only doubles the average, and this the doubling of generator and rotaries (with batteries) provides for, and doubling the cars does not double the momentary maximum, and therefore the two-generator plant, without batteries, has a greater momentary maximum than is sufficient for doubling the service. This is not intended as an argument in favor of batteries for all plans and under all conditions, but merely a statement, by the engineers, as to their function in this case and their effect on capacity.

Engineering.—The civil engineering was in charge of C. Larue, assisted by E. Carbaugh. The superintendent of the Dayton & Muncie, J. E. Feight, is a trained civil engineer, and co-operated with the civil engineers mentioned. The architects were Peters, Burns & Pretzinger, of Dayton, Albert Pretzinger having the matter especially in charge. The mechanical and electrical engineers were E. P. Roberts & Co., of Cleveland, Ohio.



Curve No. 1, rotary output in direct current. Curve No. 2, station output in direct current. Five-second readings taken Sunday a. m., March 30, 1902.

DIAGRAM SHOWING OUTPUT OF ROTARY AND BROOKFIELD SUB-STATION AND BALANCING EFFECT OF BATTERY

New Conduit Work of the Brussels Tramway Company

The city of Brussels, the capital of Belgium, which, with its many suburbs, has a population of over half a million people, has always been most prominent as a tramway center, and from this city many of the tramways throughout Europe and even Asia and Africa are controlled. At the present time there are some ten or fifteen large tramway investment companies owning tramways throughout Europe, whose headquarters are in Brussels and whose stock is actively quoted on the Brussels stock exchange. The city, in fact, occupies a commanding position in the tramway world second to no other city in Europe. In this respect it has no correspondance with any American city except possibly Philadelphia, the capitalists of which for a long time, and even at the present time, have given special attention to tramway investments all over America and control many of the larger systems. The number of tramway syndicates in Brussels, however, is much larger than in Philadelphia, and their operations are not confined to one country, but they are ready to take up enterprises of this character in practically every country on the globe.

This is one reason why the tramway system of the city of Brussels itself is of peculiar interest. Another is that the city, which is an exceedingly attractive one and contains many fine and large buildings, is located on the side of a hill on which the grades of the streets vary between five and fifteen per cent. The wholesale business district is located at the foot of the hill, but the principal retail business shops and office buildings are on the sides of the hill, while the finest residential portion and the King's palace, and a number of the principal hotels are at the top of the hill. This makes tramway riding almost essential to a large number

of residents and has been the means of developing a large traffic.

Early in the development of electric traction the company installed the trolley system on some of its suburban lines, and in 1897 had 27 or 28 km of double track equipped with electricity. The greater part of this was trolley but on some of the lines within the center of the city, where the trolley was not permitted, a conduit was employed. The trolley lines were installed by the French Thomson-Houston Company while the conduit lines were installed by the Union Elektricitäts-Gesellschaft, both representatives in Europe of the General Electric Company, of New York.

The power for operating the lines is supplied from a direct-current station containing two 400-kw machines, two 250-kw machines and five 100-kw machines, the latter having been installed at the time of the establishment of the first electric lines in 1894. In spite of the fact that the station is small and the transmission circuit has to be divided into two parts for use, respectively, on the conduit

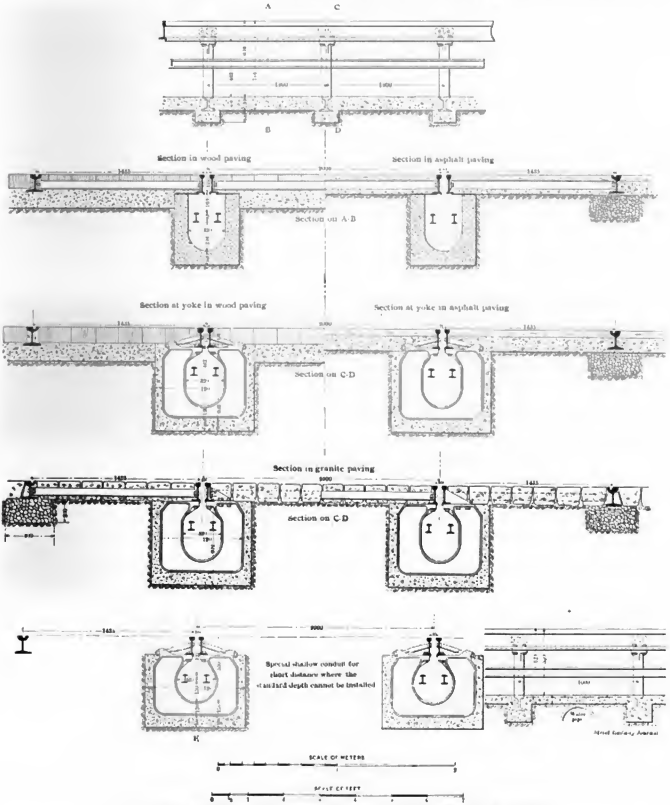


FIG. 1—SECTIONS SHOWING STANDARD CONDUIT CONSTRUCTION USED IN BRUSSELS

and the trolley lines, the economy of the current generation has been very satisfactory and the consumption of coal per kilowatt-hour has varied between 1.7 kg and 1.85 kg (3.74 lbs. and 4.07 lbs.) The consumption of energy per car-kilometer is about 575 watt-hours on the conduit lines and 850 watt-hours on the trolley lines. The greater power required on the trolley lines is due to the steeper grades which are encountered.

As a result of the successful operation of this electric system, the company decided recently to change over some of the few remaining horse-car lines to electric power, and as it was not possible to secure the right to install a trolley on this section, the conduit was adopted. The work is now being carried forward under the direction of Mr. d'Hoop, chief engineer, and Messrs. Pedriali, Lechat and Dugniolle, engineers, and is now approaching completion.

The conduit is laid under one of the rails instead of between the rails, as in America. This system was adopted because the authorities were not willing that the center conduit should be used, on the ground that it introduced too much iron in the streets. The side conduit, as is well known, is employed quite extensively in a number of cities, including Vienna and Budapest. While cheaper to construct, in that it does not require so much excavation, the system has certain disadvantages, the principal ones being that the switches are quite complicated, and the slot opening must be considerable, especially at the switches. The width of the slot opening in Brussels at the switches is 45 mm (1¾ ins.). At first these openings caused a number of accidents, as the wheels of light vehicles and of bicycles were caught in them and sometimes slipped through them. These troubles have about disappeared, however, as the public generally has learned to avoid driving over these places. Considerable trouble is also found in the accidental movement of the switch tongues by vehicles passing over them, but a switchman is now employed to keep them in position as well as to prevent carriages from passing over them. The company reports that the additional supervision required for the conduit system over the trolley system consists of a force of eleven men for each 2 km of single track. This is made up as follows: The chief inspector; 6 cleaners, including 1 car driver; 2 ordinary day inspectors and 2 night inspectors.

The original conduit was 62 cm (24.4 ins.) from the top of the pavement; the slot was 30 mm in width, and the slot rails were of the Harrmann type, each weighing 6 kg per meter (12 lbs. per yard). The latest conduit is slightly deeper, *i. e.*, 634 mm (25 ins.). The yokes, which are 1 meter apart, weigh 90 kg (198 lbs.) each. The conductor rails are of iron, originally weighed 9.3 kg per meter (18.6 lbs. per yard), and were 10 meters in length. The new conductor rails are 10 kg. (20 lbs. per yard) in weight and 15 meters in length. They are supported by insulators every 5 meters.

The insulators are not made up of porcelain as in this country, but are of hard rubber, moulded around an iron stud. So far this insulation has proved very satisfactory, being much less breakable than porcelain and seeming to retain its insulating properties. The use of these insulators has made it much easier to align the conductors, as the insulators are not rigid.

The contact device, or plow, differs radically from those used in America in four respects. In the first place the plow is arranged to be lifted from the conduit by means of a small winch on the car. This is necessary because the through cars will be run partly on the trolley system and partly on the conduit system, and a serious delay in the change would vitally affect the desirability of the service. The second point of difference is that the contact shoes instead of being pressed out horizontally, as in the New York and Washington plows, are mounted on a short lever and swing out vertically in the arc of a circle. In this respect the shoes are similar to those of the plows used in Vienna and Budapest, except that the latter are hinged from above and swing around an arc of about 45 degs., while the Brussels shoes swing around an arc of about 135 degs. The third point of difference lies in the fact that the positive and negative contacts are supported on separate shanks instead of being opposite each other, as in the American installations and in the Siemens & Halske roads in Budapest and Vienna mentioned above. This was done to avoid any dangerous short circuits between the leads, and in practice has seemed to work very satisfactorily. The fourth difference is that the rubbing surface of the contact is on top of the contact rail instead of on the side, as in all the other conduit systems. This makes

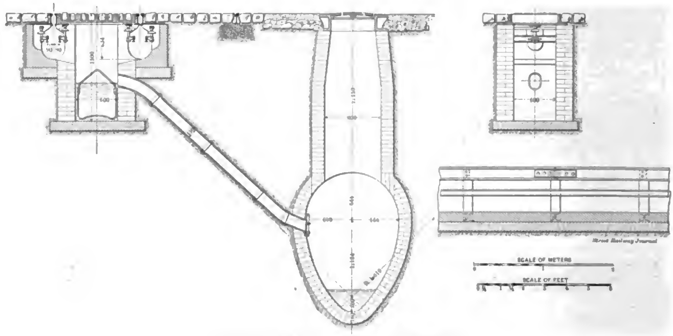


FIG. 2.—SECTION OF CONDUIT AT A MANHOLE

it necessary to have the joints of the contact rails well aligned, as any deviation would be apt to tear off the shoe. No serious difficulty, however, has been experienced in this way. The expansion and contraction is taken up in the crossing where the conductor rails are bolted to the insulators through oval bolt holes.

At these crossings, the conductors are necessarily interrupted and the car passes over the break by momentum. To allow the shoe to rise again to the level of the conductor, the free ends of the conductor bars are furnished with inclined planes in the form of horns, as illustrated in Fig. 4. These pieces originally gave considerable trouble; they were first made of soft wood, but under the repeated shocks of the trolley shoe the wood wore rapidly away and the shoes caught in the hollow thus formed. The experiment was then made of covering the surface of these inclined planes with porcelain, but this broke after a short time owing to the pounding of the shoes. Various types of hard woods, such as box, were then tried, but did not give entirely satisfactory results until experiments were made with elm, in which the grain of the wood was an angle with the direction of the movement of the shoes. The latter, then, in passing over the wood rubbed against the fibre in a different way. In spite of this precaution, the cars have to pass over the switches at a moderate speed.

The plow itself, as illustrated in Fig. 3, consists of two pieces of sheet steel separated by a filling piece of bronze in which the insulated conductor is held. The lower part of the contact shoe, which is of ordinary cast iron, is hinged at its upper end and is held by a spring in the position shown as *O A* in Fig. 6. No part of the plow has a greater width than 36 mm, so that the plow can be lowered or raised from the conduit at any point in the track. When the plow is lowered, the shoe lever first swings around to

The plows are also fitted with chafe plates of hard steel to take up the wear against the slot rails. The time required to make the change from a trolley to a conduit line or vice versa does not require more than 15 to 20 seconds. A special switch, which is attached to the controller, changes the connections from the trolley pole to the conduit.

The company has tried flexible current leads between the shank of the plow and the main car cable, but found that these are subject to considerable deterioration. The device was finally adopted which is illustrated in the side

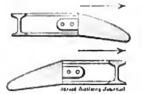


FIG. 4.—HORNS AT END OF CONTACT BARS

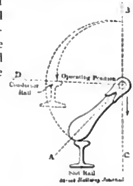


FIG. 6.—DIAGRAM SHOWING MOVEMENT OF CONTACT SHOE

elevation of the plow, and which consists of a sort of lazy tongs made of strips of copper. The same engraving shows the method of raising and lowering the plows mechanically by means of a steel cable wound around a winch.

The insulation of the conductors in the conduit is in general satisfactory and varies from 4000 to 400,000 ohms per km, depending upon the humidity. The principal cause of the breaking down of insulation is the mud and street

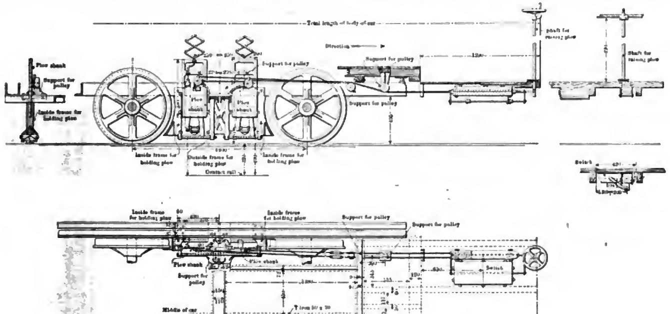


FIG 5.—SIDE ELEVATION, CROSS SECTION AND PLAN OF PLOW

the position *O B* and then to *O D*. When it is removed from the conduit, it takes the position *O C*. When it is taking current from the conductor-bar it is in the position *O D*. After a number of experiments, the form of a spatule which could be replaced and used on both sides was adopted. The shoes last from three to four weeks and cost about 18 centimes, so that the cost of replacement is insignificant.

refuse, which are washed into the conduit and upon the insulators in the case of a heavy rain. The company has found it advisable to wash off the insulators from time to time as the insulation of the positive conductor tends to increase, and that of the negative conductor to grow less, due to electrolytic action. For the same reason the sections are changed over from one side to the other at the switchboard of the power station.

The switchboard is equipped with the usual earth indicator, consisting of two banks of lamps connected to the two conductors of the underground system and joined at the center to earth. This shows in a visual way the approximate insulation between the conductors and the earth. Short circuits, however, are not unknown, and as it is difficult to locate them in the ordinary way, owing to the fact

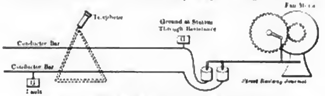


FIG 7.—METHOD OF TESTING FOR GROUNDS

that the conductors themselves are enclosed within the conduit, a special device for this purpose, devised by Prof. Eric Gérard, is employed. This method, which must be employed when there is no load on the section, consists in first connecting to earth at the power station, through a resistance, the end of the conductor bar on which the short circuit does not exist. A make and break contact device, similar to that shown in Fig. 7, is then connected to both conductors. This current, of course, starting, say, from the power station, follows the short circuited conductor up to the point where the short circuit exists, then passes into the earth and returns through the earth connection of the good conductor to the power station. An inspector is then sent along the route with a triangular induction coil about 60 cm (2 ft.) in height and including a telephone receiver in its circuit. This can be slipped through the slot between the conductor rails. The make and break circuit will then produce a noise in the telephone when the coil is inserted in the slot between the power station and the fault, but is not affected if the coil is placed in the slot beyond the short circuit. The coil and telephone weigh only about 1 km (2¼ lbs.), and yet a fault can be determined within a meter. All the conduit installations have been carried out by the French Thomson-Houston Company and by the Union Elektricitäts-Gesellschaft.

Reference has already been made to the present direct-current station of the Brussels Tramways Company. The demand for power and the extension of its lines has led the company to draw up plans for a new large station, which is now under construction, and which will have a capacity of 10,500 kw. The station, the plans of which are presented herewith, will contain seven units of 1500 kw. The engines will be cross-compound and built by Van der Kerckhove, of Ghent. The alternators will be supplied by the Union Elektricitäts-Gesellschaft and will generate current at 6600 volts and 25 cycles per second. The boilers will be supplied by the Babcock & Wilcox Company, and superheaters will be used for supplying steam to the engines at a temperature of 330 degs. C. The tramway company has guarantees of an ihp-hour on 4.75 kg (10.45 lbs.) of steam.

There will be three sub-stations; one containing five rotary converters of 550 kw each, and two, each containing three rotary converters of the same size. Both power station and sub-station will be equipped with a storage battery and the present station will be used as one of the sub-stations.

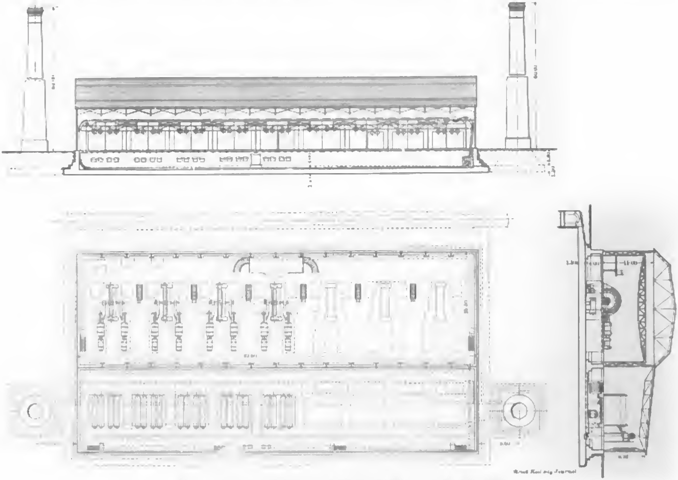


FIG. 8.—PLAN AND SECTION OF NEW POWER STATION, BRUSSELS

The president of the Tramways Bruxellois, which now controls the Brussels system, is Léon Janssen, who is also president of the International Tramways Association of Europe.

Discipline of Street Railway Employees

BY W. E. HARRINGTON

There are various systems of discipline in practice, of which the Brown system is the best known. All have for their purpose the advancement of those employees to the most desirable positions who by good work and steady service have shown that they have the welfare of the company at heart. In some systems employees are discharged for failing to comply with rules and regulations, the men remaining in employ being advanced to the position previously held by the discharged men. The disadvantage in such a system is that frequently employees who should be disciplined in some way or other do not lose their position on the seniority list. The result of this is that men who by faithful service should receive some consideration for such service remain for a long time in a position which does not properly reward them for their good service.

In other systems, where the promotion plan is followed, men are frequently advanced for good service rendered in such a way that a feeling of bitterness is engendered in the breasts of other men who have not been advanced, as it is a well-known fact that employees are very jealous of their position and standing. To follow the promotion plan great care has to be observed in awarding promotions, and it is very easy, owing to the multitudinous cases that arise in street railway practice, to advance men unjustly over the heads of their fellow employees.

In the system where merits and demerits are employed the same objections apply as is shown in the promotion system, as it is exceedingly difficult properly to apply merits, and whatever practice be followed for crediting a man with a given number of merits, difficulty is experienced in deciding the number of merits to be given for each case of good service. In the strict application of this system, as long as a man's standing on the seniority list is not affected, he does not seem to care whether he has 60 or 200 merits or demerits.

It has been noticed among street railway managers and, in fact, in all industrial operations where large numbers of men are employed, that great jealousy exists on the part of the men as to their standing.

It suggests itself to the writer, after trying various methods of discipline, to take advantage of this latter feature, and on April 1, 1901, the demotion system was put into effect. After eighteen months' operation the following interesting results have been obtained. Prior to the adoption of the system great trouble was occasioned on the part of employees missing roll calls. There were repeated cases where men would miss the roll call a number of times. Taking figures at random from out files during a month, these offenses will run, at the time referred to, from nine to seventeen times for individual employees. After the change, the greatest number of times any one employee missed in a month has not exceeded six.

It is proper here to describe the essential features of the demotion system. The general rules of the despatching of conductors and motormen are outlined below in the appendix. Part first relates to regular men, and part second to extra men. In addition to the credits and demerits mentioned in the appendix, conductors and motormen are demoted by the general manager one or more points on the seniority list, as may be deemed advisable. In cases of petty irregularities and violation of rules, for instance, a conductor may be demoted five points for permitting smoking on his car, or the motorman may be demoted five points for starting car without receiving signal from conductor.

It has been noticed since the adoption of the system that men who have been in the employ of the company for years, and have been careless and negligent of their duties, have been demoted gradually until they have reached points well down on the seniority list. In looking over the files of the eighteen months in which the system has been in force, there are men who have been demoted as high as forty-three points and one thirty-seven points, and several, respectively, 27 points, 26 points and 22 points. This, as can be readily seen, throws those men who have been rendering faithful services, by the inverse process, in advance; that is, it has promoted them on the list.

It is an interesting fact to note in looking over the files, as an instance, a conductor who entered the employ of the company in 1891 is on the straight day run and is below men on the seniority list who entered the employ of the company in 1896. This is the best class of runs at the disposal of the company. In the straight from noon runs it is interesting to note that men entering the employ of the company in 1901 are ahead of men who had entered in 1900. In the swing runs, men who entered in 1902 are ahead of men entering in 1901. On the extra list men who were employed in June, 1902, are ahead of men entering in May. The above applies to conductors.

The motorman list also shows quite a fluctuation, but does not work as rapidly as the conductor list. We find, however, under the operation of this system, cases of men who are above other men who have been in the employ of the company for two or three years longer.

It took the first year for the employees to realize the full significance of the demotion system. During the last six months it has been found that the men exercise the greatest amount of care in order not to come under the ruling of the demotion system, and wherever they can, by explanation, they will endeavor to have the points removed.

It has been found that by posting on the bulletin board in the car house the names of those men who have been reported for irregularities that they will be demoted one or more points if the irregularity be not explained on or before a set date, that they take special pains to meet the general manager to clear their record, giving the general manager an opportunity to get in better touch with his men and enabling him to exercise judgment in enforcing the discipline.

The writer has noticed in many instances that a man who has reached a point in his demotions where the exercise of discipline would throw him, for instance, from a straight from noon run to a swing run, will often, even while admitting his fault, request that he be given one or more weeks' suspension, or that he be placed for one or more weeks at the bottom of the extra list, rather than be demoted.

Under this system any employee by good, conscientious service can advance to the better runs at the sacrifice of less capable men, and it has been found that the men approve the plan and appreciate the reward for faithful service.

This system permits the gradual weeding out of such men as are undesirable, by a natural process of the "survival of the fittest."

The following facts are noticeable in the operation of this method of discipline:

Men have a general knowledge of how the list stands, and when someone ahead of them misses they will look at the rack and see if their name has been advanced. They do not talk much about it or seem glad that someone else has been set back, but regard an advance as a reward for good service. The man missing says very little about it, usually being a person who does not seem to care much for discipline. The majority of men missing roll calls seems to

consist of young, single men who do not take the necessary rest when they should.

It is noteworthy that in many cases when an employee realizes that he is gradually going down on the list he wakens up, and from that time on becomes a more efficient employee.

In conclusion, prior to the adoption of the demotion system the percentage of men missing roll calls to the total number of men employed averaged monthly 42 per cent. After the adoption of the demotion system for the last six months has averaged 26 per cent.

The following is a copy of the rules of the Camden & Suburban Company, referred to above, and is descriptive of the system:

REGULAR MEN

(1) In case a regular man wishes to be excused from duty he should ask the day before, and, if excused, such runs will be marked up from top of extra list (as it stands on the next day) in the order of the reporting time of the runs to be filled.

(2) A regular man must report ten minutes before it is time for his car to leave the car house. For failing to report, either in person or by message for car, the first time in a month he will be demoted one point and given one day for each hour or fraction of an hour missed and he will have to report at each succeeding roll call, and in that time to receive work only after all men on extra list have been assigned.

Any employee having a clear record for the previous two months will be relieved from demotion for the first failure to report in a month.

The second time in a month a run is missed he will be demoted two points and given one day for each hour or fraction of an hour missed, and he will have to report at each succeeding roll call, and in that time to receive work only after all men on the extra list have been assigned.

The third time in a month a run is missed he will be demoted three points and given one day for each hour or fraction of hour missed, and will have to report at each succeeding roll call, and in that time to receive work only after all men on extra list have been assigned.

The fourth time in a month a run is missed he will have to report to general manager.

All the above rulings subject to appeal to the general manager.

(3) No extras are carried to relieve men who may miss their second car, as at dinner, supper or swing time. In such cases the early men will be demoted to the bottom of late runs, the late man will be demoted to the bottom of swing runs, and the swing man to night car. The night car man will be demoted to tripper runs and the tripper man demoted to extra list. In case of an extra, he will be demoted from his position on the extra list, three (3) points.

(4) The slate will be put out daily at a regular time suitable to the requirements of the depot, after which no one will be excused without reporting.

(5) A regular man asking off sick must lose two days work and must report at depot the day before he takes his car.

Telephonic or telegraphic messages or letters sent by mail or by employees will not be accepted as requests for leave of absence due to sickness or other causes.

The only recognized forms of request will be by letter brought to car house by some person not an employee or made personally at the car house, not later than ten minutes before the allotted reporting time.

Requests will be accepted only at car house.

Employees not complying with the above will be placed at bottom of extra list one day for each hour or fraction thereof for failing to report as above provided.

(6) No regular man is excused from work after taking his car, unless he is sick or disabled. He must work run out.

(7) Changes on account of vacancies will be made from first to tenth day of each month, unless in case of a run being vacant three (3) days or more; in that event it will be filled by the oldest extra not otherwise engaged, until such time as he may be called for regular position, or the man to whom it belongs returns.

(8) Promotions on account of discharge, etc., are made from extra list to tripper runs, from tripper runs to night car, from night car to swing runs, from swing runs to straight from noon runs, from straight from noon runs to straight day runs.

EXTRA MEN

On and after Monday, April 1, 1901, extra men will report as follows (at car house for morning work):

(1) After the noon roll call at the ferry the list is telephoned to the car house and despatcher books off the regular men for the next day, the first extra men booked up for regular runs are those working tripper runs, then come those who did not get work at noon. In event a man who did not get work at noon should get a six-hour run at night roll call he will be expected to take run he is booked up for the next morning, in event he is not booked up he will not have to report until 10:59 next day.

(2) Instead of extra men reporting at 4:30 a. m., a limited number of men will be delegated to report at 4:30, 5, 5:20 and 5:35 a. m.

On arrival at car house each man will report to despatcher giving name and time of report.

(3) For failing to report as scheduled, the following rules will be strictly enforced:

First.—The first report missed in a month will be demoted one point on the extra list and must stand on bottom of extra list one day for each hour or fraction of an hour late.

Second.—The second report missed in a month will be demoted two points on the extra list and must stand on bottom of extra list one day for each hour or fraction of an hour late.

Third.—The third report missed in a month will be demoted three points on the extra list and must stand on bottom of extra list one day for each hour or fraction of an hour late.

Fourth.—The fourth roll call missed in a month will have to report to general manager.

All the above rulings subject to appeal to the general manager.

Any employee having a clear record for the previous two months will be relieved from demotion for the first failure to report in a month.

(4) Extra men not otherwise excused from morning work will report as above.

Extra men not reporting and sending note that they are sick must take two days on bottom of extra list and must report at car house the day before taking place on list.

(5) Extra men taking straight from noon runs are not required to report until 10:59 report next day, if extra man has a noon run for more than one day, he must report ten minutes before it is time for the car to go out. Subject to Rule Third, Section 1st, 2d, 3d and 4th.

Telephonic or telegraphic messages or letters sent by mail or by employees will not be accepted as requests for leave of absence due to sickness or other causes.

The only recognized forms of request will be by letter brought to car house by some person not an employee or made personally at the car house, not later than ten minutes before the allotted reporting time.

Requests will be accepted only at car house.

Employees not complying with the above will be placed at bottom of extra list one day for each hour or fraction thereof for failing to report as above provided.

(6) Extra man taking six-hour run at night is not required to report at early report next day, except he is booked up for a run, then he must report ten minutes before car is due to leave car house. Subject to Rule Third, Section 1st, 2d, 3d and 4th.

(7) Extra men will take runs as booked and hold until regular man returns. Subject to provision, Rule 7, regular men.

(8) Early morning roll call at car house. See rule (second) extra men. Noon roll call is made at the ferry 10:59 a. m. daily; 10:50 a. m. Sunday.

Night roll call is made at the ferry 5 p. m. daily; 4:50 p. m. Sunday.

(9) After the noon runs are given out, all men not excused will report at car house, subject to Rule 2, extra men. Despatcher will appoint five or more men, as may be required, on extra list not working, to report at Federal Street ferry 5 o'clock p. m. roll call.

(10) An extra man relieving a sick man for part of a run will be entitled to such run until regular man returns. Subject to Rule 7, regular men.

(11) Extra men who have been excused from work will be turned down on list same as if they had been called for a car.

(12) Men appointed for roll calls or reports will not be excused for failing to report.

(13) Extra men holding straight day runs, not scheduled for Sunday work, must report at depot Sunday morning (as per Rule 2, extra men).

(Signed) THE CAMDEN & SUBURBAN RAILWAY COMPANY,
W. E. Harrington, General Manager.

Instruction for Street Railway Employees

The question of securing competent men to operate their street railway lines is often a perplexing one, and it is constantly confronting the manager. A certain amount of training is required for nearly all positions in street railway operation, and, while some of these may be filled satisfactorily after a little coaching, it is now generally recognized that a regular course of instruction under competent teachers is of great assistance. As they become familiar with the construction and operation of the apparatus, it is found that their interest in the work increases and correspondingly better results are secured. Many of the large companies have met this demand by establishing departments of instruction, and in some of the articles descriptive of large street railway systems which have appeared in the STREET RAILWAY JOURNAL, during the last year, attention has been called to these training schools maintained for the instruction of employees. In the case of motormen, for instance, the novice is coached until he acquires a certain proficiency, and "runs extras" until familiar with his duties. It is found that men who have the advantage of such training may be entrusted with cars much earlier than others, and, other things being equal, they become much better motormen than those who have not had special training.

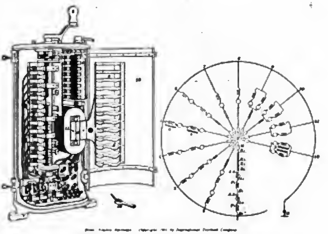
This fact has encouraged the belief that the special training of employees in other departments connected with the operation and maintenance of the system would effect still further reduction of expenses. Thus, a trackman having practical training on the subjects of bonding and track returns, a car-shop employee thoroughly conversant with the operation and proper installation of all types of car appliances, a pitman who fully understood the construction and underlying principles of motors, air brakes and trucks, and a dynamo tender with sufficient experience to install, operate, and repair any railway generator, would not only increase the efficiency of the service, but would also effect a saving in the maintenance and repair accounts.

Admitting its need, or great desirability, how can better and more specialized practical training be most readily brought about? For large companies to extend their educational systems to include all classes of employees would entail enormous expense, and necessitate the formation of a corps of instructors similar to the faculty of an established technical school. For small or medium-sized roads to give any education to their men, beyond such supervision and advice as is given a novice by an old hand detailed for that duty, would also be out of the question. On many roads the management has found it desirable to encourage the co-operation of correspondence schools, as this plan enables the men to pursue their studies without giving up their employment, and affords them an opportunity of combining theory and practice in the most approved manner. This plan has proved practicable in many other industries, and the International Correspondence School has prepared several special courses for street railway employees, embracing every feature of construction and operation, every system of distribution and all forms of apparatus. Methods of control are shown in diagram, and roadbed construction and rail-bonding are illustrated with numerous examples of every-day practice. The car-running course includes instruction on shop methods, wiring for lamps, motors, controllers and car appliances, all of which are graphically illustrated. In the accompanying cut, for instance, is shown the construction details of the G. E. K-2 controller with diagram of connections, presented in such a manner as to be readily understood.

To the man who aspires to rise to the higher positions in the railway and lighting fields, a more extended course of training is offered. The electric lighting and railway course comprises a technical training for the position of electrical engineer, superintendent of overhead or track construction, or manager with either a lighting or railway company. To become the electrical engineer of such a company, a man must thoroughly understand not only the entire electrical work required in a power station in connection with the machinery, switchboards, electrical appliances, and wiring for lights, but also must be able to handle any of the problems that arise in testing new apparatus for acceptance, the protection and testing of cables, etc. The superintendent of overhead or track work must be thoroughly conversant with the best methods of the day, and must be able to adapt them to special situations, or to originate special construction that will be entirely successful. Every manager should have a broad understanding of all departments of electrical work as applied to the plant under his charge.

Throughout the instruction theoretical considerations are subordinated to those of practical importance, but when a discussion of theory is necessary, it is given in a lucid manner, so that a thorough comprehension of it is readily obtained. Original illustrations and novel methods of presenting difficult points are used, making the instruction more effective than that of the ordinary text-book.

The value of this instruction is appreciated by prominent railway officials, and the methods employed have been approved by such men as President H. H. Vreeland and J. F. Kane, of the Metropolitan Street Railway Company. Mr. Kane took the course of instruction in electric railways, and he says that he found it invaluable to him in his work as chief instructor of the Metropolitan Street Railway Company. The electric car-running course papers are being used to advantage, Mr. Kane says, "in conjunction with my practical lectures in the instructing room." It is the purpose



METHOD OF EXPLAINING CONTROLLER CONNECTIONS

of this course to give a man a practical, as well as a theoretical, knowledge of motors and their connections. Instruction begins with clear explanations of the actions of an electric current, and how it turns the armature and makes the motor go. Every principle is presented simply, interestingly, and completely. Illustrations are freely used, some of them being reproductions from actual photographs. It enables the student to inspect his motor properly, operate it economically and intelligently, keep it in good repair, and meet emergencies in case of accidents. Operating lessons are given with every piece of construction explained, so as to qualify the student upon completing the course to direct the equipment of a complete modern car, and operate it safely under all conditions of weather and traffic.

The same methods are employed in all branches, thus making the electric railway course a series of practical instructions upon practical subjects for practical men.

The Kingsland Surface Contact System

The Kingsland surface contact system, of which a short section is in operation in Wolverhampton, England, was briefly described in these columns about a year ago. Since that time improvements have been made in the system, based on the experience obtained in practical work. The principal feature of the Kingsland system is the use of a mechanical switch, operated by a lever

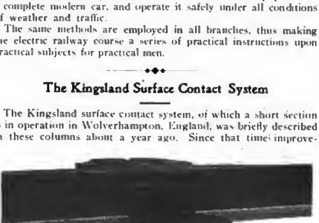


FIG. 1.—CONTACT BOX CLOSED

from the car, by which the contact studs are thrown in and out of circuit. In addition to the usual skate for collecting the current, which is in the middle of the car, there are two striker bars attached to side of the car, one in a forward position and one in the rear. The first throws the switch lever one notch, connecting the stud in the middle of the street with the main conductor, and the second switches the current off.

FIG 2.—CONTACT BOX WITH CASE REMOVED

FIG. 4.—STUD

As shown in the cross-section (Fig. 5) a slot or channel is provided outside one of the rails by means of a guard rail, making a shallow conduit the depth of the rail along which the striker bars can pass freely. With the exception of this guard rail and a small pit for the switch boxes, the construction is the same as with an ordinary railway.

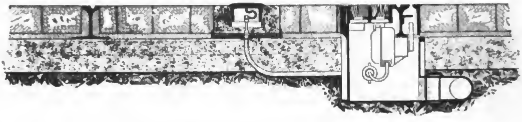


FIG. 5 —SECTION OF TRACK, CONDUIT AND STUD

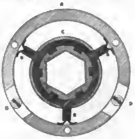


FIG. 6.—SECTION OF CONTACT BOX

The switch boxes are located about 20 ft. apart underneath this conduit, and one of them is illustrated in Figs. 1 and 2. These boxes project down about 12 ins. from the base of the rail, but this distance may be made less in special cases. The slot at the surface of the road is 5/8 ins. wide.

Fig. 2 shows a view of a section box with a portion of the rail. The slot rail is removed to show the switch lever. It will also be noticed in this and in Fig. 1 that there is also a bracket attached to the rail immediately over the switch lever. This bracket is for the purpose of preventing the lever from being tampered with by means of a stick or anything passed down through the slot. The striker bars on the car are curved so as to pass this bracket easily. It should also be noticed that the conduit contains no conductors, bare or otherwise, and that the switch is enclosed in a water-tight case. In this way the arrangement is not affected by water in the conduit; in fact, it is said that water is desirable in that it washes out the slot and the outer part of the switch box.

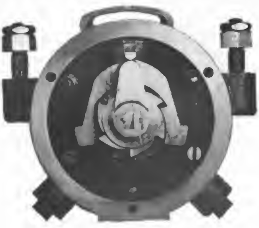


FIG. 3.—INTERIOR OF CONTACT BOX

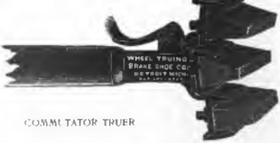
Another feature of the system is that the stud in the street contains or covers no switch mechanism and the wearing portion can be easily and cheaply renewed.

The switch itself is enclosed in a water-tight case, which is bolted to the under side of the rail, a small portion of the base of the rail being cut away to accommodate it. The interior of the box is shown in Figs. 3 and 6. It consists of a center revolving piece of insulating material containing a metal ring with three brushes, *B*, which press against the inner circumference of the box, *A*. These brushes are set at an angle of 120 degs. with each other and two contact plates, *DD*, are also set at the same angle. At every operation of the switch the center portion is moved one-sixth of a revolution, so that the contact plates, *DD*, will be automatically connected and disconnected with the center by means of two of the contact brushes. This affects the alternate connection and disconnection of the stud with the main cable. As the distance between the front and rear striker bars is slightly greater than the actual length of the skate, a stud is always in circuit before the skate actually touches it and is not taken out of circuit until the skate has left it. This prevents any sparking within the switch itself; at the same time the switch is designed to break a large current at the full potential of 600 volts, if necessary, without damage. The distance between the studs depends upon the length of the car, but an average may be taken at 18 ft. to 20 ft.

Arrangements are also provided by which the blow of the striker bar will turn the switch just the right distance; that is, 120 degs., and also by which the switch lever is returned to its normal position with absolute certainty after being struck by the bar. The skate is suspended from the wheel axles by springs and may be of the usual pattern.

Device for Truing Commutators

The accompanying illustration shows a tool for truing commu-



COMMUTATOR TRUER

tators while the motor is running, and which is an improvement over the usual method of using sand paper or that of turning down

in a lathe. The device is suitable for stationary motors and dynamos as well as for railway motors.

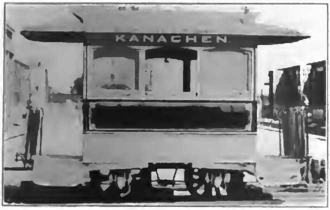
The construction and operation of the device can clearly be seen from the illustration. It only remains to be said that the central cutter can easily be raised or lowered, and then held in place by means of a short lever. As this changes the arc subtended by the cutters, the truer is automatically and very easily adjustable to any diameter of commutator. It can, therefore, be instantly applied to any commutator while the latter is running, and having a three-point bearing, it must necessarily cut truly. The tool is insulated so there is no danger of a short circuit. The abrasive used is a non-conductor, and no emery is used in its composition. The principle employed in this device is the same as that used in the wheel-truing brake-shoes of the Wheel-Truing Brake-Shoe Company, of Detroit, Mich., which experience has shown is both practical and economical.

J. M. Griffin, president and manager of the Wheel-Truing Brake-Shoe Company, who is also the inventor of the commutator truer, does not pretend that it will accomplish everything that can be done with a lathe, but he believes that by frequent use of the truer the commutator can be kept true, and therefore will not require turning, at least as often as formerly. The abrasive can be of any desired hardness, so as to cut rapidly or slowly, as may be desired.

The Old and the New

The accompanying illustrations show two types of cars recently shipped from the works of the John Stephenson Company, of Elizabeth, N. J.

The small car is a duplicate of those built by this company, in



SHORT MEXICAN HORSE CAR

the early horse-car days, some thirty years ago, and is one of several built for use on a private plantation in Mexico, running on a gage of 29 ins. The body is 8 ft. long and 6 ft. wide, and the total weight, including running gear, 4000 lbs.

In marked contrast to this car is that shown in the two other illustrations, which are of a car built for the Muncie, Hartford & Fort Wayne Railway Company, and the Fort Wayne & Southwestern Traction Company, under specifications prepared by E. P. Roberts & Co., engineers, of Cleveland, Ohio. This car shows the very latest type of construction for interurban electric roads. High speed and durability as well as elegance and convenience were the principal objects borne in mind in the building of these cars. The outside sills are double, having a heavy steel plate between them, and in addition there are four longitudinal sills, equally spaced, running the entire length of the floor. These, together with the double posts, double siding and heavy platform and vestibule construction, provide a car suitable for the highest speed desired, and in appearance very much like a Pullman car.

EXTERIOR OF MODERN INTERURBAN ELECTRIC CAR

There is a small baggage compartment at one end, having hinged seats, so that it can be utilized as a smoker when necessary, and at the other end a toilet and wash room, equipped with water-cooler, etc.

The inside is finished in mahogany of plain yet elegant design, and is equipped with parcel rack, wrecking tool box, etc. The car is heated by the Peter Smith hot-water system, the stove being located in the front vestibule. The weight of this body alone is 24,000 lbs. The cars will be mounted on Peckham No. 26 double trucks, and will be equipped with four G. E. No. 57 motors, equivalent to 200 hp.

The illustrations show the range of work turned out by this energetic car company, and proves that, although the original builders of horse cars, it still keeps to the front in the larger and more modern methods of construction.

INTERIOR OF MODERN INTERURBAN CAR

International Jury of Awards for St. Louis

The special rules and regulations providing for an international jury, and governing the system of making awards at the Louisiana Purchase Exposition have been announced by President Francis. The total number of jurors shall be approximately 2 per cent of the total number of exhibitors but not in excess of that number, and each nation having fifty exhibitors or more shall be entitled to representation on the jury. The number of jurors for each art or industry, and for each nationality represented, shall, as far as practicable, be proportional to the number of exhibitors and the importance of the exhibits. The duties of the jurors are carefully explained and their work outlined. There will be three classes of jurors, group, department and superior.

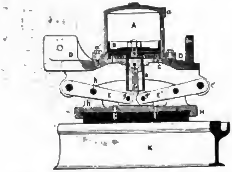
The duties of the department juries shall be to consider carefully and review the reports of the group juries, to harmonize any differences that may exist between the recommendations of the several

group juries as to awards, and to adjust all awards recommended so that they will be consistent with the rules and regulations. The superior jury shall determine finally and fully the awards to be made to exhibitors and collaborators in all cases that are formally presented for its consideration.

A Pneumatic Track Brake

The extended use of track brakes in San Francisco, where the grades are probably more severe than in any other large city in the country, if not in the world, has often aroused curiosity as to why track brakes were not employed to any greater extent in the Eastern States. S. L. Foster, the electrical engineer of the Market Street Railway, of San Francisco, offered an explanation for this fact in a recent issue of the STREET RAILWAY JOURNAL. His theory was that track brakes, to be desirable, should be applied quickly, and that this was possible in San Francisco, because in that city the lever brake was in general use. His conclusions were that the ordinary revolving handle was not sufficiently quick in operation to secure the best results with the track brake, and that, consequently, on Eastern roads, where the room on platforms was limited, or considered so to be, the track brake would not appear to its best advantage. This difficulty, however, certainly so far as the quick operation of the track brake is concerned, has been overcome by Estler & Brothers, of London, through the design and application to a number of English cars of a pneumatically operated track brake, or, as it is called in England, a slipper brake.

The air pressure for this brake is applied by means of a



SECTIONAL VIEW OF PNEUMATIC TRACK BRAKE

short handle, which should be placed conveniently near the hand brake and the air pressure can be secured from any type of air compressor on the market. Four shoes are fitted to each car, whether the car is mounted on single or double trucks. Better braking is obtained on single trucks by the use of four shoes than two, as on descending inclines it has been found that the weight of the car is taken by the front brakes, but when only two brakes are used the weight of the car is taken by the front wheels and not by the brake shoes.

A sectional view of the brake is shown and clearly indicates the construction. An air cylinder is carried on a bracket, *D*, attached to the truck. The piston, *B*, of the cylinder is connected by a swinging rod, *G*, to two levers, *EE'*, which have their fulcra on the bracket at *e* and *e'*. The levers carry the slipper shoe, *H*, on which is fixed a brake block of oak, beech, or other hard wood. There is nothing in the slipper brakes which is liable to get out of order, but the flexible connections should be examined daily with the air compressor equipment to insure their being in perfect condition, and no car should be allowed to leave the depot on which the slightest defect in the brake equipment has been detected.

The brake blocks can be used efficiently until they are worn down to within about a quarter of an inch of the steel shoe, and then it is only a matter of a few minutes to have them renewed.

The views already referred to, Fig. 1, and Fig. 2, which illustrates a car on the Dundee Tramways, give a very good idea of the construction and appearance of this brake. Some particulars of tests recently conducted on this tramway may be of interest. On a down-grade of 4½ per cent, the car was repeatedly brought to a standstill from a speed of 16 miles an hour within 21 yds. from the instant when the air brake handle was put into action. The stop was effected without any jolt, as the brakes seemed to act like an elastic cushion. On a level, the car was brought to a standstill in about 12 ft. from a speed of about eight miles an hour.

An important advantage of the brake is, of course, that it does not skid the wheels, and is less dependent upon the condition of the track than a wheel brake. Owing to the fact that air pressure is used, the brake can very easily be employed upon cars equipped with the ordinary wheel air brakes, and, in fact, a number of the cars on the roads which are using the brakes are equipped with air brakes. The brake can also be used with the storage system of air.

A number of the roads in Great Britain are using the slipper

CAR EQUIPPED WITH PNEUMATIC TRACK BRAKE

or track brake, including the Potteries Electric Traction Company, the Stockport Corporation Tramways, the Dundee Tramway and the Oldham Corporation Tramways. It has been employed at Oldham, where the grades are nearly 10 per cent, for more than twelve months, and the general traffic manager, Mr. Wilkinson, speaks highly of it.

Prizes for Railway Protective Devices

Frederick Weidl, of Dresden, calls attention to the circular offering prizes for protective devices for electric street cars just issued by the city of Dresden, the first prize for which is to consist of 5000 marks; the second, 3000 marks; and the third, 2000 marks. The successful inventor will receive a royalty up to 20 marks for a motor car and 10 marks for the use of the equipment on a trailer, while the invention remains the property of the inventor. Patent Attorney Frederick Weidl will be pleased to give to interested parties any desired information free of cost, and all conditions can be obtained from his office, which is located in Jahnstrasse 2, Dresden.

Opposition to Electric Line to Vesuvius

The faculty of science in the University of Naples has forwarded to the Government an urgent protest against the proposed electric railway to Mount Vesuvius from the naval arsenal in the city of Naples, thus affording increased facilities to tourists who visit the crater and who have hitherto depended upon the funicular railway. It is contended that the proximity of the line to the University Observatory on Vesuvius would interfere seriously with the scientific value of the records on the seismic instruments.

which register the slightest earth tremors, and measure their inherent energy with the utmost precision. The faculty further urges that a powerful electric train on the mountain, even at a distance from the observatory, could not help affecting injuriously other magneto-electrical scientific apparatus already installed or about to be installed there by the Royal University. Between 30,000 and 50,000 persons are carried on the present railway every year.

New Boiler Plants for the Pennsylvania Railroad

The Allis-Chalmers Company has received orders for a number of Sederholm boilers, for the Broad Street station of the Pennsylvania Railroad in Philadelphia, as well as for the Juniata shops. The Pennsylvania Company made the selection after a most searching investigation, and as a result of practical experience with pretty nearly every boiler manufactured.

BOILER FOR BROAD STREET STATION, PHILADELPHIA

These boilers have now been in successful use for several years and are distinguished especially for their perfect circulation and complete combustion, as well as their great accessibility, which permits of a most thorough cleaning, without the time-absorbing process of taking off hundreds of hand pole plates. They are in very general use on the sugar plantations in the Hawaiian Islands, where the Allis-Chalmers Company has furnished a great number of large high-lift pumping plants for irrigation purposes. In the islands the coal used is mostly Australian or Puget Sound coal, both kinds of which are difficult to burn without smoke, but wherever these boilers are installed the plants show a smokeless chimney.

Brill Narragansett Cars for York, Pa.

When the Pennsylvania State Street Railway Association meets at York, Sept. 10, four new cars will be seen on the streets which will doubtless greatly interest the members. The cars are worthy of careful inspection, for they are of a type which has satisfactorily solved the problem, long in the minds of street railway operators and builders, of how to obtain a double-step open car without going beyond the width of the standard single-step design.

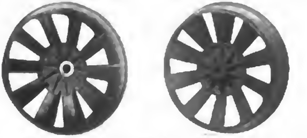
Present-day suburban and interurban service demands more than the single-step open car is able to fulfil. "Larger and faster open cars" has been the cry from many quarters, with the answer always the same, "Impossible! Double-steps are necessary and the width would be too great; besides, there are insurmountable structural difficulties, and loading and unloading would be too slow." Last year the "Narragansett" type appeared, making large claims and attracting wide attention. The claims were substantiated by a season's trial and this summer several large roads in different parts of the country have a goodly number in operation.

The "Narragansett" type secures the desired advantages without losing any of the good features of the standard single-step car. Some of the chief points may be briefly stated as follows: The width over all does not exceed that of the standard single-step open car; main sills of deep angle-iron, to which another angle-iron is bolted, together forming a Z-bar, not only provide an intermediate step, but afford an unusually rigid support to the long car body; the posts are set in deep sockets formed in brackets which support the panels, and are bolted to sills and panels; there is ample space for the radiation of high-speed trucks; the seats are standard length, and access and egress is rapid and convenient.

The York cars are 40 ft. $4\frac{1}{2}$ ins. over the crown-pieces, and 8 ft. 1 in. over the sills. The inside finish is of natural cherry and ash, with ceilings of decorated birch. The cars are fitted with sand boxes, radial draw-bars, angle-iron bumpers, "Dedenda" gongs, ratchet brake-handles, and round-corner panels. The trucks are the Brill No. 27-G.

Roberts Track-Laying Cars

Several features of the track-laying car which is manufactured by the Roberts Car & Wheel Company, of Three Rivers, Mich.,



PRESSED STEEL WHEELS WITHOUT RIVETS OR BOLTS FOR ROBERTS TRACK-LAYING CARS

commend this product to contractors and railroad companies. The car is strong in every part, and is equipped with the Donovan improved pressed steel wheel. This wheel, by the way, forms a very important element in the car. It is made from one piece of steel, passing through a series of processes until the proper shape is obtained giving the greatest amount of strength to the given amount of material. The metal, which in other processes is gen-

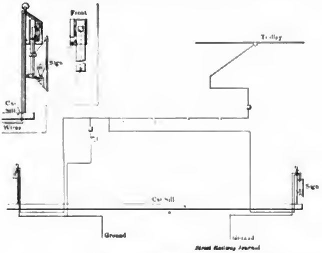
NEW CARS FOR YORK, PA.

erally cut away, is in the wheel cut on one side and both ends and bent at right angles, the center being dished. A lateral brace is formed which is pressed tightly against the tread, making a perfect support, obviating all tendency to spring or crack, and preventing any ringing sound when in operation. These wheels are made without rivets or bolts.

The iron parts of the Roberts hand and push cars are made without a single weld, which greatly increases their strength and durability. The company equips its cars with either roller or brass bearings, and insulated wheels are furnished if desired.

Reversible Electric Car Sign

The subject of illuminated car signs has received so much attention that the sign illustrated herewith, which is of an entirely novel type, will undoubtedly attract attention. It is being put on the market by the Reversible Electric Car Sign Company, of Richmond, Va.



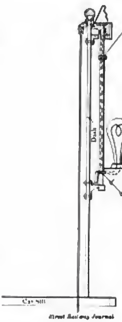


FIG. 1.—DETAILS OF WIRING FOR REVERSIBLE SIGN

The sign is reversible or interchangeable from end to end of car, so that but one sign for each car in service is required. The sign is also nearly indestructible, owing to its construction, and the points of destination can be readily changed by substituting others in the slide at the end of the sign. The connections are such that they cannot be affected by snow or sleet, and the sign is equally as efficient in the day as at night, and is visible at a great distance.

FIG 3.—TOP CONTACT CASE

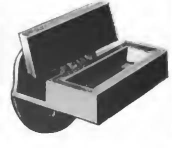


FIG. 2.—BOTTOM SUPPORT

FIG. 4.—FRONT OF CAR BEARING REVERSIBLE SIGN

Fig. 1 shows one method of car wiring employed in the operation of the sign. As will be seen, the insertion of the stem of the sign in the dash socket throws the lamp in the sign in series with the other lamps in the car, while one lamp can be cut out to reduce the total number to five. Fig. 2 shows a front view of the sign. Fig. 3 is a view of the top contact case with the latch up. Fig. 4 shows the bottom support, by which the sign can be supported from below, if desired. With this method, there is absolutely no possibility of the contact box or sign support being affected by any weather, as it is entirely weather-proof.

The front of the sign is made of a transparent substance, and can be changed by the introduction of different destination faces, so that any sign can be used on any route.

Single-Phase Motors for the Washington-Baltimore Line

Particulars are published elsewhere of the proposed electric railway between Washington and Baltimore. Information received after that article went to press indicates that single-phase motors, built by the Westinghouse Electric & Manufacturing Company, will be used. Specific details of the system, as proposed by this company, are lacking, but it is stated that it avoids the inherent limitations of the induction motor and the disadvantages of a polyphase system of conductors by the use of single-phase current in the trolley and the motors. It is stated, however, that the motor has a variable speed and characteristics that adapt it for railway service fully as well as the ordinary direct-current railway motor.

The controlling apparatus is of a new type, and is said to possess valuable features which have not been heretofore attained in railway operation, while avoiding many of the inherent difficulties in the ordinary systems of direct-current control.

The advantages in this system through the omission of rotary converters and attendance for them; also the reduction of copper over that which would be necessitated for operating direct-current motors at 500 volts, are among its notable commercial features. The adoption of 1000 volts as the motor voltage was deemed by the engineers of the railway company to be preferable to a higher voltage, on the ground of general policy, although there is nothing in the system to prevent the use of several times this voltage. A higher voltage would probable be used on longer roads or where the conditions made a higher voltage more advantageous than in the present case. The car equipments are designed for a normal speed of 40 and 45 miles, and a maximum speed of 60 miles an hour.

This system has been developed by the Westinghouse Electric and Manufacturing Company, largely through the work of B. G. Lamme during the past few years. The final results were so satisfactory that the company was ready to undertake as an initial commercial installation a road of the size and importance of the one above described. The engineers of the railway company made a careful investigation of the system and of the motors which have been made and operated on the company's experimental railway track at Pittsburg, and as the outcome of their investigation they were satisfied to place the whole matter with the Westinghouse Company.

Hydraulic Press for Assembling Commutators

The accompanying engravings show an hydraulic press for assembling commutators, constructed by the West Hydraulic Engineering Company, of London, and Bradford, Yorkshire. The radial press (Fig. 1) consists of a heavy weldless steel ring, to the inside of which are bolted a number of hydraulic cylinders, with rams which transmit pressure to the loose die-blocks surrounding the commutator. This type of press is suitable for a large range of commutators from 30 ins. diameter down to 6 ins. diameter. The vertical position of the commutator in the press is adjustable by means of a table shown in the center of the press. Distance-pieces of different lengths can be used to adapt the press for varying diameters of commutators, these distance-pieces fitting into pockets in the rams. A view of a commutator removed from the press is given in the foreground of Fig. 1. In order to obtain a clear view, the photograph was taken of a commutator without lugs.

FIG. 1.—HYDRAULIC PRESS FOR COMMUTATORS

When the ends have been machined, the commutator is placed on the table of the press (Fig. 2), which rises against the fixed tension bolt, and the retaining rings are bolted on under pressure, after which the die-blocks can be removed from the commutator. Instead of the two presses, Figs. 1 and 2, being separate, the press (Fig. 2) can be placed in the center of the radial press (Fig. 1), in lieu of the rising and falling table.

Australian Engineers in New York

Edward Noyes and W. G. T. Goodman, of Noyes Brothers, of Sydney and Melbourne, spent a few days in New York last week, and sailed for England on the "Lucania," Aug. 30. Their visit to this country was made largely for the purpose of placing contracts for apparatus for the electric tramway system in Dunedin, New Zealand, for which Noyes Brothers have been appointed the engineers. This system is being operated by horses. It comprises about 20 miles of track, and has recently been taken over by the city from the former private owners.

The rails will be of grooved girder type, will weigh 92 lbs. per yard, and will be supplied by the Société Belge at Antwerp. They will be laid on ties of hard Australian wood, 9 ins. x 4½ ins. x 7 ft. 6 ins., and spaced 2 ft. 6 ins. centers. The ties will rest on a ballast of 6½ ins. of broken stone. The special work will be supplied by the Lorain Steel Company. The bonds will be of the Brown plastic type.

Thirty-four cars have been ordered from the J. G. Brill Company, and all will be mounted on the Brill 21E truck. Fourteen of these cars will be of the California type with closed body and four benches at each end, fourteen will be standard box cars with 18-ft. body and 26 ft. over dashers, and six will be of the open type with ten benches. The cars will be equipped with two Westinghouse No. 68 motors each.

The poles have been ordered from the Mannesmann Works in Germany, and the construction will be partly single bracket, partly double bracket, and partly span. In the sections using the double bracket poles every other pole will carry an arc light. A new car house with a capacity of fifty-two cars has been commenced.

The city is proposing to operate its line from a water-power situated some 14 miles distant from the city of Dunedin. Until this plant is completed, a temporary steam plant will be installed. The transmission will be at 15,000 volts to within 2 miles of the city, when the voltage will be reduced to 5000 for transmission within the city to converter and transformer sub-stations. Connecting with the latter, a storage-battery plant will be used with accumulators of the Accumulatoren Fabrik Aktien-Gesellschaft, of Hagen. The generating station will contain two 600-kw generators, each directly connected to a turbine and two exciters of 25 kw each. The electrical machinery will be supplied by the Westinghouse Company, for whom Noyes Brothers are the Australian agents.

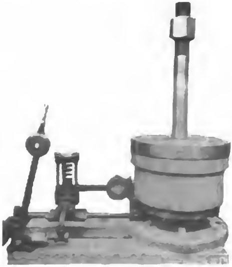


FIG. 2.—COMMUTATOR ON TABLE OF PRESS

Trenton and New Brunswick Equipment

The Trenton & New Brunswick Railroad Company, which will operate its cars by electricity, has decided upon the equipment that will be used. The cars will be of the steam-car type, 45 ft. long, equipped with four 50-hp motors, Christensen air brakes, arc headlights, cross-seats, Pullman windows and aisle carpets, and the exteriors will be painted red. Express and freight cars will also be run over the road. A schedule speed of 35 miles per hour will be made between Milltown and the Interstate Fair Grounds, at Trenton, a distance of 24 miles. Each of the cars, in addition to being numbered, will be named after some town along or adjacent to the route of the road. The line runs entirely upon private right of way, 100 ft. wide, and the company has a steam railway charter, so that it may also run locomotives if desired. But one village is encountered between terminals, and all the traffic, or nearly all, will be through from Trenton to New Brunswick or points beyond. It has been suggested, locally, that the company might run excursions from Trenton to Coney Island and Manhattan Beach next summer, by connecting with steamers at some point along the Raritan. Trenton's pleasure resorts now are Willow Grove, Pa., and Washington Park, N. J., both near Philadelphia, and each more than 25 miles away, while Coney Island, by this route, would be but 50 miles. The opening of the Trenton & New Brunswick road will complete the trolley connections between Trenton and New York, and all the way to Philadelphia, with the exception of a break, about 2 miles long, at West Palmyra, and this will be closed during the present month.

A party of influential gentlemen from South Australia, including Sir Edwin T. Smith and Mr. Arthur W. Ware, ex-Mayor of Adelaide, will probably visit the United States and make a tour of inspection of the principal electric railways during October. The contract for the electrical equipment of the Adelaide Tramways has just been awarded to the British Westinghouse Company.

NEWS OF THE WEEK

Serious Accident in Pennsylvania

Twenty-five people were injured in a collision between two cars on the Youngstown & Sharon Street Railway near Sharon, Pa., on Aug. 27. The accident occurred a short distance beyond the switch at the car house. A car was going toward Youngstown, and it is said that it should have waited at the switch for the incoming car. The heavy fog is said to have prevented the motorman from seeing the approaching car until it was only 10 feet away.

The cars came together with frightful force, one telescoping the other. A dozen men seated in the smoking compartment were hurled through the wooden partition and landed under the wreckage, 10 feet forward in the car, and the other passengers were hurled about in confusion.

Strike on Hudson Valley Railway

The lines of the Hudson Valley Railway Company, operating between Warrenburg, Saratoga, Ballston, Troy and Schuylersville, N. Y., are tied up, because of a strike of motormen and conductors. The strike was declared on Aug. 30, and two reasons are given for its declaration. The company announced that on Sept. 1 there would be a reduction in wages from $1.80 to $1.25 per day, and to this reduction the men objected. In addition to this, dissatisfaction among the men was aroused because a motorman in charge of a car that was in collision was discharged by the company. The company said that this man was grossly negligent, and that there was no excuse for the accident. On the other hand, it was maintained by the discharged man that the accident was unavoidable. He claimed that the brake mechanism of the car was defective.

To Arbitrate Chicago Railway Troubles

Although the local union of the Amalgamated Association of Street Car Employees at Chicago, by an overwhelming vote on Aug. 26, refused to accept a proposition made by President Roach several days ago in behalf of the Union Traction Company and the Consolidated Traction Company, it is very probable that an amicable adjustment of the differences between the companies and their employees will be arranged. On Aug. 28, by unanimous vote, it was decided to submit all differences to arbitration. Clarence Darrow, an attorney, has been selected to represent the men, President Roach will select an arbitrator for the company, and both parties will agree to the selection of a third arbitrator. The time and place for the meeting of the board has not yet been decided.

Growth of the Electric Railway

The Census Bureau has just issued some statistics showing the rapidity with which the electric system has supplanted horse and cable power. According to the Census Bureau, in 1890 the street railway companies of the United States in operation numbered 789, of which 144 were electric. At that time there were 2895 electric cars in use, out of 32,505 of all kinds, and 1262 miles of track, out of 8123. By 1899 the number of cable cars had declined from 5089 in 1890 to 4250, and horse cars from 22,408 to 1489; but in the meantime electric cars had increased to the number of 50,658, and the number of miles of track to 17,969. The stimulus given the industry is further brought out by the fact that, whereas in 1890 the total capital and funded debt for all roads appears to have reached $363,150,000, in 1900 the total for 871 street railway systems, chiefly electric, was $1,023,819,987 capital stock and $777,-862,571 funded debt, making a total of slightly over $1,800,000,000, or just five times the figures of ten years before. On this vast capitalization the returns from the operation would indicate a net earning capacity of from 4 per cent to 5 per cent. The Bureau quotes the annual report of the Metropolitan Street Railway Company, of New York, for the census year ended June 30, 1900, as indicating the saving that has resulted from the introduction of electricity. A comparison is made of the cost of operation per car mile and electric, cable and horse.

The Pennsylvania Tunnel

According to reports from Philadelphia officials of the Pennsylvania Railroad are of the opinion that there will be no difficulty in securing the consent of the Aldermen of New York for the construction of their underground road, although no action has been taken by the Aldermen in regard to granting the franchise for the construction of the tunnel under Manhattan Island. An officer of the Pennsylvania Railroad is even quoted as stating that an understanding had been reached which was agreeable to all parties interested, and that within a short time a new bill would be presented to meet with the approval of the Aldermen, as well as the members of the Rapid Transit Commission and Mayor Low. Some of the changes which the Aldermen wanted in the tunnel bill have been complied with by the Pennsylvania, it is said, but it is understood nothing will be done in regard to the question of employing labor. It is contended by the railroad officials that they will have nothing to do with this. The work will be given to a contractor, and he will be responsible for carrying out the plans.

The Sensational in the Daily Press

An instance of the injury that may be done an employee and employer by the publication of a sensational newspaper story is furnished at San Francisco, where minor differences between a street railway company and its employees were so magnified and distorted by one of the yellow journals of that city that it was made to appear that a street railway strike was to be declared at once. The agreement entered into several months ago between the company in question and its employees provides that the company shall deal with a committee of the employees when there is any grievance. A few days ago the officials of the company were visited by a committee, but the company refused to deal with it, because one of its members was not an employee of the company, the agreement between the company and its employees stating precisely that a committee of employees only would be dealt with. Now, the refusal of the company to deal with the committee was worked up into a most sensational first-page story, full of inaccuracies and entirely without foundation. A meeting of the street railway employees was called at once, and resolutions were passed deploring this act of the yellow journalist, branding the whole story as a most outrageous misrepresentation of the facts of the case.

Connecting Worcester with Providence, Hartford and Boston

With the plan for consolidating as the Worcester & Connecticut Eastern Street Railway Company, the Worcester & Webster Street Railway, the Webster & Dudley Street Railway, the Worcester & Connecticut Eastern Street Railway, the Danielson & Norwich Street Railway, not yet built, and the People's Tramway Company, which companies control lines from Worcester to Norwich, Conn., attention is again called to Worcester as an interurban railway center. Now, in addition to the lines mentioned, which in themselves form an important system, there extend from the city the various suburban lines of the Worcester Consolidated Street Railway Company, the Worcester & Blackstone Valley Street Railway Company and the Westboro & Marlboro Street Railway Company. Then there is the Boston & Worcester Street Railway, under construction between Boston and Worcester, the Hartford & Worcester Street Railway, contemplating a line between Hartford, Conn., and Worcester, and the Providence & Worcester Street Railway, which contemplates constructing a line between Worcester and Providence, R. I.; but on the road under construction between Boston and Worcester and those planned to connect Worcester with Hartford and Providence interest is now centered. Interests identical with those that are backing the Boston & Worcester Street Railway are behind both the Hartford & Worcester Street Railway and the Providence & Worcester Street Railway.

The distance between Providence and Worcester, as it is proposed to build the new road, is about 40 miles, and the fare between the cities will probably be 50 cents. The run on the New York, New Haven & Hartford Railroad between the cities is about 40 miles, and the fare charged is $1.10. Entrance to Worcester will be made over the lines of the Worcester Consolidated Street Railway, and at Providence entrance to that city will be made over the lines of the Rhode Island Suburban Railway. Locations and franchises have been secured for this line, and charters are to be applied for at the next sessions of the Legislatures of Massachusetts and Rhode Island.

For the line between Hartford and Worcester it is said that little has been done in the way of securing grants. This line will

pass through a territory not so thickly settled as either the Boston & Worcester Street Railway, or the Providence & Worcester Street Railway, but the through traffic will be large. In this connection it is interesting to note what inducements the company can offer to secure through travel from the steam road with which it will enter into direct competition. The route of the electric railway will be about 20 miles shorter than that of the steam road, but the time required to make the run on the electric railway will exceed by one hour that which is required by steam. But frequency of service and a low rate of fare will compensate for this additional time. The fare by electric railway will be about $1.00 less than that by steam, it is expected.

The Boston & Worcester Street Railway, on which construction work is now progressing so satisfactorily, will pass through Brookline, Newton, Wellesley, Natick, Frantingham, Southboro, Westboro, Northboro and Shrewsbury, some of the prettiest towns in the State. The length of the run from Boston to Worcester is 40 miles, and the Boston & Worcester Street Railway will practically parallel the lines of the Boston & Albany division of the New York Central Railroad. It is said that the running time of the electric railway between the cities will be two hours, and the plan is to charge a fare of 35 cents. Through trains of the Boston & Albany, making no stops between points, make the run between the cities in a little over one hour. The fare by steam, however, is $1.00.

For Perpetual Street Railway Franchises in Cleveland

The street railway interests of Ohio are intensely interested in the new code bill now being considered by a special session of the State Legislature. The section relating to electric railway franchises, as provided in the code submitted to the Legislature by Governor Nash, provides that franchises shall be granted only after advertisement and competitive bidding, the bidder who gives the most to the city and people, either in the way of money payments or lower fares or other concession, to have the franchise; that the life of such franchise shall not be for more than twenty-five years, with a revision of rates every ten years with a resort to arbitration if the city and company cannot agree.

Senator Mark Hanna, president of the Cleveland City Railway Company, of Cleveland, has had drafted an amendment to the franchise clause of the proposed code, providing that street railway franchises shall be perpetual, with a revision of rates every ten years. The proposed amendment is attracting almost as much attention as the code itself, and there is likely to be a long controversy on the subject. The arguments in favor of perpetual franchises, as given by Senator Hanna in newspaper interviews, may be summarized briefly as follows:

That it would give stability to investments in such enterprises; capitalists would not hesitate to invest their money, and to give to the public the highest class of service, as they would be sure they would receive a proper return from their investments. If a company's franchise is to expire within a short term, and there is doubt of renewal on favorable terms, it will not invest money in improvements and extensions, nor hardly keep up necessary repairs, because of the uncertainty of any adequate return. Further, the bonds of a company with a perpetual franchise can be floated at a much lower rate of interest, because they will attract those who purchase for permanent investment, and will possess the stability of government bonds.

The proposed amendment makes changes in sections 29, 30, 31, and 34 of the Nash code bill. The words inserted are capitalized. The words left out are designated by stars. The sections with the proposed amendments are as follows:

Section 29—Council shall have power to grant the use of the streets or other public places AND TO PERMANENTLY RENEW AND GRANT HERETOFORE MADE AT ANY TIME BEFORE OR AFTER ITS EXPIRATION, to any street railway company, natural or artificial gas company, electric or other light company, water company, pneumatic tube or package company, heat and power company, telephone company or any other similar corporation, and the right to use the streets or other public places may extend over, upon, along, across, or beneath the surface thereof.

Section 30—No such right shall be granted OR RENEWED except by ordinance of Council * * * nor shall any such ORIGINAL grant be made except upon written application to Council from the corporation desiring the use of the streets, and after advertisement for thirty days in some newspaper of general circulation in the city or village, inviting proposals to furnish the inhabitants thereof with the public service proposed in the application. No ORIGINAL grant shall be made except to the company offering the best terms to the municipality and its inhabitants, with respect both to the compensation or return to be given in the way of rental and repairs, and the rates of charges to be made; and where any bid includes an offer to pay the municipality an annual percentage of the gross receipts of the company, such bidder, if awarded the grant, shall permit Council, or any person or persons designated by Council, to examine its books at any time for the purpose of ascertaining such gross receipts.

Section 31—Council shall have power at all times to adopt police regulations with respect to the use of the streets or other public places by such companies, and, at the end of each period of ten years, to regulate the price, rate of fare, or other charges, TERMS AND CONDITIONS for the public service, by agreement with the companies, WHICH PRICES, RATE OF FARE AND OTHER CHARGES, TERMS AND CONDITIONS SHALL ALWAYS BE JUST AND REASONABLE, and every grant, AND RENEWAL OF GRANT, shall provide a method of arbitration to be thereafter pursued in case the Council and the company are unable to agree upon such regulation of the price rate of fare or other charges, TERMS AND CONDITIONS, provided, that the council shall have power at any time with the consent of the company, to secure more favorable terms to the municipality in the operation of any grant herein authorized, and any taxpayer shall have the right, in the manner provided in sections 1777, 1778, and 1779, of the Revised Statutes, to prevent a violation of this section of any abuse of the power herein conferred.

Section 34—Extensions of existing street railway routes may be made by the Council of any municipal corporation to any company owning or having the right to construct any street railway within the corporate limits whenever such extension is deemed beneficial to the public; * * * and the terms upon which such extension may be made shall not be less favorable to the public or to the municipality than those imposed in the grant of the original route; and provided further, that before any work is done upon the streets or other public places over which the tracks of the company are to be extended, said company shall produce to the council the written consent of a majority of the abutting property owners as required in such original grant.

In section 31, as designated by stars, the matter left out is as follows: "And no grant shall be valid for a greater period than twenty-five years."

In section 34, as designated by stars, the matter left out is as follows: "Provided that the rights under said extension shall expire at the same time as those conferred in the original grant."

Interurban Lines Secure Entrance to Indianapolis

After discussing, for about two years, the question of terms for admitting the interurban railway lines to Indianapolis, that city, as previously mentioned in the STREET RAILWAY JOURNAL, has recently solved the question in a manner equally satisfactory to the residents of the city and the companies seeking entrance. A franchise has been granted to the Indianapolis Traction & Terminal Company for the erection of passenger and freight terminal stations, and the construction of downtown loops to be used by the interurban cars in reaching these stations, and, in addition to this, franchises have been granted to the eight interurban companies that were seeking entrance to the city.

Provision is made for the payment to the city by the Indianapolis Traction & Terminal Company for 4 cents on each car entering the city for the first eleven years, 6 cents for each car entering the city for the next ten years and 10 cents on each car entering the city for the following ten years, and payment is also to be made to the city by each of the interurban companies receiving franchises of 1 cent for each car entering the city during the entire time of thirty-one years for which the franchises are granted. Under these provisions the revenue to the city, during the franchises, from the car tax will be $381,383.

The city has fixed the freight rates to be charged by the companies. It is stipulated that the companies shall carry freight at rates not exceeding the rates now charged by other common carriers for the same classes of merchandise, provided that the companies cannot be compelled to charge less rates than 80 per cent of the present published rates of other common carriers. The city reserves the right to regulate the carriage of freight and to change the routes in the city limits used by freight and express cars in reaching the freight terminals.

The Indianapolis Street Railway Company is given the right to construct a new belt line, and it is estimated that this line, if double-tracked, will call for the laying of eleven miles of track.

Engineering Societies

THE NEW ENGLAND STREET RAILWAY CLUB will hold its annual outing at Hampton Beach, Thursday, Sept. 4, 1902. This is the last outdoor meeting of the club for the year, and it is generally expected that there will be a large attendance.

NEW YORK RAILROAD CLUB.—The first meeting of the club for the coming season will be held on the evening of Sept. 18. An interesting paper is promised by Chief Engineer J. C. Brackenridge, of the Brooklyn Rapid Transit Company on "Track Construction for Rapidly Moving Heavy Loads in Electric Railroading." The place of meeting will be announced later in the usual way.

PERSONAL MENTION

MR. C. W. MARTIN succeeds Mr. W. P. Cosper, resigned, as general agent at Chicago of the Consolidated Car Heating Company, of Albany, N. Y. Mr. Martin is ably assisted by W. S. Hammond, Jr.

MR. E. W. MOORE, of the Everett-Moore syndicate, leaves this week for a six-week's vacation in Europe. He will be accompanied by Mr. F. J. Wolfe, assistant passenger agent of the New York Central Railway.

MR. FRANCIS C. GREEN, former superintendent of the Consolidated Car Heating Company, of Albany, N. Y., has recently been appointed general manager of the company, succeeding Mr. H. P. Scales, resigned. Mr. Green has full charge of all the affairs of the company.

MR. T. M. GATHRIGHT has resigned as general superintendent of the Camden Interstate Railway, of Ironton, Ohio, and will be succeeded by Colonel W. W. Magoon, who has been treasurer of the company. Colonel Magoon will be succeeded by Mr. T. McK. Hays, who has been connected with other lines operated by Hon. Mr. John Graham, president of the Camden Company.

MR. O. W. BRAINE, who succeeded Mr. G. Fischer as electrical engineer of the New South Wales Government Railroad, is at present in London on business connected with important extensions now being carried on in the Sydney tramway system, which is owned by the New South Wales Government. Mr. Braine is planning to return to Australia by way of America, and will probably attend the convention of the American Street Railway Association at Detroit.

MR. W. O. HANDS, superintendent of the Northeast Division of the Metropolitan Street Railway Company, of Kansas City, Mo., has resigned from that position to accept a more lucrative position on the engineering staff of the company during the reconstruction of the system. Mr. Hands, fourteen years a constructing engineer, is especially fit for his new position. Mr. J. W. Sherman has been appointed to succeed Mr. Hands as superintendent for the Northeast Division.

MR. H. P. BRADFORD, who was formerly general manager of the Compania del Ferrocarriles de Distrito Federal de Mexico, of Mexico City, and previously was the general manager of the Cincinnati Inclined Plane Railway Company, has just been appointed general manager of the Compagnie Genevoise des Tramways Eleqtriques, of Geneva. This property, as stated in recent issues of the STREET RAILWAY JOURNAL, has recently been equipped electrically. The two largest stockholders in the company are Mr. H. A. Butters and Mr. John Hays Hammond.

CONSTRUCTION NOTES

LOS ANGELES, CAL.—The ordinance granting the California Pacific Railway Company the right to construct a railroad along certain public streets of the city of Los Angeles, to be operated in connection with the electric railway between Los Angeles and the city of San Pedro, has been adopted by the City Council.

WATSONVILLE, CAL.—W. J. Rogers, of San Jose, has applied to the Supervisors of Santa Cruz County for a franchise to construct an electric railway through the county. Bids for the franchise will be received on Sept. 10.

STOCKTON, CAL.—H. H. Griffiths has filed with the City Council his acceptance of the franchise recently passed by the Council. The franchise gives Mr. Griffith permission to build an electric railway over the principal streets of the city, and it is his intention to build not only such lines as are stipulated by the franchise, but lines to Lodi and other suburban points. It is the intention to begin work in the near future.

SAN JOSE, CAL.—The supervisors have granted L. A. Sage a franchise for the construction of an electric railway from San Jose to Saratoga, a distance of 12 miles.

NORWICH, CONN.—The Railroad Commissioners have approved the construction plans of the Danielson & Norwich Street Railway Company, for a proposed extension of its line from Killingly, through Falls Brook to Central Village.

ROCKVILLE, CONN.—Thomas C. Perkins, promoter of the Rockville-Stafford Springs Electric Railway, is quoted as authority for the statement that the bonds on the whole proposition have been underwritten by a Boston house, and that the stock has been subscribed for and a conditional contract let with a Boston firm of street railway contractors, subject to the local company's being able to get the rights of way, etc. It is said that Mr. Perkins has secured the rights of way from the Connecticut State line to Worcester, and that he will begin at once securing rights of way in the Connecticut towns through which the road is to pass. The road will be about 40 miles long.

INDIANAPOLIS, IND.—The Indianapolis & Eastern Railway Company has under construction 18 miles of road between Knightstown and Dublin, Ind., giving a line from Indianapolis to Dublin, a distance of 4 miles. At Dublin connections are made with the Richmond Street & Interurban Railway, thus completing a line from Indianapolis to Richmond. Between Richmond and Eaton, Ohio, a distance of 13 miles, contracts have been let, and in the spring it is expected that the line between these points will be completed. At Eaton connection will be made with the Dayton & Western Railway, thus giving a through line from Indianapolis to Dayton. The Indianapolis & Eastern will erect its own power house, which will be equipped with two 400-kw generators, two 600-hp compound condensing engines, and three 500-hp Sterling boilers. C. M. Kirkpatrick, of Greenfield, Ind., has the contract for the track work, the Carnegie Steel Company has the contract for the rails, and the St. Louis Car Company has the contract for the rolling stock. The cars are to be equipped with Steel motors. The authorized capital stock of the company is $1,200,000. Of an authorized funded debt of $1,000,000, $700,000 has been issued. The officers of the company are: F. M. Faovre, president; C. E. Coffin, vice-president; J. W. Chipman, secretary, manager and purchasing agent; M. B. Wilson, treasurer; D. H. Robinson, superintendent.

MADISONVILLE, KY.—It is possible that an electric railway will be constructed from Morganfield to Sebree. It is proposed to run the line through the oil fields in Webster County, thence to Dixon and from there to Sebree. Should the project materialise, it will give connection with the Louisville & Nashville Railroad at Sebree, and the Ohio Valley at Morganfield.

SACO, ME.—F. A. Hobart, of Boston, has informed the local interests identified with the Saco Valley Railroad that he has closed a contract for building the road. The contractor gives a bond that he will begin work upon the construction of the road within sixty days. The contract stipulates that the road shall be constructed this fall to the depot of the Portland & Rochester Railroad at Bar Mills where the power station is to be located. The balance of the road is to be completed as soon as possible next year.

WATERVILLE, MAINE.—The hearing on the application of the Waterville & Oakland Street Railway Company for a location of its road from Waterville to Oakland, a distance of about 6 miles, has been closed. The Railroad Commissioners are expected to announce their decision shortly.

SANDWICH, MASS.—The Sandwich Street Railway Company, organized to build an electric railway from a connection with the Middleboro, Wareham & Buzzard's Bay Street Railway in Bourne, through Sandwich to Barnstable, a distance of 24 miles, has elected officers as follows: R. A. Hammond, president; C. M. Thompson, vice-president; John A. Holway, treasurer; Arthur Braman, clerk; C. B. Jefferson, A. H. Armstrong, Thomas C. Day, William A. Nye, George T. McLaughlin, Fletcher Clark, James L. Wesson, R. D. Woodward, R. H. Faunce, M. D., directors.

NORTH ADAMS, MASS.—A franchise has been granted the Hoosac Valley Street Railway Company by the Williamstown Selectmen to extend its lines to the Vermont State line.

MAYNARD, MASS.—The Selectmen of Maynard have denied the petition of the Lowell, Acton & Maynard Street Railway Company for a location in Maynard, because of the refusal of the company to pave between the tracks. The cost of paving will be from $2,500 to $3,500.

WORCESTER, MASS.—The Worcester & Connecticutt Eastern Street Railway Company has completed its line from Danielson, Conn., to Wauregan, Conn.

WORCESTER, MASS.—Brown & McLain, of Boston, engineers representing a syndicate, have acquired a large tract of land at Barre Falls in the town of Barre, with water rights on the Ware River, where they will erect a water-power plant for the generation of electricity. The water-power is estimated at 2500 hp, and the natural conditions are such that a small dam will create a large storage reservoir. Negotiations are being entered into with the Worcester & Holden Street Railway Company to supply power for its new line.

GREENFIELD, MASS.—The Greenfield, Deerfield & Northampton Street Railway Company has opened its line from Greenfield to South Deerfield. The company has built its line from Northampton to Hatfield, but there is a connecting link between South Deerfield, through the town of Whately still to be built. The matter of a location in Whately has been taken to the Railroad Commissioners.

SPRINGFIELD, MASS.—The Enfield & Somers Street Railway, a new feeder to the Hartford & Springfield Street Railway, has just been opened between Enfield and Somers, Conn.

GARDNER, MASS.—James A. Stiles, of Gardner, a well-known street railway man, has, with Samuel Williams and Ernest Jose, of Boston, bought the White Valley Street Railway, running from Bethel, Vt., a distance of 19 miles. The road was sold at auction by the receiver, R. H. Sawyer, for $65,000. The street road, which was built about three years ago, cost about $400,000, it is said.

BROCKTON, MASS.—The Norwell & Scituate Street Railway Company has been organized, with a capital stock of $150,000, to build an electric railway from the terminus of the lines of the Old Colony Street Railway in Assinippi through Norwell, Greenbush, Scituate Harbor, North Scituate and Cohasset, connecting with the third-rail system in the latter place. The distance is 15 miles. In Scituate Harbor the line will extend to the Sand Hills, a favorite summer resort for residents of the inland towns, following the highway recently laid out and accepted by the County Commissioners to North Scituate. Henry D. Smith, of Norwell, is interested in the project.

PLYMOUTH, MASS.—It is said that the Plymouth, Carver & Wareham Street Railway will form a connection at Tremont with the Middleboro, Wareham & Buzzard's Bay Street Railway for all points north and south, and also with the main line of the steam road from Boston to all points on Cape Cod and the Fairhaven branch to this city. An extension is also contemplated from Tremont south through Rochester, to Acoahnet, connecting there with the lines of the Union Street Railway, of New Bedford, and the New Bedford, Middleboro & Brockton line of the Old Colony Street Railway Company.

ATLANTIC CITY, N. J.—An ordinance to grant the People's Traction Company, of which I. A. Sweigard, formerly general manager of the Reading Railway, is president, the right to build an electric railway here, has been introduced in City Council.

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The Trolley Accident at Pittsfield

The most unfortunate collision which took place between one of the cars of the Pittsfield Electric Street Railway Company and the carriage carrying the President of the United States, on the morning of Wednesday, Sept. 3, has been the cause of much unnecessary agitation against high-speed operation of trolley cars. Unfortunately for the accuracy of the reports telegraphed over the country purporting to give details of the catastrophe, the reporters who were the President's constant attendants on the trip were miles away at the time. It has been said that the authenticity of history is inversely as the number of witnesses to any given event, and many of the published accounts of the Pittsfield accident show earmarks of having been founded on the hysterical utterances of excited passengers.

We give, in another column, a conservative statement of the facts as they appear from an investigation on the spot by an editorial representative of this paper. That the railway company or its employees are entirely to blame for the occurrence will be seen to be quite inadmissible, but the amount of responsibility which should be placed upon their shoulders must be left for the courts to decide. We believe that, while in many States the law gives the right of way to the trolley car in a case of this kind, in Massachusetts both motormen and drivers are expected to exercise an equal amount of care. That the driver of the President's carriage failed to look behind him before turning on to the railway track directly in front of the approaching car seems evident. Whether the motorman was guilty of culpable negligence will be decided when the official investigation takes place, and it is fortunate that this hearing has been postponed for several weeks, so that an impassioned examination of all the facts bearing upon the occurrence can be had.

The Pennsylvania Tunnel Franchise

Discussion of the terms proposed for the Pennsylvania tunnel franchise has been renewed by representatives of the Pennsylvania Railroad Company and the city of New York, and it now appears that there is still a wide difference of opinion between the Aldermen and the railroad management, and that each side has evidently determined to insist upon having its view accepted. The principal points of difference developed at the meeting last week were upon the suggestion that the tunnel company indemnify the city against any claim for damages that may arise out of the closing of Thirty-Second Street between Seventh Avenue and Ninth Avenue, and the proposal that a clause be inserted in the tunnel contract providing for the prevailing rate of wages for men at work on the tunnel and for an eight-hour day. The company refused positively to accept these terms. In agreeing to the price of $778,600 for the ground within the vacated portions of Thirty-Second Street, the company contends that it is paying what is admitted to be the full fee simple value of the land, and that this value largely results from such vacation. It held, therefore, that it is incumbent on the city to meet such damages, if any, occasioned by the vacation, for which it may be held legally liable. Regarding the question of wages and the eight-hour clause, the company contends that this whole question has been fully disposed of by the Court of Appeals of New York, that the law is now settled, and that the city can not impose such conditions, even in the building of its own subway. Moreover, it is pointed out that the work will be let to contractors, who will necessarily have to conform to the labor situation as it exists in New York.

* * *

The Pennsylvania Railroad Company has pursued a broad and liberal policy throughout these negotiations, and has met every reasonable demand that has been made by the city. It has even submitted to conditions that have never before been exacted from any corporation seeking a franchise of similar character in this city or elsewhere, but it has firmly and emphatically resented the attempt to impose terms that would seriously handicap the company, directly conflict with its established policy and invite

meddlesome reformers and sandbaggers to annoy the management in the future. Moreover, it would establish a dangerous precedent, and one of which other municipalities would quickly avail themselves. President Cassatt very clearly explained the attitude of the company upon the questions in dispute. Much as the corporation desires to secure the franchise, it is evident that it cannot consistently or safely abandon its position, even for such a valuable prize. The city's representatives admit that the clauses affecting labor and wages which they seek to have inserted in the contract can not be enforced, as the courts have decided that such matters are not within the province of the municipality to regulate, yet they persist in their demands that these promises be made. It has been explained that this is done merely for political effect, and that the difficulty might be solved by permitting the Aldermen to insert the obnoxious clauses, accepting the contract in that form and then ignoring these provisions. This plan was broadly hinted at during the conference last week by one of the advocates of the amendments, but the company positively refused to accept any clause which it had not the power and inclination to enforce. It has been frank, consistent and honorable in its dealings, and because of its attitude enjoys the respect of the community in a higher degree than ever before. We believe that public sentiment will eventually compel the granting of the franchise without the obnoxious clauses, although there may be some delay in securing the necessary legislation.

* * *

The failure of the city and the railroad to agree upon terms would result in great disappointment and embarrassment for the company, but it would prove a much greater loss to the city. It would deprive the city of a large sum of money which the company had agreed to pay for the franchise, the tax for track mileage alone amounting to upward of $2,000,000 for the first period of twenty-five years under the terms fixed in the original contract. The city would also forfeit a large expected increase in assessable valuation, especially in the Borough of Queens, resulting from this improvement. But of far greater importance would be the loss to the business interests which are now suffering from lack of proper railroad terminal facilities. The abandonment of this project would work serious loss and disadvantage to laboring men of the city, to whom many millions of dollars would be paid by the company during the construction of the tunnel and the station. It may be said that $25,000,000 would be a moderate estimate of the loss and injury to the city through the abandonment of the Pennsylvania Railroad's undertaking. The Aldermen are certainly risking a great deal to satisfy their desire to compel the company to accept their terms, especially when no advantage is to be gained. In other words, the Aldermen are willing that this great improvement should be sacrificed, unless the company will accept certain conditions and make certain pledges which both parties know can not be enforced.

Promise and Performance

A St. Paul politician, who was elected to the Assembly on a platform advocating 3-cent fares, undertook to carry out his promises, but found that he and his associates were powerless. At his request the corporation attorney was instructed to make a report upon the authority of the City Council to fix the fare at 3 cents. The city's legal department has conducted a very careful examination of the records since that time, and, as a result, finds that the Council has no right to compel the reduction of fares on the St. Paul street-car system to 3 cents. The ordinance under which the company is now operating, it has been found, is a contract agreed to by the city and accepted by the company, and can not be modified by either. The street-car company is operating under a fifty-year franchise, of which thirty-seven years still remain. The result of this movement should teach the people not to pin their faith to the political reformer, who generally promises much more than he can possibly perform, no matter how good may be his intentions.

Regarding the Fuel Bill

The present high price of coal is likely to fall ere long, but the predictions of the economic prophets will go far wrong if it drops for some time to come to anywhere near the old plane. Indeed, for the last few years there have been many signs pointing to a steady upward gradient in the cost of fuel of every kind. The coal supply is, by no means, so near to exhaustion as the soothsayers of the past would have us believe, but for practical purposes it makes little difference to the man who foots the bill whether the supply is lessened by approaching exhaustion of the mines or by production deliberately limited. From either aspect the outlook for cheap fuel is distinctly bad, but if the present scarcity, by its acuteness, can teach the economical use of what fuel is available it will have been not altogether an unmixed evil. Particularly in the early days of electric railroading, when coal was low, there came to be a reckless disregard of measures of economy, and we well remember how even the use of condensing engines was regarded as a sort of theoretical refinement unworthy the attention of the practical man. In those days, when the chief item of operating expense was the repair bill, the fuel account seemed a small factor in the total expense. To-day, we face a very different situation in every respect, and unless we mistake greatly the cost of motive power will steadily give the manager more and more concern. The old fallacies regarding the virtues of simple non-condensing engines have gone by the board long ago, and a really modern power plant for an electric railway is highly economical. But the evil days have come apace, and more attention must be given this subject than ever before.

* * *

Perhaps the first subject for immediate consideration in this particular is the chance for successful power transmission from water power. An investment in such a proposition is almost absolutely certain to rise in value, for the desirable powers are rapidly being taken up, and each increase in the price of coal gives transmission from water power an added economic advantage. Furthermore, the working distance for successful transmission is steadily increasing, and many a proposition that was apparently turned down upon its merits five years or six years ago is now highly attractive. Hence, it is the part of wisdom to cast about for opportunities of this kind. One must not plan, in a permanent investment like a street railway, for next year alone, but for the next generation, and even if a power transmission seems barely able to pay at the present time, it will probably be paying very handsomely before the securities issued to pay for it reach maturity. Even the element of change in the art alone is likely to improve the economic status of power transmissions, while no change in the art seems likely to improve very greatly the fuel situation. The only factor tending in that direction is the increasing use of producer gas, and this is of somewhat dubious utility on the scale necessary in modern electric railroading. All in all, therefore, the water-power question seems to be particularly well worth looking up, and we do not doubt that many roads will find it worth their while to introduce it. But there are many points at which hydraulic power is not conveniently available, even with the present facilities for transmission. Burning practically refuse fuel at the pit's mouth has often been suggested as an important future phase of power transmission, but save in two or three plants of moderate size it is not yet an accomplished fact. Now and then, however, it may prove to be worth serious consideration.

* * *

Improvements in generating power are always and everywhere applicable, and the keenest watch should therefore be kept on everything of this sort that looks at all feasible. The development of the steam turbine is a subject worthy of the closest attention, since it seems to be able to give asssistance in small plants and at relatively light loads, the very points in economical power generation where help is most needed. We must, of course,

recognize the fact that the turbine is in a comparatively early stage of development, but it certainly gives great promise even now. When a rather small turbo-generator can show economy comparable with that attained in a good-sized plant with compound condensing engines, a great step forward has been taken, and there is reason to hope for even better results in the future. Even aside from turbine practice, every year shows some improvement in engine performance, so that the best work of ten years ago seems rather ordinary to-day. Greater, we think, than any probable saving in the engine itself, is the possibility of improving the performance of boilers and furnaces, particularly the latter. Almost every class of fuel has some peculiarities in combustion that require modifications in the furnace, in order to obtain the best results. The ordinary standard furnaces require, for the most part, good coal to obtain the results for which they are designed. A change to poorer grades of fuel ought to imply, for the sake of economy, a change in the furnace and the scheme of firing. Again, the enactments against undue production of smoke bear heavily on those who are trying to economize by the use of low-grade coal, and furnaces must be designed not only to give economy with such fuel but to diminish the smoke. Generally, the two ends may be met simultaneously, but a so-called smoke consumer does not necessarily imply obtaining good evaporative efficiency from the fuel. Far too little attention is given to the boiler and furnace end of the power station. A decrease of 10 per cent in the steam required per hp-hour would be a sensational improvement in engine performance, but an evaporation of 10 lbs., instead of 9 lbs., of water per pound of coal by better furnaces and firing achieves the same economic result at, probably, lessened expense. And to retain the evaporative efficiency while burning a grade of coal 10 per cent cheaper than before is an equally important advance, although it is not so heralded from the house-tops. The "man behind the poker" is a very essential factor in economical power production.

Sauce for the Gander

Experience brings wisdom even to Boards of Aldermen, and after a decade of electric traction, municipal authorities have recognized the advantage of being fairly liberal in the matter of speeds permitted. To get the greatest good from modern methods of traction, it is necessary to allow time as fast as security permits, and the city which keeps the schedule time down to 8 miles an hour steadily falls behind her more progressive neighbors. The ordinary electric road is fairly well suited with the conditions at the present time, but we are disposed to think that there is trouble brewing. Why should our plutocratic contemporary who drives his Devouring Dragon 50 miles an hour over the public roads be exempt from the same limitations that are enforced against the trolley car? The latter is a public convenience, the former a public nuisance. Why should the one be repressed, while the other goes scot free? To be sure, the police occasionally screw their courage up to the point of arresting some venturesome chaffeur, whose employer promptly pays the $5 or $10 fine as often as it is imposed. If both were given thirty days for the first offense and a double dose afterward, it would hurt their feelings, no doubt, but the death-rate would be perceptibly decreased

* * *

So far as danger is concerned, a trolley car at 20 miles per hour is a far less serious menace than an automobile at the same speed, for the former is rigorously confined to a track which all can see and avoid, while the latter runs where it pleases, has relatively very inefficient brakes, and is driven by those who care very little for collisions, so long as their own precious skins are not endangered. Further, a trolley car, from motives of economy, is geared so as to have only a moderate margin of speed above the rate ordinarily required for the schedule, while very many automobiles are deliberately built for three times or four times the legal speed, and with the intention of running at the top notch. The temptation to "cut loose" seems to be irresistible among operators of automobiles.

* * *

This is no joking matter, despite the comic papers. If vehicles weighing two tons or three tons are run over public roads at 30 miles to 50 miles per hour, why should an electric car confined to a track which all may see and avoid be held down to 12 miles or 15 miles? Or, conversely, if considerations of public safety have demanded that the car be confined to this moderate speed, why should a private vehicle of a much more dangerous character, often driven by reckless and irresponsible persons, be permitted to transgress all rules of decency? One does not die the easier because he is run over by Mr. Billions, of the Soft Soap Trust, rather than by a plain trolley car driven by No. 1049.

* * *

This matter, moreover, has a practical and commercial, as well as an ethical side. Suppose Mr. Billions and his friends, instead of being satisfied with "tooling" a green and yellow four-in-hand, establish an automobile line from Snobhurst-on-the-Sea into town. And following this, suppose we should have a season of fast automobile omnibuses coming into direct competition with the electric cars? How about the speed limit then? You can not hold a private Juggernaut to one limit and a public one to another, and why should not both be held rigidly to the conservative limits already imposed on electric cars? What is sauce for the goose is sauce for the gander, and we know of no good reason why the public streets should be given over body and soul to dangerous vehicles. In a few years the competition which cuts no figure to-day may become, by steady improvements in the automobile, a pretty serious matter, and it seems to us that whatever influence the electric railroads can muster should be turned to securing one law and one practice of enforcing the law for themselves and their competitors. The competition is trivial now, but if a coterie of wealthy scorchers, with big pulls, gets the bars down in the matter of speed now, they will never go up again. It is well to kill snakes before they get a chance to grow fangs.

* * *

Seriously, the unfairness of allowing in automobiles which may be, and will be, used for public traffic, speeds which are forbidden to electric cars running under much better conditions for safety, is manifest. We think that, in most cities, the street cars are allowed all the speed that good conservative practice permits, and practically the speed is generally limited not by statute, but by the conditions of service. To place automobiles on the same fair plane requires not raising the limit allowed for street cars, except, perhaps, in a few places, but stern enforcement of the same legal speed limit for both classes of vehicles. The operation of a vehicle geared for two times or three times the legal speed in the public streets ought to be *prima facie* evidence of law-breaking, to be treated as such, and the punishment ought to extend beyond nominal fines. Truth to tell, we do not know of any passenger automobile in the market which is not geared to run at illegal speeds—if there is such an one, we shall be glad to give it publicity and commendation. The great and useful future of automobiles lies not in scorching, but in the development of types fitted for the steady and useful work of every-day transportation. It would be a good thing for the business if the law should step in and compel designers to turn their thoughts to a steady-going, reliable motor-vehicle to run at a maximum speed of 10 miles or 12 miles per hour, and to be available for the ordinary work and play of life. And the time is soon coming when the law must step in. Racing is well enough in its place, and some men are born with a love of a hot pace which they may reasonably expect to gratify, but the world's work is done at a more moderate rate. Certainly, there should, at least, be fair play in the matter of speed, and the electric car deserves enough from the public to be permitted a fair show in the public streets, and the street railways have a right to demand that others shall be held to the same rules as themselves.

President Roosevelt in a Trolley Accident

While driving from Pittsfield to Lenox, Mass., on Wednesday, Sept. 3, a carriage containing the President of the United States and the Governor of Massachusetts was struck by a trolley car. The accident resulted in but slight injuries to the occupants of the carriage, but caused the death of Secret Service Agent Craig, who was on the box with the driver, and severely injured the latter. The car was a special car, chartered by members of the Pittsfield Country Club from the Pittsfield Electric Street Railway Company, and was about 1000 ft. from the end of the company's line when the collision occurred. The President had made an open-air speech to the citizens of Pittsfield earlier in the morning, and was being driven to Lenox and Stockbridge, where arrangements had been made for further speeches previous to his taking his train for Great Barrington and other cities in his extended New England tour.

Unfortunately, the brake containing the corps of newspaper men who had accompanied him on his trip had been sent on ahead of the carriage, while the President stopped to visit a moment with ex-Senator Dawes in Pittsfield, and the first reports of the accident that reached the daily press contained, therefore, many inaccuracies and exaggerations. On account of these misstatements, which appeared in their reading pages, the editorial writers of a large number of papers have felt it incumbent upon them to

SCENE OF THE ACCIDENT

VIEW OF THE ROAD, SHOWING POINT OF CROSSING TRACK

flay unmercifully the motorman, the railway company, the city authorities, and, in fact, the New England electric roads in general. The hearing, which will be held in a few weeks to fix the blame for the accident, will undoubtedly disprove many of the stories that have been so widely circulated, and the Pittsfield Electric Street Railway Company, which only the night before had handled 4000 passengers between Pittsfield and Dalton, without a scratch to its patrons or any member of the crowds thronging the streets of the latter city in honor of the President's visit, will be placed in a position where a more reasonable estimate of its responsibility may be had.

The facts of the accident are as follows: There is a single-track line running from the center of the city to the Country Club, a distance of about a mile and a half. This track holds the center of the road, South Street, until within a short distance of the terminus, where the roadway bends slightly to the left, and the track keeps on in a straight line, passing from the center to the side of the road. Ordinarily the vehicular traffic going south, i. e., in the direction of the club, keeps to the west side of the track until the end of the road on that side is reached, as the good condition of the road and the wheel tracks at this point evidences. A carriage, therefore, which has not reached this turning point is naturally expected by motormen of approaching cars to keep off the tracks as completely as if they were to cross the track at any other point on the system. The President's carriage on Wednesday was in just such a position, between 250 ft. and 300 ft. from the ordinary crossing. As the car had almost reached the vehicle Driver Pratt, of the President's carriage, whose attention was wholly occupied in managing his four-horse team, swung the leaders suddenly to the left and attempted to cross immediately in front of an approaching car. The motorman did everything in his power to stop, but was too close to avoid the collision, overturning the carriage and throwing Mr. Craig, who had jumped to his feet at the approach of danger, directly under the wheels of the trolley car.

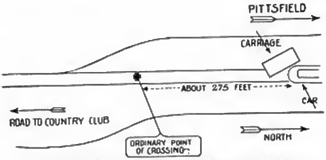


DIAGRAM OF ROADWAY, SHOWING RELATIVE POINTS

THE PRESIDENT'S CARRIAGE AFTER THE ACCIDENT

The gearing of the motors was such that running on level track 15 miles per hour would have been the maximum speed attainable. The accident occurred, however, on an up-grade, and it is attested by passengers on the car that the motorman was running at the time with current off. That the car was stopped almost immediately after striking the carriage is shown by the fact that the body of the vehicle was scarcely marred, and that there was hardly a scratch on the car. The strain on the wheels on the far side of the carriage caused them to give away, tipping the occupants out into the road and inflicting a few bruises. The near hind wheel was broken in, and it is probable that this was the point of collision. The carriage was pushed to one side and the car went far enough ahead to hit and kill one of the wheel horses.

Motorman Madden, who had charge of the car, was a thoroughly reliable man, having been in the service of the railway company for a long time, and having had a most excellent record. He was not, as was reported, a new man, and he did not lose control of his car. In many of the stories published impertinent remarks were said to have been made to the President by the motorman, a statement which is entirely without foundation in fact.

While the President was in the city the regular schedule on the railway lines was suspended so that the City Hall Square could be roped off during the addresses. The car which was in the accident was a special car, chartered by members of the Country Club to carry them from the City Hall Square after the President's address to the club house, where it was expected to give him an ovation as he passed. Before the trip the conductor was given special instructions that he need not hurry, as the schedule had been entirely abandoned for the time being, and he could take as much time as he wanted in getting back. That he tried to pass the President's carriage in a place where vehicles ordinarily kept to the road is true, but that the car was moving at a dangerous rate of speed seems highly improbable. The official result of the

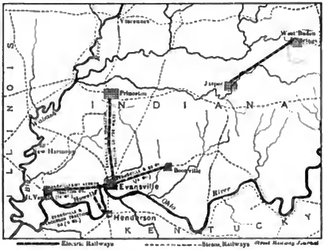
REAR WHEEL OF CARRIAGE STRUCK BY TROLLEY CAR

hearing will be awaited with impatience by street railway men throughout the country, and until the testimony of the motorman, conductor, passengers, driver and others is made public all the facts connected with this catastrophe cannot be known. The foregoing, however, is as accurate a description of the accident as can at this time be obtained by a careful investigation, on the spot, by a representative of the editorial force of this paper, and shows that not only were the published reports in the daily press greatly exaggerated but many of them contained details that were pure fabrications. The unenviable position in which it has placed the town of Pittsfield, however, has produced a combined effort of the press and public to "regulate" the speed of trolley cars. It is quite likely, therefore, that sufficient pressure will be brought to bear upon the company to compel it to modify its present excellent high-speed schedule, which has previously been operated with universal satisfaction and perfect safety.

Trolley Construction in Southern Indiana

With the growth of trolley enterprises in the States of the Middle West it would be expected that Southern Indiana would come in for some attention. In no section of the country are the people more enthusiastic in the prospect of enjoying the pleasure and convenience of interurban roads than those of "the Pocket." No doubt considerable municipal aid could have been secured to supply necessary financial backing had that plan been adopted by promoters at an earlier date, but now that the public has been assured so unqualifiedly by some of the companies organized that their propositions will go through, it would be more difficult to get financial assistance.

Up to the present time no work except surveying has been done on any line projected in this section. Four companies have been incorporated to construct roads to connect outlying towns with the city of Evansville, but some of them have not shown the financial stability that was expected of them. The first in the field was the Evansville & Southern, with a proposition to build a line to Boonville, in Warrick County, 18 miles in length. This has been abandoned, although right of way was obtained. The Evansville & Princeton Traction Company was next incorporated, to



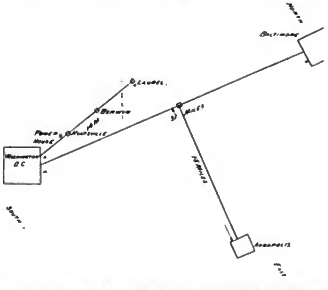
MAP SHOWING TROLLEY EXTENSION IN SOUTHERN INDIANA

build a line of about 28 miles to Princeton, in Gibson County. This line is now being surveyed, and the public is constantly assured through the daily newspapers that financial arrangements have been made for its completion. There seems some doubt about this, however, and local subscriptions are being asked for. The line has many attractive features, extending through a fine, thickly settled district. The third company to be incorporated is the Evansville & Mt. Vernon Traction Company, to construct a line of about 16 miles to Mt. Vernon, in Posey County. The money necessary to construct this road has been secured, but before entering upon the work it was desired to make arrangements for the satisfactory bonding of the property, so as to replace local money. This line is intended to connect with the Evansville Street Railway. Recently the Evansville & Henderson Traction Company has been organized to construct a road from Evansville to Henderson, Ky., using a ferry to cross the Ohio River at the latter point. It is also proposed to connect with the city lines of Evansville. A company has been incorporated to build a road from Jasper, in Dubois County, to the West Baden Mineral Springs, a well-known health resort. Evansville is surrounded by a wonderfully fertile agricultural country, and the people have been unusually prosperous for several years, and it is probable that any of the proposed lines would be a financial success, especially when the city is experiencing a steady and reasonably rapid growth.

Single-Phase Equipment for Washington, Baltimore & Annapolis Interurban Railway

As announced in the last issue of this paper, the Westinghouse Electric & Manufacturing Company, of Pittsburgh, has contracted for the equipment, with alternating-current apparatus throughout, of the Washington, Baltimore & Annapolis Electric Railway, which is to operate an interurban system, including a line from Washington to Baltimore about 40 miles in length, and a branch to Annapolis 15 miles in length.

Single-phase, alternating current will be generated in a main power house located at Hyattsville, by three 1500-kw single-phase Westinghouse generators, delivering current at 15,000 volts and driven by Hamilton-Corliss cross-compound engines. This station is of more than average size, and is, in no sense, experimental.



MAP OF WASHINGTON, BALTIMORE & ANNAPOLIS INTERURBAN RAILWAY

The power house will be built of brick with stone and concrete foundations, and will contain, in addition, two 125-volt direct-current generators to be used as exciters for the alternators, and a large switchboard with electrically-operated oil switches, circuit-breakers, lightning arresters, etc. Current will be distributed from the power house at 15,000 volts to transformer stations located at suitable intervals along the line. These transformer stations will contain only stationary transformers with the necessary switches and fuses, but no moving machinery, and will not, therefore, require the presence of an attendant. From these stations, current will be fed to the single trolley wire at 1000 volts. The pressure of 1000 volts, which has been adopted for the trolley wire, is not a necessary part of the system, as a much higher voltage could have been used if it had been deemed advisable by the engineers of the road.

The cars will probably be 60 ft. in length and weigh about 50 tons each. They will be supplied with M. C. B. trucks designed for high speed; the track is laid with 80-lb. rails, and it is expected that the distance of 31 miles will be made in forty-five minutes, including stops. The cars are to be equipped with four motors, each of 100 hp, and it is expected that a normal speed of 40 miles to 45 miles can be attained and a speed of 60 miles reached when necessary.

The motor, which is the novel part of the equipment and the key to the entire system, is a variable speed machine having characteristics adapted to railway service, and the manufacturers claim that it is, in all respects, equal to the present direct-current railway motor. It has been developed and tested in severe service by the Westinghouse Electric & Manufacturing Company, under the supervision of B. G. Lamme, assistant to the chief engineer. The company thus far, however, has closely guarded the details of design and construction, but it claims to have attained very satisfactory results in experimental work.

As mentioned before, the power house is now being erected at

East Hyattsville, Md., where the railway company owns a site of three acres. This station will be completed in about twelve months, will be 133 ft. x 203 ft. in size and cost in the neighborhood of $350,000. It is located conveniently to water for condensing purposes and to railway facilities for handling coal, and will furnish power for the Chesapeake Beach Railroad, which is to discontinue the use of steam, and, perhaps, in addition, to manufacturing plants to be located in this neighborhood.

The company is to take over a small direct-current road about 14 miles long, running from Washington to Laurel, Md., and current for this line will be furnished by two 200-kw single-phase rotary converters located at the power house in Hyattsville. This apparatus is also a new departure and of considerable interest, especially since it shows the possibilty of operating the new system with existing direct-current plants.

The single-phase motor, if successful, will mark a radical departure in electric railroading. In the ordinary method of operating street railways, direct current is fed to the trolley line for the car-motors. For city lines and densely-populated districts, the current is often generated as direct current, but for long-distance interurban roads this would involve a cost of copper conductors entirely prohibitive. To meet the latter objection, it

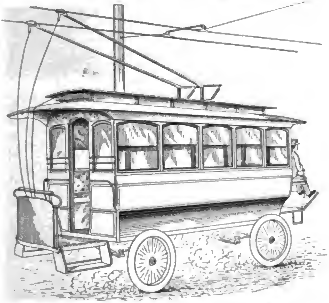


FIG. 1.—TRACKLESS TROLLEY CAR AND OVERHEAD CONTACT ARRANGEMENT

has become common practice in this country to generate alternating currents at 10,000 volts to 30,000 volts and transmit them to sub-stations where, by means of transformers and rotary converters, the current is supplied to the trolley wire as direct current at the usual railway voltage from 500 volts to 650 volts. The rotary converter sub-station, however, has always been an expensive feature, chiefly on account of the cost of the apparatus and building and the attendance required. In Europe the polyphase induction motor has been used to some extent, but it implies the use of two or three overhead wires, and, moreover, the characteristics of the induction motor in regard to starting and average efficiency in railway service are said to be not of the best. Other systems which have been proposed involve the use of single-phase motors upon the cars driving generators, which, in turn, supply power to the motors on the axles, or, in other words, placing a sub-station upon the car itself, which can not be considered a great improvement over the ordinary alternating-current, direct-current system. Details regarding the new Westinghouse system have not been given out, but it is contended that by its use the limitations of the induction motor and the disadvantages of the multiplicity of overhead conductors, as well as the great cost of the system last described, will be avoided.

The engineers of the new road are the Cleveland Construction Company, of which Will Christy is president. The officers of the Washington, Baltimore & Annapolis Railway Company are W. H. Lamprecht, president, and Otto Miller, secretary, both of Cleveland, Ohio. The directors are as follows: W. H. Lamprecht, F. T. Pomeroy, F. N. Wilcox and Otto Miller, all of Cleveland, Ohio; Will Christy, of Akron, Ohio; James Christy, Jr., of Washington, D. C., and W. L. Marbury, of Baltimore, Md. It is also stated that Henry Everett, E. W. Moore and W. J. Mandelbaum & Co., of Cleveland, are largely interested in the enterprise.

The Trackless Trolley in New England

Mention has been made of several projects to introduce the "trackless trolley" in New England, but thus far no serious attempt has been made to establish a commercial system in this country after the manner of the foreign undertakings. Now, however, it is announced that a company has been engaged upon the problem and that a modification of the methods described in the STREET RAILWAY JOURNAL, of March 1 and Aug. 2, has been perfected and will shortly be put into practice in Lowell, Mass., and other places in New England where permission has been secured from local authorities. It is claimed that A. B. Upham, of Boston, president of the Eastern Trackless Trolley Company, more than a year ago installed a temporary line to demonstrate its practicability; and the company of which he is president hopes soon to have a line in practical commercial service.

The accompanying sketch, Fig. 1, shows a car designed to seat twenty passengers, with standing room for ten more, and is equipped with two motors, and controller for changing speed. In this system two trolley poles are employed. They press apart

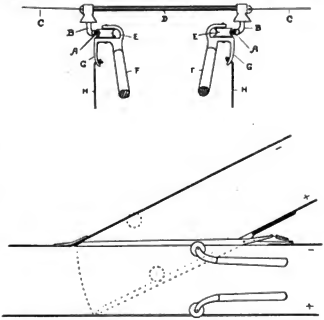


FIG. 2.—TRANSVERSE SECTION OF TROLLEY WIRES, AND METHOD OF CONTACT WITH TROLLEY WHEELS

a pair of horizontal trolley wheels, as shown in the cuts. As these wheels are horizontal and pressed against the sides of the wires, it makes no difference what angle the poles make with the wires, as viewed from above; whether in the same vertical plane, or reaching over sideways from any direction. On this account, the vehicle can travel with greater freedom either directly beneath the trolley wires, or along lines parallel with the wires at any distances within the reach of the trolley poles. This, with trolley poles of the usual length, gives a variation extending to about 8 ft. on each side of the wires; thus permitting a vehicle 6 ft. in width to travel along any part of a roadway 22 ft. wide, and is found to be ample for all practical purposes, as it enables the motorman to guide his car around and between other wagons without thought of the trolley.

The two trolley wheels are strongly pressed apart with their flanges embracing the inner faces of the trolley wires.and they thus constitute, in effect, a dovetail hold upon the wires. Such arrangement permits of a simple and practical method of switching the trolley from one line to another. The form of switch employed for this purpose consists of a laterally swinging switch-tongue, introduced as a section of one of the trolley wires at a point where another pair of wires join the main line, as shown in the accompanying sketch, Fig. 2. A spring retains the switch-tongue closed and so permits the trolley wheels to traverse the main line without interruption; but, when a trolley approaches on the branch line, the instant one trolley wheel meets the switch-tongue it forces the latter over until its end makes contact with the opposite main-line wire, and so provides a means for guiding the wheel over to this wire, while the other wheel simply rolls about the corner from the branch wire to the other of the two main-line wires. After the trolley wheels have passed, the switch-tongue is returned to its normal position by its spring. Fig. 2 is a transverse section of a pair of trolley wires showing

their hangers and trolley wheels in engagement with the wires, the reference letters *AA* indicate the trolley wires; *BB*, the wire-hangers; *CC*, the stay wires; *D*, the wooden bar joining the hangers; *EE*, the trolley wheels; *FF*, the trolley poles; *GG*, the bearing extensions for guiding the trolley wires into the grooves of the trolley wheels, and *HH*, the cords reaching from the bearing extensions into the reach of the car conductor.

Another advantage in the horizontal arrangement consists in the facility with which the wheels can be applied to the trolley wires. This is accomplished by providing the bearings of each wheel with a rigid extension flush with the wheel flange, and having a rope hang from the end of each extension into the reach of the occupants of the car, while a third rope is provided for drawing the two trolley poles together and at the same time giving them an upward pressure.

To apply the trolley to the wires, the conductor or motorman pulls upon this third rope until the upper ends of the poles are drawn together and so rendered capable of rising up between and above the wires, the two ropes first named being used to guide the same. The third rope being then released, the trolley poles and wheels separate until the two ropes meet the wires. These latter ropes are now pulled down upon until the extensions referred to reach the wires, and until the wires pass from these extensions into the flanges of the wheels.

Owing to the facility with which the trolley can be shipped and unshipped, it may be adapted for a mixed passenger and freight business. It is explained whenever a swift passenger car approaches or overtakes a slow freight carrier, the latter removes its trolley while the other steers around and past it without stopping. This facility would likewise do away with waits at turnouts, enabling the cars on a single line to keep on until two approach each other, when the out-going car, for instance, removes its trolley and the other passes without delay.

Home-Made Parlor Car

The equipment of the Concord, Maynard & Hudson Railway Company includes a handsome parlor car, which is in constant demand for theater parties and excursionists who desire to make a trip over its lines and enjoy the natural beauties of that section. The scenery in this part of New England is unsurpassed, and the ride over the company's line forms a very popular trip, as it passes a number of historical houses and points of interest. A picture of the car, which is now in operation, is presented herewith, together with an interior view, which shows the decorations and furnishings of this handsomely fitted coach. This car is particularly interesting, as it is the first of three special cars to be turned out from the company's shops under the personal direction of John W. Ogden, superintendent of the system. At the present time there are two more cars of the same type going through the

INTERIOR OF CONCORD PARLOR CAR

shops, and these are being hurried to completion because of the demand which has been created by the operation of the first car.

The company had six cars which were originally built for a storage battery road, but which were never put into service. These cars were spliced so as to make three trolley cars, 40 ft. over all. As the entire frame work, including sills, cross timbers and studding, was of extra heavy construction, it was an easy matter to rebuild them into a substantial structure. One end of each battery car was taken out to a point about 3 ins. above the door, and the end was arched, as may be noticed in the interior view. The advantage of this plan was in preserving the frame of each car intact and making the whole structure particularly strong when bolted together. After joining these parts they were reinforced by 6 in. x 8-in. Southern pine timber, extending the whole

RECONSTRUCTED PARLOR CAR OF THE CONCORD, MAYNARD & HUDSON STREET RAILWAY

length of the car and bolted through the original sill. Outside of this timber was secured a ⅝-in. angle iron, 5 ins. x 5 ins., and a small angle iron as well for drip rail to increase the rigidity of the top of the car. For bolsters 8-in. x 8-in. oak was used, reinforced by ½-in. plates. Another improvement was effected in changing the windows so as to open up instead of dropping down, as originally designed. The old hoods were saved, but new platforms and vestibules were built. The floor of the car is of ⅞-in. maple, and the sheathing inside of white wood, mahogany stained.

The outside of the car is painted dark blue for the body and the trimmings are in a lighter shade. The scrolls are gold leaf and aluminum. As represented in the illustrations the car presents a very handsome appearance. The car is wired for eight ceiling lights and twenty side lights, with lily pattern shades of different colors, thus ensuring an even distribution and the diffusion of subdued light. The panels back of the side lamps are painted a light blue and the rest of the interior is of mahogany finish. The draperies at the windows are of electric blue, with white cord and tassels, and a very handsome velvet carpet covers the floor. In one corner of the car is a toilet room, and there are also provided two ice boxes arranged under seats, so as not to occupy space and not to spoil the appearance of the cars. The tops of these corner seats are upholstered in crimson plush. In addition there are twenty-one rattan chairs with colored plush cushions, two tete-a-tetes, one mahogany and one rattan table, and plenty of sofa pillows to ensure the comfort and convenience of the occupants on long rides. The bronze rod from which the draperies are hung runs the entire length of each side of the car, and the brackets supporting it were especially designed so as to furnish at the same time hooks upon which to hang wraps and hats. All the trimmings and furnishings throughout the car blend harmoniously and present a very attractive appearance. The car has a seating capacity of thirty-one people.

The dimensions of the car, as rebuilt, are as follows: Length over all, 40 ft. 8 ins.; height, 12 ft. 5 ins.; width, 7 ft. 10 ins.; distance between bolsters, 21 ft. 3½ ins.

The car body is mounted on Peckham No. 14 B-3 double trucks, with four 12-A 30 motors, K-12 controllers, Christensen air equipment, arc and incandescent head lights, trolley catchers and two trolley poles.

To Defeat Twenty-Five-Year Clause in Ohio

The traction interests of the State are exerting every effort to defeat the clause in the proposed code for Ohio cities, which provides that railway franchises shall be for twenty-five years, and that every ten years they shall be subject to change at the will of the Council of the municipality, having the right to regulate the rate of fare or other conditions of travel. The ten-year provision is seriously objected to. A leading promotor, in speaking of the proposed code, summarizes the results in a very few words. "We will," says this authority, "be unable to finance a road under such conditions. It practically means a straight ten-year franchise, and no bond-buyer would consider the bonds of a road having such franchises. The State of Ohio has, within the last few years, had its tax duplicate increased from $40,000,000 to $50,000,000 by capital from New York, Boston and Philadelphia invested in interurban roads, not one of which could have been financed under the provisions of the proposed Nash code. The franchise is one of the first things financiers look at in furnishing money for such a road. Twenty-five years is short enough period under which to sell bonds, but ten years is out of the question."

Electric Locomotive for Freight and Industrial Service

The establishment of interurban roads and the development of the freight and express business of these lines have created a demand for electric locomotives for hauling heavy trains in place of single cars mounted on electric trucks. Up to the present time, heavy railroad service has not received as much attention at the hands of electrical engineers as the street railway and elevated service. For this reason the field has been left practically to the steam locomotives, but in many cases it has been found that electric locomotives can be conveniently and profitably employed. This is also true of private railway lines in large industrial establishments, of switching yards, and where it is desired to replace steam locomotives in hauling trains through tunnels.

FIG. 1.—FOUR-WHEELED, TWO-MOTOR, ELECTRIC LOCOMOTIVE FOR HAULING COAL AND ASHES OF BROOKLYN RAPID TRANSIT COMPANY

A careful examination of the problem shows that under suitable conditions, especially where the work is largely concentrated, a central power plant transmitting electrical energy to a number of motors is more economical than numerous steam locomotives, which, of necessity, are not working under the conditions most favorable to economy. This is particularly true of localities where the cost of fuel is high, and it is believed that the transmission of electricity at high potential for long distances will open up a wider field for electric locomotives in heavy railroad service. For short branch lines or for suburban freight or passenger traffic, where it is not convenient to equip the cars with motor-driven trucks, electric locomotives may be operated economically, but this, of course, is governed largely by local conditions. One of the most promising fields for electric locomotives is the switching service, either for heavy or light traffic. Where the service is intermittent, as, for instance, at railway ter-

minals and on docks and in industrial plants, they are especially economical. There are some classes of industrial establishments to which electric locomotives are particularly well adapted, as for instance, in lumber mills, on account of the fire risks or where ever the smoke and gases from steam locomotives would be objectionable.

Several examples of recent installations of this kind are illustrated in the accompanying cuts. Fig. 1 shows an equipment employed by the Brooklyn Rapid Transit Company for hauling coal and ashes at its power plant. This is a 4-ton, 4-wheeled locomotive of the mining type, equipped with two direct-current motors and a trolley pole standard. Fig. 2 shows another type in use by the Hawaiian Electric Company. It is employed to haul sugar-cane from the plantations to the grinder. This also is a 4-wheeled, 2-motor equipment. Fig. 3 shows a 4 ft. 8½ ins. gage switching locomotive weighing 13 tons. This locomotive is employed at the Atlantic Coast Lumber Company's yards in Georgetown, S. C. It is a 4-wheeled locomotive driven by two motors capable of exerting a full load draw-bar pull of 4500 lbs. at a speed of 6 miles an hour. A series-parallel controller is used on this locomotive, and permits of a speed of 3 miles an hour with the motors operating in series. Probably the most interesting example for the steam railroad men is that presented in the illustration of the Carnegie Steel Company's equipment, Fig. 4. This comprises an 8-wheeled electric locomotive hauling a heavily-laden freight train. Two motors are employed.

FIG. 2.—HAULING SUGAR CANE FROM HAWAIIAN PLANTATION TO GRINDER

FIG. 3.—ELECTRIC LOCOMOTIVE HAULING LUMBER TRAIN OF ATLANTIC COAST LUMBER COMPANY

All of these locomotives have been built and equipped by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company, which have been engaged jointly in investigating the special requirements of this service and developing suitable apparatus to meet the conditions of general practice. The mechanical details of these equipments receive the same careful attention that is given to steam locomotive work. A large variety of motors are available that are suitable for ordinary gages, but on exceedingly narrow gages, such as are sometimes used in industrial plants, it is found desirable to use motors of larger size than can be placed between the wheels, and special designs have been prepared, whereby motors of large capacity may be applied to any reasonable gage by double-transmission gears. The general arrangement of gears and suspension is illustrated in Fig. 5. The journals of the shaft carrying the intermediate gear run in boxes working in pedestals over the main journal boxes of the locomotive and rigidly connected with them, permitting the locomotive to rise and fall on the axles without disengaging the gears. The locomotive is supported on springs in the usual manner. The motors are hung on the shafts of the intermediate gears, as if they were the ordinary wheel axles with the usual nose suspension. This arrangement gives a motion to the motors exactly the same as if hung between the wheels with single gears.

FIG. 4.—EIGHT-WHEELED, FOUR-MOTOR, ELECTRIC LOCOMOTIVE OF CARNEGIE STEEL COMPANY

FIG. 5.—MOUNTING LARGE MOTORS ON A NARROW GAGE

Small 4-wheeled pedestal-type locomotives usually have frames made of wood, substantially put together in the same manner as steam locomotive tender frames, with cast-iron pedestals securely bolted. Most of the larger 4-wheeled locomotives and all locomotives with eight wheels have frames made either of steel channels or of cast-iron channels, securely bolted.

Trucks for 8-wheeled locomotives are designed especially for the weight they are to carry, allowing strength for an ample factor of safety. Two types of trucks may be used; the "M. C. B. equalizing-bar" type, illustrated in Fig. 6, or the "direct-spring hung" type. The latter has springs placed over the journal boxes, supporting the frames. Either of these types may be constructed with swing bolsters or rigid centers. The frames are made of wrought-iron throughout, carefully finished to templet, with center frame or transom and pedestals accurately fitted and squared, all bolts being turned to a driving fit in reamed holes. Bolsters and spring planks are made of channels, steel plates or bars, or of oak. Equalizing bars of wrought-iron are designed for ample factor of safety in service, two bars resting on the journal boxes

The locomotive is entirely supported on springs, of cast-steel, tempered in oil, designed to insure smooth riding and prevent pounding. The motors are suspended on springs, relieving them from shock in starting and on rough tracks. On small locomotives the wheels are generally of chilled cast-iron, while locomotives of larger size are usually equipped with steel-tired wheels. Chilled wheels have the advantage of cheapness, while the steel-tired wheels have in their favor durability and facility in making renewals. Tires are secured to the centers by retaining rings, permitting replacements to be readily made.

In general practice, it is recommended that one end of the motor be attached to the axle with suitable bearings, and the other end supported by a spring suspension hung from the locomotive frame on four-wheeled locomotives, and usually from the truck transom on eight-wheeled locomotives. The eight-wheeled double-truck type may also be equipped with the Gibbs cradle suspension, in which the entire weight of the motors and cradle is carried on the axles, the suspension springs taking up the shock in passing over frogs, switches, cross-overs, rail-joints and unevenness of track.

The experience of the engineers who have been engaged upon this investigation, as well as the companies that have employed electric locomotives, is that one of the most important questions to be determined is the proper capacity of the motors to be employed. Locomotives of the same draw-bar pull may require very different motors. It is pointed out that a short, straight haul over a level track, as in carrying material from a railway

line to industrial works, requires a motor differing in capacity from that used in a locomotive employed in shifting; and the presence of grades may further differentiate the types of motors. The power required for propelling a locomotive is, therefore, exceedingly variable, and the railway motor under normal conditions works for only a brief interval at any one given output. The maximum load which it can momentarily carry under such conditions will, of course, depend upon its commutation, but it is almost invariably the temperature rise of the coils which limits its capacity. With rapidly intermittent and varying loads, this temperature rise will not follow each application or change of the current, but will depend upon the average rate of working of the motor.

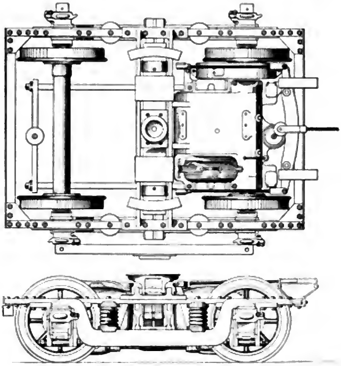


FIG. 6.—PLAN OF ELECTRIC LOCOMOTIVE TRUCK

The equipment includes controllers of the series-parallel or rheostat type, the latter being recommended for switching. The controllers are provided with a magnetic blow-out device. An automatic railway type circuit-breaker and a Wurts lightning arrester are also provided.

The trolley is designed to withstand heavy strains, and where the current is large, a double-tandem trolley is employed. Where service conditions prevent the use of a ground return, a double trolley for an overhead return system is furnished. In some installations it is desirable to use a third-rail for the distribution of current, and for them a cast-iron contact shoe is furnished. Current connections are made by a flexible cable. The standard shoe is of the same design as that used on the Boston Elevated and the Brooklyn Rapid Transit systems.

Increase of Wages in Buffalo

During the early part of this year an announcement was published in this paper of an increase in wages of conductors and motormen on the lines of the International Traction Company, of Buffalo, and, in connection with this increase, of a system of paying premiums for immunity from accidents. This system has proved so satisfactory to the company that last week a second announcement was made of another increase in wages. This, following a number of other improvements which the management has made in the condition of its employees, and several outings which have been extended during the summer to the families of the workmen have evoked a great deal of favorable comment from the men, as well as from the general public and press of Buffalo.

The increase just made amounts to about 10 per cent of the wages paid the men, and was made without solicitation on their part. The information was conveyed to employees, who are about 1300 in number, in the form of an individual letter to each motorman and conductor in the employ of the company. This letter read as follows:

Dear Sir.—The general excellence of the service rendered by our trainmen prompts me to express my appreciation and to take this opportunity of thanking you personally for the part you have taken in bringing about such a gratifying state of affairs.

Your painstaking efforts have made the present success possible, and in recognition thereof I now advise we will at once materially increase the wages of all trainmen; notice to be posted on Sunday will give the new rate, effective on Sept. 1, 1902, as follows:

Twenty cents per hour, platform time, for the first-year continuous service.

Twenty-one cents per hour, platform time, after one year's continuous service.

Twenty-two cents per hour, platform time, after two years' continuous service.

I would also remind you that the wages paid on the various lines controlled by this system, in March, 1900, ranged from 14 cents to 18 cents per hour, an average increase of over 5 cents per hour having been made since the date of our meeting in Saint Stephen's Hall. Superintendent Coons and his assistants have aided me in carrying out the promises made at that time, and, as a result, the rules have been modified and revised; regular men are not obliged to forfeit their runs as formerly; runs have been so arranged as to make the hours of relief most pleasing to the men; all high-speed cars have been equipped with air brakes and seats have been provided for motormen of interurban lines.

It is, therefore, apparent that we appreciate your loyal support and intelligent work, and, in consequence, are endeavoring to so improve both the wages and surrounding conditions as to make the positions worthy of your best efforts.

Trusting that the present happy state of affairs may continue undisturbed, and that each man will do his utmost to give this company the reputation of having the most careful and courteous trainmen in the world, I am Yours truly,

T. E. MITTEN, General Manager.

Pennsylvania Tunnel Franchise

Representatives of the Pennsylvania Railroad Company, the Rapid Transit Commission, Board of Estimates and Appropriations and Board of Aldermen, and the borough presidents, of New York, held a conference last week, at which the terms of the proposed contract between the city and the railroad, for the building of the tunnel from Jersey City under the North River into Manhattan, and thence under the East River into Long Island City, were discussed. There were several points upon which the conference failed to reach an agreement. The position of the Pennsylvania Railroad Company was very clearly set forth by President Cassatt in a letter which was submitted to the conference, and which was, in part, as follows:

In discussing the terms of a revised franchise with your joint committee, amendments were suggested covering proper sanitary supervision of the tunnels, the right of the city to place its fire and police wires within the same, and insuring prompt completion of the work, and the permanent possession of the franchise by a New York corporation. No objections were made to these amendments and the Tunnel Company is quite willing to accept them; but another suggestion that the Tunnel Company shall further indemnify the city against any claim for damages that may arise out of the closing of Thirty-Second Street, between Seventh Avenue and Ninth Avenue, cannot be assented to, for the reason that in agreeing to the price of $788,600 for the ground within the vacated portions of this street, the Tunnel Company is paying what is admitted to be the full fee simple value of the land, and which value largely results from such vacation. It is, therefore, incumbent on the city to meet such damages, if any, occasioned by the vacation, for which it may be held legally liable. It can hardly be claimed that the Tunnel Company should first pay full value for the land and in addition thereto pay damages which are an essential part of such value.

One point more remains to be referred to, upon which the Pennsylvania Railroad Company desires that no misunderstanding shall exist, and that is the suggestion that in the grant of the franchise, a condition shall be imposed regulating the rate of wages and the hours of the men employed upon the work. Counsel advise that this whole question has been so fully disposed of by the Court of Appeals of New York, that it is unnecessary to do more than to say that the law is now settled, and that the city cannot impose such conditions even in the building of its own subway. As has been explained to your committee, this is a question of no practical moment, for the reason that the work will be let to contractors, who will necessarily have to conform to the labor situation as it exists in New York. It would, therefore, be simply a pretense for the Tunnel Company or the Pennsylvania Railroad Company to agree to do something over which neither company has any control. But, outside and beyond this, the City of New York is not justified in imposing any such condition.

So far as the Pennsylvania Railroad Company is concerned, its relations to labor, organized and unorganized, are of the most friendly character. It does not ask its employees whether they belong to one or the other class. It only asks for and insists upon faithful service.

Several modifications were proposed by the city's representatives, but to none of them would the railroad agree. The com-

pany took the position that the city could not legally saddle these conditions upon the company, that it could not enforce them if the company accepted them, and that the company would not lend itself to a scheme that was palpably a bid for the labor vote by Borough President Cantor and the Tammany Aldermen. Comptroller Grout wanted to know how the eight-hour and the prevailing rate of wages clauses could be enforced if put in the contract.

"If they are included in the contract I will be satisfied," said President Cantor. "Let the enforcement take care of itself."

The conference was discontinued after President Green agreed to submit the plan of arbitration proposed by Comptroller Grout to President Cassatt. Another conference will be held on the franchise on Sept. 17.

Transportation Arrangments for Detroit Convention

The transportation committee of the American Street Railway Association has completed special arrangements with the railway companies of the several sections of the country for the transportation of delegates and visitors to the Detroit Convention. The New York and New England delegation will have a special train, with which connection may be made by those living in cities throughout the Eastern district. Through car schedules have also been arranged from Western and Southern points to Detroit. The committee has issued the following bulletin, containing detailed information regarding arrangements from all parts of the country:

A special train will be provided, consisting of Pullman buffet, smoking and drawing-room and sleeping cars from New York and Boston as per schedule, under charge of a special passenger agent of the New York Central.

From New York and New England:
Boston—Leave Boston & Albany Ry. 2:00 p. m. Tuesday, Oct. 7.
Worcester—Leave Boston & Albany Ry. 3:05 p. m. Tuesday, Oct. 7.
Springfield—Leave Boston & Albany Ry. 4:29 p. m. Tuesday, Oct. 7.
Pittsfield—Leave Boston & Albany Ry. 6:06 p. m. Tuesday, Oct. 7.
Albany—Arrive Boston & Albany Ry. 7:30 p. m. Tuesday, Oct. 7.
New York—Leave New York Central 4:00 p. m. Tuesday, Oct. 7.
Poughkeepsie—Leave New York Central 5:56 p. m. Tuesday, Oct. 7.
Hudson—Leave New York Central 6:53 p. m. Tuesday, Oct. 7.
Albany—Arrive New York Central 7:35 p. m. Tuesday, Oct. 7.
Albany—Leave New York Central 7:40 p. m. Tuesday, Oct. 7.
Schenectady—Leave New York Central 8:10 p. m. Tuesday, Oct. 7.
Fonda—Leave New York Central 8:45 p. m. Tuesday, Oct. 7.
Utica—Leave New York Central 9:54 p. m. Tuesday, Oct. 7.
Syracuse—Leave New York Central 11:15 p. m. Tuesday, Oct. 7.
Rochester—Leave New York Central 1:05 a. m. Wednesday, Oct. 8.
Buffalo—Arrive New York Central 3:00 a. m. Wednesday, Oct. 8.
Detroit—Arrive Michigan Central 7:45 a. m. Wednesday, Oct. 8.
Dining car serving dinner from Boston and New York.

Connections will be made from all New England points either at Boston, Worcester, Springfield or New York. Applications for sleeping car accommodations from Boston and Albany points should be addressed to J. L. White, city passenger agent, Boston & Albany Railroad, 366 Washington Street, Boston, Mass.; from New York and points on New York Central, to Milton C. Roach, general Eastern passenger agent, New York Central & Hudson River Railroad, 1216 Broadway, New York City. Early application should be made for space on the special, as reservations will be made in the order applications are received.

THROUGH CAR SCHEDULE FROM WESTERN AND SOUTHERN POINTS TO DETROIT, MICH.

From Louisville and South:
Leave Louisville, Pennsylvania lines, 4:00 p. m. Pullman sleeper Louisville to Detroit.
Leave Indianapolis, Pennsylvania lines, 7:20 p. m. Pullman sleeper Louisville to Detroit.
Leave Logansport, Pennsylvania lines, 9:50 p. m. Pullman sleeper Louisville to Detroit.
Arrive Detroit 7:35 a. m.
Apply to agent, Pennsylvania lines, at points named.

From St. Louis and the Southwest:
Leave St. Louis, Wabash Railroad, 8:30 p. m. Through sleeping car.
Arrive Detroit, Wabash Railroad, 9:30 a. m.
Apply to city ticket agent, Wabash Railroad, St. Louis.

From Cincinnati and South:
Leave Cincinnati, C. H. & D. R. R., 9:45 p. m. Through sleeper.
Arrive Detroit, Michigan Central, 7:45 a. m.
Apply to city passenger agent, C. H. & D. R. R., Cincinnati, Ohio.

From Pittsburgh:
Leave Pittsburgh, Pennsylvania lines, 1:06 p. m. Through sleeper
Arrive Detroit, Michigan Central, 7:45 a. m.
Apply to city ticket agent, Pennsylvania line, Pittsburgh, Pa.

From Chicago and the West:
Leave Chicago, Michigan Central, 10:30 a. m., 3:00 p. m., 10:00 p. m., 11:30 p. m.
Arrive Detroit, Michigan Central, 6:10 p. m., 10:45 p. m., 7:35 a. m., 9:50 a. m.
Parlor cars on day and sleeping cars on night trains.
Address L. D. Heusner, general western passenger agent, Michigan Central Railroad, 119 Adams Street, Chicago, for reservations.

Rates of Fare.—The various traffic associations have named fare and one-third on the certificate plan. When purchasing tickets ask the ticket agent for certificate.

Pullman Fares.—Regular rates apply from all points.

The committee, in submitting the foregoing, announces that the lines named were selected as official routes, all having through Pullman service to and from Detroit. In addition to the foregoing, the committee advises the following direct connections:

From Philadelphia:
Pennsylvania Railroad. Sleeping cars to both Pittsburgh and Buffalo, connecting with Pullman service to Detroit.
Philadelphia & Reading and Lehigh Valley route. Sleeping cars to Buffalo, connecting with Pullman service to Detroit.

From Baltimore and Washington:
Pennsylvania Railroad. Sleeping cars to Buffalo and Pittsburgh, connecting with Pullman service to Detroit.

From Canadian Points:
The Canadian Pacific and Grand Trunk lines run Pullman cars from Montreal and Toronto to Detroit.

New York Central Plans

The first official announcement of the plans of the New York Central & Hudson River Railroad Company regarding the substitution of electricity for steam in the operation of trains through its tunnel, and the other improvements contemplated at the terminal station, was made last week by President H. H. Newman in a communication to the city officials, asking for the necessary authority. The company has filed a petition asking the local Board of Improvements of the Murray Hill District to initiate proceedings immediately for certain changes in Park Avenue, between Forty-Fourth Street and Fifty-Sixth Street, and sections of intersecting streets at points where they cross the railroad yards. The petition asks for the widening and closing of a part of Park Avenue and for the discontinuance and closing of certain cross streets.

President Newman says that the improvements are to be effected without cost or expense to the city, and that it is the object of the railroad company to acquire title, by proper proceedings, to the discontinued portions of Park Avenue and intersecting streets, and the railroad company proposes to vest, or cause to be vested, in the city titles to the land to be acquired for a new portion of Park Avenue and to bear all the expense of opening, regulating, grading and paving the same. For the discontinued portions of the streets the railroad company agrees to pay the city full cash value.

Upon the subject of the change of motive power in the tunnel, President Newman says in his letter accompanying the petition:

It is the present intention of the railroad company, and the Mayor has already been so advised, to discontinue the use of steam as a motive power for all of its trains on the Hudson and Harlem divisions, within the city limits, and to operate by electricity on the Hudson division, probably as far as Croton, and on the Harlem division, probably as far as White Plains.

The date upon which operation by electricity can be commenced will be determined, the necessary authority being obtained, upon the time required for the construction and equipment of power houses. It was with the desire of hastening and of prosecuting so much of this work, as might be possible under the existing law, that the negotiations were begun; and with the same desire the company is ready, if it has the co-operation of the city as prayed for in the petition, to enter into contracts for the power houses required for operation by electricity, just as soon as necessary details can be perfected.

Accompanying this letter is the petition of the railroad company for authority to close the streets named. The petition is signed by W. C. Brown, third vice-president of the New York Central Railroad Company, and W. S. Crane, treasurer of the New York & Harlem Railroad Company. The petition contains a complete description of the streets to be closed, together with maps upon which the changes are clearly designated. The railroad company announces its willingness to indemnify the city from all costs and expenses which may be incurred, in order to effect the alterations, and agrees further that the existing bridges in the streets mentioned shall be properly and suitably extended over the portions of the streets proposed to be discontinued.

New Car House and Repair Shops at Minneapolis

The Twin City Rapid Transit Company is now building, in Minneapolis, on the property bounded by University Avenue, Fourth Street, First Avenue and Second Avenue, a most complete car house and repair shop, setting aside a portion of the building for the use of the employees. The structure is not an entirely

new one, but the old building has been so enlarged and remodeled that few traces of it remain. The entire front has been set back 40 ft., an addition, 125 ft. x 330 ft., and a new central building for offices and men's quarters erected, making the dimensions of the modern structure 330 ft. x 290 ft.

The cars are to be cared for in two long wings flanking the new central building. The entire floor space of these immense wings has been excavated 5 ft. below the floor surface, and a solid concrete floor has been laid over the excavated surface. The regular pits for car inspection and repair work are provided

The central building, which is two stories high, contains the offices and men's quarters. These latter show, on the part of the company, an unusual consideration for the comfort, health and entertainment of its employees. It is, in short, a club for the motormen and conductors when off duty. Just back of the airy offices is the main room for the men, 24 ft. high, with a balcony on three sides. Here will be easy chairs, and tables for games, books and magazines, etc. Around the walls, both on the main floor and the balcony, are 650 handsome roomy lockers. Back of this room are the dressing and bath rooms, the latter including an apartment equipped with the latest type of shower baths, all of which will be open to the employees at all times and without cost. Still further back are the repair shops.

London Letter

(From Our Regular Correspondent.)

Mr. James Dalrymple, C.A., accountant to the Glasgow Corporation Tramways, has been asked by the executive committee of the Association of Municipal Tramway Managers of Great Britain to prepare a full report on the standardization of tramway accounts to be put before the association at its next meeting. There is no doubt that all corporation accountants and tramway managers will be ready to assist in the preparation of such a report.

At the ordinary half-yearly general meeting of the shareholders of the Metropolitan District Railway Company, the chairman, Mr. R. W. Perks, M.P., in moving the acceptance of the report, together with the half-yearly statement of accounts, called attention to the fact that the company carried a larger number of first-class passengers during the period covered than during any previous term since 1892. The increase during the six months was 134,000 first-class passengers over the corresponding period of the preceding years. Continuing, he said in part: "We have carried 318,456 more second-class passengers than in the June half of last year, and our season-ticket business has very materially advanced. We have, during the half-year, issued 2471 more season tickets than during the corresponding period of last year; but I am sorry to say that we do not get as good a return out of this traffic as we do out of our average traffic, excluding the season tickets. But when we come to deal with the third-class, and especially the workingmen's business, we are not so happy in our results. We have carried, during the half-year, 1,191,000 more passengers in our third-class coaches; but the bulk of those are workingmen, and that figure has been made up by the transfer from the third-class carriages of 657,871 passengers. We have lost £8,943, and we have only gained £4,082; so that there has been a net loss of £4,860. We have issued, during the half-year, £182,000 of District second guaranteed stock, and we have been compelled to issue that stock, as authorized by you at a previous meeting, at a discount of £32,000. Under our arrangement with the Traction Company we are under contract to issue to the Traction Company ordinary stock at the rate of £25 for every £100 of stock, and we have issued some of that stock at that agreed price during the half-year to pay for expenditure which has been incurred by the Traction Company. We have been compelled, owing to the severe attacks made upon this company during the present session of Parliament, to spend a much larger sum than we care to do in parliamentary expenses. Our normal law expenses are £134, as against £200 in the corresponding period of last year; so that on our ordinary law expenditure we have really saved a little money; but when we come to the parliamentary expenses, instead of spending £191, as we did last June, we have had to spend, during the last half-year, no less a sum than £2,043. We have thought it better to charge the whole of this amount against our revenue account for the present half-year, and not to deal with it in the nature of a suspense account, or to carry it forward for discharge in future half-years." Announcement was also made that a meeting of the preference proprietors was held to consider a proposal which has been submitted to them by the Underground Electric Company. That company is under contract to take a very large block of ordinary stock as part payment for the electrical equipment of our railway. They are also building, at their sole expense, the power house at Lot's Road, and we shall have to pay a rental to them for the use of a portion of that power house. They have, therefore, very great interests in our company, and they have a very sanguine opinion of the results of electrification. Having that high opinion they have made a proposition to the preference proprietors to guarantee them a dividend, rising from 1 per cent in the first year to 2 per cent in the second year, and then 3 per cent in perpetuity, upon the preference stock.

The chairman said the old arrangement with regard to the power house was that it was going to cost £400,000, and this company would have had the right of leasing it at 5 per cent, which would have been £20,000 a year. Now, however, the power house was going to cost £1,250,000, and of course they could not pay interest upon that amount, and therefore they would take their current either at cost or at an arbitration price. The board had decided to abolish the omnibuses which were formerly run by the company, as the directors considered that they did not pay.

The Northeastern Railway Company is inviting tenders for the electrical equipment of certain local lines in the neighborhood of Newcastle-upon-Tyne. These lines consist chiefly of: (1) A circular route from Newcastle-upon-Tyne, along the River Tyne, through North Shields, Tynemouth, Whitley, Monkseaton, back to Benton and Newcastle-upon-Tyne. (2) A new line which is in course of construction to Ponteland. (3) The Quayside Branch, a short piece of line laid on a gradient of 1 in 27, running down to the Shipping Wharfs at Newcastle-upon-Tyne, used for "Goods" service only. The total length of line to be equipped is equivalent to about 40 miles of double track, and the equipment will include all necessary sub-stations, high and low tension cables, fifty motor coaches and two goods locomotives. Current will be generated at one of the power stations of the Newcastle-upon-Tyne Electric Supply Company, Ltd., and supplied as three-phase high-tension current at 40 periods and 6000 volts. The normal passenger train will consist of two motor coaches and one trailer coach, operated on the multiple unit system, the Quayside Branch being operated by electric locomotives. The average speed of the passenger trains will be 22 miles per hour, including 20 seconds stop at each intermediate station.

The chairman of the London Road Car Company, presiding at the annual meeting, intimated that amalgamation was only a matter of terms with the London General Omnibus Company. The report of the directors contained many interesting facts. The company keeps an average of twelve horses for each omnibus running; the average omnibus earns £2 10s. a day, seven days a week; it costs £2 7s. 3d. for maintenance, thus yielding a profit, roughly, of 2s. 9d. a day. The total passengers carried by this company amounted to 35,934,262 in the first six months of this year alone. The horses in service average 5335.

The new scheme of electric trams to connect Ashton-under-Lyne and Hurst has been officially tried and inspected. A large crowd assembled outside the municipal offices, and as the car proceeded on its journey there was an outburst of cheering. A double-decked car was requisitioned, and the tramways committee, with the corporation officials, were driven along the circular route, making a circuit of Hurst Urban District. The new service will be a great boon to the inhabitants, knitting the districts more closely together.

The Hove Town Council has carried a report recommending an expenditure of £103,700 to introduce trams in the borough. The proposal includes the absorption of the Shoreham tramways running between Hove and Shoreham Station, 5 miles westward, and to have three new routes in Hove—one having a terminus near Brighton Station, another at King's Road, and another at Hove Station. A net profit per annum of £3,636 is estimated.

The protracted litigation between the Manchester Corporation and the Carriage & Tramways Company has ended. The dispute was over the terms on which the company's undertaking should be acquired by Manchester and the local authorities whose tramways are in future to be worked by Manchester. The corporation, as owner of the greater portion of the tram lines, contended that it was not bound to purchase the company's depots, cars, etc., which were used on lines that it leased to the company. The company's "undertaking," the corporation maintained, comprised only the lines that it actually owned as well as worked, and the local authority was obliged to buy just so much and no more of the depots and plant as was suitable to and used for the purposes of the tramway service over these lines. The company, on the other hand, urged that its whole system was its "undertaking," and that the distinction between owned and rented lines was fanciful and unjust. As most of the depots and the plant employed in the horse tram service will not be needed for the electric service, and will be of no use to the company, it was really a question as to who should bear the loss. Mr. Justice Bigham yesterday decided that the loss must fall on the purchasing authorities, thus

confirming the decision given in May by Sir Frederick Bramwell. Manchester and the allied districts have therefore to pay £496,068 instead of £229,353 for the company's undertaking, together with all the costs of the proceedings.

Mr. Weir, in the House of Commons, called the attention of the president of the Board of Trade to the fact that the Glasgow electric tramway cars had not yet been fitted with governors or speed indicators, and asked would he take steps, under the Glasgow Tramway Act, 1899, to require their provision? Mr. Gerald Balfour replied that the requirements as to the provision of governors and speed indicators on the Glasgow Corporation tramways are those contained in the statutory regulations made from time to time by the Board of Trade. Under the regulations at present applicable, speed indicators must be fitted on all cars after Oct. 3, unless the board should see fit to prolong the time. Governors must be fitted if the board so require, but, as at present advised, the board are not convinced that it is in the interest of public safety to make such requirements.

The contractors for the construction of the permanent way of the tramway extensions at Walsall are to commence their work immediately. The erection of the car houses and depot at the Birchills has been already commenced.

At Liverpool Chamber of Commerce Mr. Waller, of London, recently outlined a scheme whereby present and proposed tram lines of the South Lancashire Tramways Company, with those of Liverpool, which would, when completed, cover 400 miles, might be utilized for conveyance of goods by night when not used for passenger traffic. He contended that the cost of transshipment and terminal charges, compared with railway, should be considerably lower, and districts at present isolated brought into connection with the Mersey, whereby coal, iron, hardware and building materials would benefit. The scheme met with general approval.

The formal inauguration of the new electric tramways from Rothesay to Port Bannatyne has been duly celebrated. On the invitation of the company over one hundred gentlemen, representative of the various local bodies, proceeded on the old horse cars from Rothesay to the power station at Pointhouse, where, after an inspection of the works, the generating plant was set in operation by Provost McIntosh. The company then proceeded in two of the new electric cars to Rothesay, where they were photographed, and afterwards lunch was served in the public hall. Mr. Miles, of the British Electrical Traction Company, presided, and addresses were given by, among others, Provost McIntosh, of Rothesay; Provost Anderson, of Greenock, who referred in highly favorable terms to the same company's system at Greenock; Mr. J. Russell Thomson, secretary of Rothesay Tramway Company, and others.

The County Council is about to take over the system of the South London Tramway Company, whose lines run along the southern shore of the Thames from the Borough, through Southwark westward to Battersea and Wandsworth. This acquisition will enable the Council to consolidate and develop the whole of the South London service.

The highways committee has recommended the London County Council to apply for parliamentary powers next session for extensions of the tramways system of a total length of 26½ miles, and at an estimated cost of £1,180,750. With three exceptions, the underground electric conduit system is recommended.

At the half-yearly meeting of the shareholders of the Liverpool Overhead Railway Company dividends of 5 per cent on the preference and 1 per cent on the ordinary shares were declared, and £3,792 was carried forward. Commenting on a diminution in the gross profits, during the half year, of £3,508, the chairman, Sir W. B. Forwood, said it was mainly due to the competition of the corporation tram service, and partly to disturbances at the docks caused by the closing of many graving docks. The closing of the Dingle Station, owing to fire, accounted for about £700 of the falling off. A new electric fireproof equipment has been adopted.

Following upon the adoption of motor parcel mail vans between Manchester and Liverpool a few months ago, the postoffice authorities have decided, in spite of initial drawbacks which led to the temporary suspension of the system, to extend the service to some of the immediate suburbs of Manchester. Another contract has been let for two vans to run between Manchester and Altrincham and Manchester and Flixton, taking in Stretford and Sale on the former route, and Urmston on the latter. The vans will be each of 18-hp capacity and will carry between 25 cwt. and 30 cwt. They will be in operation by November 1.

The report of the Dublin United Tramways Company (1896), Ltd., for the half-year ended June 30 shows that the directors have declared dividends for the half-year at the rate of 6 per cent per annum on the preference shares, and at the rate of 5 per cent per annum on the ordinary shares.

Messrs. Wernher, Beit & Co., London, the well-known South African financiers, have appointed Mr. William Clark, the chief engineer of the Glasgow Corporation Tramways, manager of the Lisbon Tramways. The salary attached to the post is £1,500 per annum. Mr. Clark is a native of Dumfriesshire, but has spent nearly all his business life in Glasgow, having served in several large engineering firms in the city. In 1885 he became engineer to the Cleansing Department, and when Mr. Young was appointed general manager of the Corporation Tramways in 1892, he appointed Mr. Clark as his chief engineer. He has a thorough knowledge of all tramway work, and personally is highly esteemed.

At the ordinary meeting of the Central London Railway, Sir H. Oakeley presiding, the directors recommended dividends on the undivided ordinary and the preferred ordinary stocks at the rate of 4 per cent per anum. In moving the adoption of the report, the chairman said they had increased the number of passengers by nearly 2,500,000, having carried 23,000,000, including about 2,750,000 at half fares. They had earned gross receipts amounting to £185,118, which was £20,000 more than in the corresponding half-year, and practically representing an increase of 12½ per cent in the receipts. They had earned £18,000 more at a cost of £2,300 less. With regard to the large sum carried forward, they had to face the expenses incurred in their unsuccessful bill during this session of Parliament, and, further, to meet the cost of the improvements and alterations necessary to avoid vibration. They were unable to ascertain precisely what the charges would be. The board, therefore, thought the shareholders would approve of the proposal to defer any definite appropriation of the available surplus until the end of the year, by which time they would have fuller knowledge of their liabilities. Lord Rathmore seconded the motion, and it was carried.

A. C. S.

Rhode Island Labor Law Upheld

The Supreme Court of Rhode Island has sustained the constitutionality of a ten-hour law passed by the General Assembly in January, which provided that no street railway company could work its employees more than ten consecutive hours in any twelve hours. The Supreme Court upholds the law by the concurrent judgment of five of the seven judges before whom the argument was made. Of the other two, Judge Douglass sat silent, for the reason that he is a stockholder in the corporation most directly and intimately affected. Judge Blodgett dissented in a long and vigorous opinion. In the majority opinion of Judges Stiness, Tillinghast, Wilbur, Rogers and Du Bois the right of the Legislature to limit the hours of labor performed under private contract is affirmed. As to the construction of the act they say:

The first section forbids an officer of a company to exact more than ten hours' work, from which an inference might arise that it could accept it, if rendered voluntarily, as by contract. The second section, however, rebuts such an inference, for in that section the intent is explained as follows: "The true intent and purpose of this act is to limit the usual hours of labor of the employees of street railway corporations, as aforesaid, to ten hours' actual work a day, to be performed within a period of twelve consecutive hours." This express intention to limit the hours is quite inconsistent with an inference to permit it by contract. If such an inference could stand it would be possible for parties to avoid the act by their simple consent, and thus to render it a nullity. The apparent purpose of the act is not to create a right in favor of the employees, which they might waive, so much as to guard the public safety from service too prolonged for alertness in the exercise of reasonable care. If this be so, the public safety cannot be made dependent upon private contracts.

The dissenting opinion of Judge Blodgett concludes as follows:

To the constitutionality of such legislation I cannot assent, whether it is sought to be justified as a valid exercise of the police power or as an exercise of the reserved right to alter and amend the character of incorporation of the several companies affected thereby.

Section 2 of the act provides: "That it is the true intent and purpose of this act to limit the usual hours of labor of the employees of street railway corporations, as aforesaid, to ten hours' actual work a day, to be performed within a period of twelve consecutive hours, as aforesaid, whether such employees be employed by the trip, the job, the hour, the day, the week, or any other manner."

If the hours of labor in any lawful calling may be thus limited by law to ten in each day, beyond the power of either party to increase, if not to diminish them, it follows that they may be limited to eight or to twelve, or to any other number of hours in like manner and with like effect, thus substituting for the constitutional right of individual liberty of contract the transient and fluctuating will of a legislative majority which both plutocrat and demagogue will unceasingly strive to control and against which the individual will be powerless to defend, alike helpless whether the legislative spoliation of the employer or industrial servitude of the employee shall for the hour prevail.

And if the foregoing observations shall seem to have been directed less to the limits of the legislative power over quasi-public corporations, than to the limits of the same power over the citizen, it is sufficient to reply that the

latter is the graver and higher question by as much as the man is above the dollar.

For the reasons set forth, I am of the opinion that the act in question is unconstitutional in the particulars enumerated and is wholly void. It follows from the unconstitutionality of the act, and as a necessary conclusion, that a street railway conductor, gripman, or motorman, may freely contract for such hours of labor with his company as may be agreed upon between them.

Convention of the New York Street Railway Association

The annual gathering of the street railway men of New York State was held on Sept. 8 to Sept. 11, at Caldwell, on Lake George, one of the most picturesque spots in the State. It was the twentieth annual meeting of the Street Railway Association of the State of New York, and was celebrated in a fitting manner. The programme for the meeting itself was carefully arranged, and provision had been made for the discussion of several very important topics; moreover, special attention was given the social features, and, as a result, there was an unusually large attendance of ladies. Ample provision had been made for their entertainment, and many of the railway men took advantage of the occasion to make the convention an extension of their outing.

The programme opened with a reception and hop at the New Fort William Henry Hotel, on Monday evening, at which delegates and visitors were entertained. The business sessions began Tuesday morning with a meeting of the executive committee at 9 o'clock, followed an hour later by the formal opening of the convention.

Tuesday was given up entirely to the business of the association and long sessions were held during both the morning and afternoon. The entertainment provided for the ladies on Tuesday morning was a trip by the mountain cable railway to the summit of Prospect Mountain. This road, which was described in the STREET RAILWAY JOURNAL for October, 1895, has a terminus very near Fort William Henry Hotel. The annual banquet was held in the evening at the Fort William Henry Hotel, and was a very successful affair. There was a large attendance, and about 200 delegates and guests sat down at the tables. An innovation was made in inviting the ladies to attend the banquet, and a large number did so. Their presence added very much to the pleasure of the banquet, and many wishes were expressed, both in speeches and otherwise, that this feature of the banquet should be made permanent in the future meetings of the association. Speeches were delivered by Messrs. Rogers, Colvin, Daly, Powers, O'Connor, Brady, Stedman and Ely. Mr. Colvin acted as toastmaster, and was particularly felicitous in introducing the several speakers

Wednesday morning was also devoted to the sessions of the association, and the day being clear the ladies made the excursion to Warrensburg by carriage, which had been originally arranged for Tuesday afternoon. The final business sessions of the association were held on Wednesday morning, and in the afternoon a trip was made by steamboat down the lake through the Narrows. The scenery at this point is considered the most beautiful on Lake George, and the air was clear and exhilirating, and just such as was needed to make the trip an ideal one. Nearly all the delegates, ladies and others in attendance at the convention participated in the trip, and in the opinion of the tourists, one of the speakers of the previous evening, at the banquet, was perfectly correct when he characterized Lake George as the most beatiful lake in the country, and among the five most beautiful lakes in the world.

The steamer returned to Caldwell pier in time to allow those who desired to take the evening train south, but many of the guests remained to take the trip to the top of Prospect Mountain, where a beautiful panorama of the surrounding Adirondack region and Hudson Valley, and extending into three States, was obtained.

Altogether, the convention was not only one of the most successful but also the largest in attendance of any in the history of the association, while the work accomplished was most valuable. The space at the disposal of this paper this week precludes the publication of more than a brief note in regard to it, a few of the papers and the president's address, but it is the intention next week to publish the additional papers as well as a report of the business meetings of the association.

To Regulate Fares on Interurban Lines in Indiana

The incoming Indiana Legislature, it is said, will be asked to enact a law fixing a maximum passenger rate of 1½ cents a mile on interurban electric railways. It is claimed the State can do this, as it has established a maximum fare of 3 cents a mile for steam roads. The rates which now prevail on the electric railways are from 1¼ cents to 2 cents a mile, but an increase is threatened because of an increase in taxation by the State Tax Board. The interurban companies can not conceive why the steam companies should be allowed a maximum fare of 3 cents and they be compelled to submit to a maximum of 1½ cents. The interurban roads will oppose such a movement.

Annual Report of the International Traction Company and the International Railway Company

The annual report of the International Traction Company and the International Railway Company, of Buffalo, N. Y., for the year ended June 30, has come to hand, under date of Sept. 1. The report reviews the history of the organization of both the International Traction Company and the International Railway Company, setting forth the present status of the companies. As is well known, the International Traction Company was organized Jan. 18, 1899, for the purpose of consolidating under one management the street railway systems of Buffalo, Niagara Falls and vicinity

In executing this plan the company purchased the entire capital stocks, as listed below in column *A*, of the following companies:

	A.	*B.*
Buffalo Railway Company	$5,370,500	....
Crosstown St. Ry. Co. of Buffalo	....	$2,860,000
Buffalo Traction Company	....	600,000
Buffalo, Bellevue & L. Ry. Co	....	90,000
Buffalo & Niagara Falls Electric Ry	1,250,000	....
Buffalo & Lockport Ry	1,000,000	....
Elmwood Ave. & Tona. E. Ry. Co	....	14,250
Lockport & Olcott Ry	200,000	....
Buffalo, Tona. & N. Falls E. R. R. Co.	1,500,000	....
Niagara Falls & Susp. Bridge Ry. Co	600,000	....
Niagara Falls Whirlpool & N. Ry	....	50,000
Niagara Falls Susp. Bridge Co. Clifton Suspension Bridge Co.	400,000	....
Lewiston Connecting Bridge Co. Queenstown Heights Bridge Co.	400,000	....
Niagara Falls Park & River Ry. Co	600,000	....
	$11,320,500	$3,614,250

NOTE.—The stocks listed in column *B* were owned by the companies whose stocks next precede in column *A*.

The capital stock of the company, authorized and issued, is $15,000,000, of which $5,000,000 is preferred 4 per cent cumulative, and $10,000,000 common, and there has been authorized an issue of $30,000,000 fifty-year 4 per cent collateral trust gold bonds, due 1949. A statement concerning bonds authorized under collateral trust indenture at June 30, 1902, follows:

Total bonds authorized			$30,000,000
Unissued and reserved under Sec. 3, Art. 1, of collateral trust indenture for retirement of like amount of underlying bonds of purchased companies		$12,285,000	
Sold and originally held by underwriting syndicate	$11,428,000		
Sold for purposes of construction improvements and betterments. (See Sec. 4, Art. 1, Collat. Trust Indenture)	1,020,000		
In treasury, applicable to corporate purposes	2,267,000		
Total issued as per balance sheet		14,715,000	
Unissued and reserved under Sec. 4, Art. 1, of collateral trust indenture for purposes of future construction, improvements, betterments and acquisitions		3,000,000	
Total			$30,000,000

The stocks heretofore enumerated in column *A* (except shares qualifying directors), together with $60,000 bonds of the Tonawanda Street Railroad Company, have been deposited with the Guaranty Trust Company, of New York, trustee, under the provisions of the collateral trust indenture.

The combined income account of the International Traction Company and the owned and controlled companies for fiscal years ended June 31, shows:

	1900.	1901.	1902.
Surplus income of owned companies before charging dividends	$350,255	$528,389	$1,135,554
Income of International Traction Company (interest on loans to owned companies)	70,832	132,839	208,917
Total income	$421,087	$661,228	$1,344,471

Deduct:			
Interest on bonds, I. T. Co.	457,120	462,885	497,920
Interest, discount and exchange	5,209	58,749	78,526
Taxes	2,250	4,500	4,500
Sundry expenses	1,029	2,449	2,464
Total fixed charges, interest, etc.	$465,609	$528,583	$583,410
Surplus for year	*$44,521	$132,644	$761,060

* Deficit.

The condensed balance sheet of the International Traction Company at June 30, 1902, shows:

ASSETS.

Securities owned	$29,471,418.12
Fifty-year 4 per cent collateral trust gold bonds in treasury	2,267,000.00
Accounts receivable	237,126.91
Prepaid taxes	2,250.00
Cash	6,128.49
Total assets	$31,983,923.52

LIABILITIES.

Capital stock, common	$10,000,000.00
Capital stock, preferred	5,000,000.00
Fifty-year 4 per cent collateral trust gold bonds	14,715,000.00
Bills and accounts, payable	1,600,622.40
Total liabilities	$31,315,622.40
By profit and loss surplus, being excess of assets over liabilities	668,301.12
Total	$31,983,923.52

The officers of the company are: W. Caryl Ely, president; Charles McVeagh, secretary; R. F. Rankine, treasurer. Charles Steele, Francis Lynde Stetson, Temple Bowdoin, Charles McVeagh, of New York City; Thomas DeWitt Cuyler, of Philadelphia, Pa.; L. J. Hayden, of Park Ridge, N. J.; William B. Rankine, of Niagara Falls, N. Y.; W. Caryl Ely, of Buffalo, N. Y.; Burt Van Horn, of Newfane, N. Y., directors.

The International Railway Company was organized Feb. 20, 1902, under the provisions of the general railroad law of the State of New York. Into it there have been gathered by consolidation, merger and purchase, under the laws of the State of New York and of the Dominion of Canada and the Province of Ontario, all of the operating companies, American and Canadian, embraced in the original plan, excepting only the Crosstown Street Railway Company, of Buffalo. This last-named corporation has an authorized capital stock of $3,000,000, of which $2,860,000 has been issued. The International Railway Company owns all of the stock excepting shares qualifying directors. Two million dollars ($2,000,000) of the capital stock is pledged under the debenture mortgage of the Buffalo Railway Company as collateral to the $1,000,000 debenture bonds issued thereunder, and as soon as the bonds are retired the Crosstown Street Railway Company will be merged into the International Railway Company. Three hundred and fifty thousand dollars ($350,000) of its issued bonds are held by the trustee of the consolidated mortgage of the Buffalo Railway Company to retire an equal amount of Buffalo Railway Company's consolidated bonds when matured. Its officers are the same as those of the International Railway Company and its property is operated by that company.

The capital stock of the company is $17,000,000, of which $16,320,500 has been issued and the balance is in the treasury of the company. The International Traction Company owns all the capital stock of International Railway Company, and has pledged the same with the Guaranty Trust Company, of New York, trustee under its collateral trust indenture.

International Railway Company has no funded debt, but it has assumed the payment of the outstanding bonds of its constituent companies, amounting in the aggregate to $10,928,000. A substantial amount of the bonds can be retired at an early date, thereby effecting a very considerable saving in interest and a corresponding increase in the surplus earnings of the International Railway Company.

The system comprises 352.95 miles of single track, of which there are 212.61 in the Buffalo division, 59.32 miles in the Lockport division, 81.02 miles in the Niagara Falls division. The gage of the track is 4 ft. 8½ ins. The equipment consists of 905 cars, divided as follows: 724 motor cars; 239 train and service cars, and 2 electric locomotives for hauling freight on the Lockport division; 15 car stations.

The following is the combined operating statement of the constituent companies of the International Railway Company for year ended June 30:

	1902.	1901.	1900.	1899.
Gross receipts	$4,426,675.97	$3,129,004	$2,575,921	$2,333,316
Operating expenses	2,256,481.44	1,574,887	1,374,673	1,354,912
Earnings from operation	$2,170,194.53	$1,554,207	$1,201,248	$978,403
Miscellaneous earnings	139,826.53	95,566	74,084	85,440
Total earnings	$2,310,021.06	$1,649,773	$1,275,332	$1,063,843
Fixed charges, including interest on floating debt to International Traction Company	$1,174,466.68	$1,121,384	$925,077	$871,795
Surplus	$1,135,554.38	$528,389	$350,255	$192,048
Per cent operating expenses to gross receipts	51%	50%	53%	57%

(Trackage, equipment and operations of Crosstown Street Railway Company, of Buffalo, included in the above.)

The earnings of the Pan-American Exposition period (May-November, 1901,) were abnormal, and are not therefore suitable for purposes of just comparison. The natural growth of the company's business may, however, be seen from the following comparison of gross earnings of the first seven months of 1900 and 1902:

	1900.	1902.	Per Cent Increase.
January	$209,176	$250,150	19.5
February	190,592	225,160	18.1
March	206,239	256,341	24.3
April	198,094	246,848	24.6
May	203,389	259,470	27.5
June	213,823	266,065	24.4
July	241,557	322,117	33.3
Total	$1,462,870	$1,826,151	24.8

Since taking over the property in April, 1899, upwards of $4,000,000 have been expended in new construction, improvements and betterments, and, physically, the company's property is in excellent condition. The officers of the company are: W. Caryl Ely, president; Daniel S. Lamont, vice-president; R. E. Rankine, secretary and treasurer; T. E. Mitten, general manager; H. M. Pease, auditor; Francis Lynde Stetson, Charles Steele, Daniel O'Day, Joseph P. Ord, Daniel S. Lamont, of New York City; W. B. Rankine, of Niagara Falls, N. Y.; Thomas DeWitt Cuyler, of Philadelphia, Pa.; W. Caryl Ely, Henry M. Watson, Robert L. Fryer, Elliott C. McDougal, Henry J. Pierce, of Buffalo, N. Y.; Burt Van Horn, of Newfane, N. Y.; Thomas Gibbs Blackstock and Edmund Boyd Osler, of Toronto, Ont., directors.

Freight Service Abandoned at Pittsburgh

The Pittsburgh Express Company, organized about four years ago and operating electric express cars over the lines of the Pittsburgh Railways Company, has announced the abandonment of this service, owing, it is said, to the opposition the company has encountered from the Pennsylvania Railroad Company. The company had stations in East Liberty, Homestead, Braddock, Turtle Creek, McKeesport and Carnegie, in addition to a large receiving and distributing station in Pittsburgh. In conjunction with the express cars, a number of wagons were operated, and although at first the Pennsylvania is said not to have felt the competition of the electric express service, after a time the express business on its lines extending to points reached by the Pittsburgh Express Company's cars fell off considerably. Some months ago suits were brought in the name of Attorney-General John P. Elkin, supposed to represent the Commonwealth of Pennsylvania, against the Pittsburgh Express Company, the Consolidated Traction Company and the United Traction to restrain the companies from continuing to handle freight. The Pennsylvania Railroad, however, is generally charged with being the real complainant in these suits, which were to have been argued in October.

Street Railway Situation in New York*

BY G. TRACY ROGERS

In behalf of the association and the Hudson Valley Railway Company, whose guests we are, it gives me great pleasure to extend a hearty welcome and cordial greeting to you all. We assemble upon this occasion, following a year of general thrift and prosperity. This is indeed fortunate, as without this condition of affairs disastrous results to the business interests we represent might have ensued, inasmuch as the summer months just past (the harvest season of street railways, particularly those of smaller cities and interurban lines) have proved the most unseasonable, stormy and disagreeable the country has ever experienced, a fact probably so plainly manifest to you all that even a casual allusion to the unfortunate condition of affairs is not necessary. I consider it proper to congratulate the street railroads of the State upon the excellent showing made under the adverse conditions that have existed.

When this year in the life of this association is completed, two decades will have passed since its birth and one has but to review the published proceedings of the twenty annual conventions to comprehend the wonderful changes which have taken place in the street railroad world during that time. What the next two decades will unfold to us is difficult to predict. During the first ten years of the association's existence the principal topic of discussion at these meetings was that of the care of horses and mules. During the last decade each succeeding meeting has proved a series of important and instructive surprises in the new and advanced ideas presented affecting street railways, their development, advancement and betterment. Instead of a few hours devoted to the business proceedings of the meeting, now the greater portion of two days is insufficient to give proper consideration to the many subjects of practical interest that could be profitably considered. In the early days of the association the number of different operating companies in New York City alone was almost equal to the present number of roads throughout the State, and the number of organizations in each city was in the same relative proportion, each charging a 5-cent fare over its respective lines, requiring a day's travel and a pocketful of nickels to reach a distant point in a large city. Truly what a wonderful change. To-day there is hardly a city which has more than one company, and in many cases the one company serves not only its own city but many of the surrounding cities, towns and villages. Cars are no longer moved by horse or mule power, and in place of the bob-tail cars running over tracks composed of a stringer and a strap rail, we have at present palatial cars, lighted, heated and propelled by electricity, operated over an almost perfect track. Now in nearly every city one may travel from one point to another and over different lines for one 5-cent fare, due entirely to the general transfer system adopted within the last ten years, and to consolidation or lease.

Were we to review in detail the evolution of the street railroad methods during the last twenty years and consider what has been accomplished in the interest of both street railroad properties and the public during that period, the time of this meeting would be more than fully occupied. We are now, without doubt, the best and most highly organized industrial body in the business world.

Years ago street railroad properties were small; served limited sections only and each respective road operated exclusively over its own lines within the confines of the city or village in which it was constructed, interurban street railway intercourse and the transfer system being practically unknown. These properties were owned by a few local men, who were usually officers of the company. To-day the public owns the street railroads, the stock and bonds are held for investment by all classes of men and financial institutions. The men in charge of the practical operation of street railroads are employed on account of their fitness and ability to manage the properties in the interest of the stock and bondholders, and to serve the public as the ostensible owners of the property.

The perplexities and cares of a successful management cannot be understood by the people at large. They are, unfortunately, too ready and willing to denounce the management of a road, when the cause of the criticism is often entirely outside of the company's control.

Does the public appreciate the efforts made by a street railroad company in its behalf? Apparently not, when compared with the horse and mule car days, when the captious public and press had little or nothing to say in the way of criticism or fault-finding, and public franchises were dealt out by municipal officials for the asking. On the contrary, with the broad development and increased transportation facilities provided by the up-to-date street railway systems, and notwithstanding the company is striving to serve their best interests, often at a loss financially, the people generally are too ready to denounce them as grasping, greedy, dishonest and anxious for its own interests alone. This spirit is shown in a more pronounced way when the company seeks any courtesy or extension of franchises at the hands of the public authorities. It is then that our requests are viewed with suspicion and criticised; we are subject to all forms of abuse, inconvenience and loss of time and money. This should not be, as railroads to-day do not ask for franchises or grants unless they are needed to better subserve the comfort and accommodation of the people, as is clearly shown when these advanced ideas are put into practice; it is then that the public realizes more fully the benefit it derives as a result of the company's efforts in its behalf. Franchises are only valuable to the extent that they may be made to serve the people. It is the high state of development of street railroading of to-day that has given life and value to these franchises—that has, so to speak, created them. There is no public serving corporation more important to a community than a street railroad; the people are dependent upon it in all walks of life. There should be more sympathy, than now exists, between the street railroad and the public, and this must come from the people. In nearly all cases the street railroad is striving to meet the public requirements, and the situation is not benefited by the adoption of drastic laws and ordinances, ostensibly for the welfare of the public, but which are, in their ultimate effects, antagonistic to both railroad and public.

The electric road is so important, not only to the cities, but to the development of the country at large, that its growth should be assisted and not impeded or retarded, either through adverse public criticism, by curtailing of franchises, by the imposing of burdensome taxation or by the press, which too often caters to public clamor, inviting and exciting public hostilities for sensational purposes. The science of transportation is the greatest study of the day.

It is unnecessary for me to attempt to call public attention or the attention of the delegates here assembled to the enormous work that is being done by the electric railroads in the improvement of social conditions and the augmentation of values and populations. The civilized world has already recognized its value —for the electric railway has taken its place as one of the economic factors in all of the countries of the globe. Where communities have been isolated by topographical conditions, electric roads have made it possible, so to speak, to give freedom and expansion to the people by making other areas of land accessible for both residential and commercial uses and occupation—by annexing the adjacent territory, in fact. Factories, extensive manufacturing plants and villages have grown up in waste places as well as outlying cities, and these have been made tributary to commercial and shipping centers, while farmers and cultivators of market gardens have found readier access for marketing their products.

A phase of the usefulness of the electric street railway, of its power for good in the direction of building up the moral, as well as the physical health of the people, is the opportunity that is afforded for outings and entertainment to the tired worker and his family—whether he be a worker of the office or factory, or the farm. For him the interurban railway especially affords the ever-present opportunity for a cheap and health-giving ride amid fields, woods and pleasant scenes; and still more is this noticeable where the company maintains a pleasure park, a casino, or perhaps a vaudeville entertainment as an adjunct to the railway system. In nearly all the cases that I know of, where such an additional attraction of a strictly moral nature is maintained, the investment has been more than satisfactory, and in many cases self-sustaining. Many of these resorts have been built upon a decidedly elaborate scale. But even if there be no pleasure resort, the outing itself is an invigorating ride and a means of entertainment as well as a promoter to the health of the minds as well as to the bodies of the people. I may, indeed, suggest that in this regard the trolley ride proves a moral factor also, by drawing people away from baser resorts within the closely-built and summer-heated cities.

It is my belief that in the near future the steam roads will seek ownership or a closer alliance with electric lines which will serve as feeders to them, as is illustrated by the acquisition and extensive construction of roads by the New York, New Haven & Hartford and other steam railways. The advantages of such an alliance to both parties are numerous and cannot help but be a benefit to the public and property. The recent decision by the Court of Appeals in the suit brought by the Hudson Valley Railway to compel the Boston & Maine Railroad to make a physical

*Annual address of president of the Street Railway Association of the State of New York at the twentieth annual meeting, Caldwell (on Lake George), N. Y., Sept. 9, 1902.

connection of their tracks and to interchange freight, the court held that the Legislature of the State has recognized electric railways as a part of the transportation system of the State, and that travelers and shippers of freight are entitled to the benefit of all the facilities provided for in the articles of incorporation of transportation companies as well as the duties imposed by the railroad law of the State. The court after stating that the steam railroads have become great arteries over which the greater part of the commerce of our country is carried, says: "It has not been considered profitable or practicable for steam roads to be constructed to every village, hamlet or productive district in the country. This, however, is being rapidly accomplished by the numerous electric roads that are in process of construction or are contemplated. By their means the farmer and mill owner and the merchandise vender in distant places may be able to reach the steam roads, and through them the great markets of our cities, with their merchandise and products, and in this way one road with their mercandise and products, and in this way one road may may become the feeder and distributor for the other."

It can readily be seen that the court does not consider the two classes of roads antagonistic, but the electric road is rendering a service that both the steam road and the people alike require. In many cases the steam roads have recognized our usefulness and have welcomed a connection with our tracks, realizing that transportation begets transportation, and that development produces freight and through passenger travel. This fact is illustrated by the development of the Hudson Valley Railway, which has adopted largely steam railroad methods of construction and operation.

In my opinion, the progressive interurban electric road must adopt the best methods of both the steam and electric railroads. In our construction of roads, outside of cities and villages, we are now building, to a great extent, on our own right of way, with double tracks, and in many instances in conformity to steam railroad principles of construction. In a number of cases steam and electric service is now carried on over the same rails and roadbed.

The great activity in electric railroad building, which surpasses the most sanguine expectations of a few years ago, is in a large measure accountable for the falling off of the increase of new mileage by the steam railroads of over 50 per cent between 1890 and 1900, as compared with the interim between 1880 and 1890. When a steam road is requested to give additional train service by the public, the public is often met with the reply, "Another train won't pay." By this policy they do not stimulate travel. The electric road doesn't wait for business but goes after it, and the result is that when they tap a territory of an existing steam railroad, they increase the rides per capita per annum many fold over what they were with the steam roads. This is largely due to lower fares and more frequent service. The cordial relation existing between the steam railroads and street railways of this State is a matter of favorable comment and congratulation, and make possible a great deal in the way of development and interchange of business from which the general public inherit an untold benefit that would not be available if this friendly relation did not exist.

I may here be permitted to call attention to the prevalence of harassing and expensive litigation through damage claims.

Many bills are introduced each year in the Legislature in the interest of the negligence lawyer, more commonly known as the "Ambulance Chaser." Each year they become bolder in their legislative demands, and to such an extent that they have fallen by their own weight and accomplished little or nothing. In the large cities their methods are no better than the highwayman who uses more violent means to accomplish his purpose. The legal profession has been seriously compromised by this class of lawyers. Equally prominent in formulating litigation is the doctor who recommends his particular friends as a lawyer, and not infrequently is a sharer in the unfair percentage wrongfully collected out of the company's treasury. In this connection I might state that, in my opinion, no better claim agent, especially for the smaller road, can be secured than the honest, upright company surgeon, who at all times works in the interest of the company. Juries are often biased and easily prejudiced by unfair counsel. They do not hear the insiduous entreaties of the shark lawyer or his agent to be allowed to bring the case upon a basis of 50 per cent and often larger. Some very good work has been done of late in exposing their methods, and it is to be hoped with good results. As the law now stands, a suit can be brought for $10; the company must either settle or stand an expensive litigation and take its chances on the fairness of the jury. In my opinion, a large percentage of this speculative litigation of the "hold-up" class can be overcome by proper and just legislation. I am aware that the Court of Appeals of our State has approved in general language of agreement between lawyers and their clients, whereby the former should receive a percentage of the recovery for their professional services. However fair this may seem to be in those cases where the amount is fixed in the contract or promissory note, I am unalterably of the opinion that this course of dealing should not be allowed in suits for personal injuries, but that on the contrary, the fee should be one fixed by statute or by a competent authority to pass equitably on cases of this nature. The sharing in the recovery, whereby the counsel becomes as much interested financially as the client in the recovery is a condition to be deprecated by all right-minded persons. This is exactly what Congress has found it necessary to do and has done by legislation in the cases of the compensation which attorneys are allowed to collect for services in pension claims against the government.

I will also call your attention to the injustice of the present law, whereby an action can be brought against us in an accident case any time within three years without giving notice. We and the individual or other corporations are entitled to the same consideration in this respect that is now given to the municipalities, whereby notice is required of the accident. This question has been before the Legislature for a number of years, and I believe it is the duty of every member of the association strenuously to urge that some law be passed to remedy the evil. In my opinion the association should make a determined effort to have a law passed to the end suggested, thereby in a degree stemming the tide of unjust speculative litigation which is so rapidly increasing.

The Mutual Benefit Association so generally inaugurated on our roads still continues to be of untold value to all. The plan of furnishing pleasant club rooms for our men is another step in the right direction; too much interest cannot be taken in endeavoring to raise the standard of our men and looking after their comforts, by elevating them to a higher degree of efficiency and improved discipline. The sentiment and enthusiasm of the street railroad employee is of greater importance than in most any other business, as the dealings are more direct with the public than any other industry, and the success of the operation depends largely upon the policy of the company towards its employees. The discipline and handling of men is one of the most important, if not the most important, of a street railroad. Each year finds a marked improvement in the class of men on our roads. This improvement has been brought about, not only through care in selecting the men, but largely by the conditions we have surrounded them with, and this class of men must have just and fair treatment.

A number of street railroads are refusing to continue carrying the mails at a loss. I have referred to the fact in my previous report that the rate paid per car per mile for the transportation of the mails is insufficient to meet the expense; at the present rate we are simply paying for the privilege, and some step should be taken to have this injustice corrected.

The unfortunate recurrence of some half dozen severe and fatal accidents within the present summer brings to the members of this association, in the most forcible manner, the ever present obligation of ceaseless care and vigilance in the management and operation of their respective roads. It is a simple matter to lay down a formula for the "prevention" of such accidents, but so long as human nature is fallible, railway accidents can never be wholly prevented. The most that can be done is to minimize the risk or possibility of accidents. You all know what elements of care, of prudence, enter into this consideration—substantial construction, complete equipment, good discipline, and last of all, but of the highest importance, constant inspection and accountability. When due attention is given to these four elements, accidents will be very rare, and then will only occur through the failure of the human elements—the forgetful inspector, the careless motorman, the confused car dispatcher, or the incidents of storms or other unavoidable occurrences. We owe it to the public, as well as to ourselves, and to the reputation of industrial and mechanical intelligence, that every safeguard which experience, caution and liberal expenditure of money affords shall be applied to the carrying on of our several enterprises.

The standardization of equipment for electric railways is a subject which is year by year engrossing more closely the attention of both operating officers and manufacturers, and it is only necessary for me to say here that it is a matter worthy of fullest consideration. Its effect will be to facilitate, as well as cheapen maintenance, to improve practical operation, and to add, in a large degree, to the safety of our patrons.

I should consider myself derelict if I did not make a brief allusion to the excellent work performed by the committee appointed to prepare a standard code of rules. We all appreciate that this is a difficult proposition to handle to the entire satisfaction of all parties, but I feel confident that the vast amount of time and thought devoted to the report that will undoubtedly be submitted at this meeting will be productive of beneficial results.

I am also gratified by the large number of supply men that are always in attendance at our annual meetings, as they not only

add to the numbers but to the interest of the occasion, and the pleasant interchange of social intercourse between the street railway officials and the men with whom they deal cannot help but prove beneficial in many ways.

I take pleasure in stating that the predictions made in my last year's report regarding the street railway development of Greater New York and the continued advance in reconstruction of horse lines in the older city of New York have been fully carried out, and the general interests of the citizens thereof greatly subserved. That very noteworthy improvement, the construction of the subway in the city of New York, is progressing and has now reached a stage where 70 per cent of the construction work is completed, and upon reliable official information I am prepared to state that the work is progressing quite up to expectations and that the contract for equipment, buildings, etc., are all made predicated upon beginning operation of a portion of the road to at least One Hundred and Forty-Fifth Street on the West Side, and to One Hundred and Forty-Fifth Street and Lenox Avenue on the East Side by Jan. 1, 1904. The rapid transit proposition seems still to be in an embryonic state, as far as furnishing a complete system of transportation is concerned, for the chief engineer of the subway frankly concedes that the present construction will not be adequate to satisfy the requirements of the city. The elevated roads in old New York still continue to carry on the work of improvement, and the introduction of a third-rail system on the several lines is well advanced, while the facilities furnished the public by the improvement are plainly noticeable.

I have often called your attention to the unjust discriminations in the State Franchise Tax Law, whereby we are taxed one per cent of our gross earnings and other public serving corporations pay but one-half of one per cent. This subject is one that merits your thoughtful consideration and action.

In this connection I desire also to mention the unjust burden imposed upon the street railways of the State by the enactment of the Ford Franchise Tax Law. I shall not attempt a detailed argument of the situation, which remains practically unchanged since the presentation of certain figures and statistics submitted by me as president of this association at the hearing before the Governor of this State on May 11, 1899; suffice it to say that 101 street surface railroads operated by mechanical traction submitted reports to the State for the year ended June 30, 1901; sixty-one showing a surplus for the year, forty showing a deficit. Of the total surplus 58 per cent is shown by the companies of Greater New York; of the 101 companies, but sixteen declared dividends, three of which showed a deficit after so doing and which are included in the sixty-one roads mentioned as showing a surplus.

An enromous amount of money is invested in the street railways of this State, a large percentage of which was sunk in the depreciation of values and in demonstrating the practicability of electrical traction, the benefit of which the public at large has inherited, and for which the State under the Ford Franchise Tax Law now assess as real estate. That public corporations should pay their full and just measure of taxation none will deny, but that any discrimination should be made against them simply because they are public corporations is unjust and unfair.

The most serious annoyance and handicap the street railroads of the State have suffered since the introduction of mechanical traction is the burdensome and perplexing question of pavements. The general State law regarding the proportion of expense to be borne by street railway companies is one of the old methods of horse street railroading handed down, of which we are unable to rid ourselves. The exorbitant demands made upon us in this respect are a constant menace not only to the financial interest of the smaller roads of the State, but the larger ones as well. Fortunately the Legislature of the State recently modified the law slightly whereby the smaller municipalities and street railroad companies can now fix by contract the amount to be paid by the company. This is only a step in the right direction, and the modification should apply to all cities. That we are entitled to still further legislative consideration in the pavement matter no street railroad company which has suffered the burdensome taxation under the law as it now exists will gainsay.

In closing I esteem it a pleasure to briefly allude to the general usefulness of our association, which has been so clearly and frequently demonstrated in the past, especially from an operating standpoint. The annual meetings have proved fruitful and profitable, and I firmly believe that the properties we represent and public interest as well, have been greatly subserved by the presentation and discussion of the many subjects of practical interest. Notwithstanding the past enviable record of the association there is a still broader field of usefulness to be developed which can only be completely accomplished by every street railway company of this State becoming identified with the asssociation and its work.

Removal of Snow and Ice in the Borough of Manhattan*

BY W. BOARDMAN REED

The handling of snow in the larger cities may well be treated under two heads. First, the keeping of the tracks clear for the moving of cars, and, second, the clearing up of the streets in accordance with certain statutes and ordinances, and, as we in Manhattan believe, for the benefit of our service and receipts.

My first experience as a railroad man was gained on a little steam road about 60 miles north of here, where 12 inches was not a heavy snowfall. I recollect some snow we had to handle there in 1888 after the storm ever since known as the blizzard, when one of the foremen stationed at an outlying line came to the main office on snowshoes and was able to rest his hand on the telephone poles on the way down. We were not, however, operating conduit electric lines, and some way the locomotives of this northern country get used to traveling through the snow. A 6-in. fall will tie up some of the steam roads entering New York, whereas up here such a storm is hardly noticed. We do not have such heavy storms in Manhattan as are usual in this section and the western part of the State, and our cars are, like the New York locomotives, not accustomed to traveling through snow, and will balk at a few inches on the rails. Still, we have had storms during the last few years that have, at times, called forth our best efforts, and once or twice tied up our cars not primarily from snow on the track but from the conduit being filled so that the plow could not pass through it or get proper contact with conductor bars. We hope, however, to be able to overcome this difficulty in the future, as we have increased very materially our equipment for the cleaning of the conduit.

In 1893 I completed the construction of an electric road in Fulton County, and remained a few weeks to finish estimates, and I was thus able to watch its operation. The master mechanic, a young Irishman, had charge of cars, equipment, maintenance and all else. The first snow storm stalled many of the cars. He was appealed to by the general manager and asked what could be done. He replied, with ready wit, "kape the cars a-moving." We, in Manhattan, endeavor to keep our tracks clear of snow upon this same principle, for we use rotaries only and depend upon the frequency of their running. On about 153 miles of single track we have fifty-eight rotary sweepers, or one for little more than each 2½ miles of track, enabling us to operate them on from 15-minute to 20-minute headway, so unless the snow is dry and drifting badly there is no chance for much accumulation on the rails. In addition to rotaries we use walkaways or ordinary road machines, drawn by two horses or four hourses, to shove the snow well back from the rails. These are worked in pairs, two machines covering from 2 miles to 4 miles of street. On streets that are narrow or have elevated railroad columns near the tracks, we are obliged, in case of heavy storms, to shovel the snow back from the rails by hand, and, of course, use hand power to get rid of what falls between the tracks. Special work is also cared for by hand. Special gangs are sent out to each place where there are switches, curves or cross-overs, as soon after it begins to snow as possible. They keep the curved rails, frogs and switches, both slot and tram rails swept clean, and use a very small amount of salt on the moving parts. No salt is used on straight track, except on a few very steep grades, and none on curves, except in severe sleet storms when ice is forming in the grooves. In Manhattan the "Trilby" section of rail is used almost exclusively. To keep the groove clean, diggers or small scrapers fitted to the shape of the groove are attached to each sweeper. These have always proved sufficient for the purpose, except in the few cases where the road has been tied up and rails became covered with ice and packed snow, when picking and pickeling had to be resorted to.

In regard to pickeling I may say that we find salt plays havoc with electrical equipment, especially the plows. Salt water getting on the shank destroys the insulation and often forms a short circuit around the plow. No amount of paint or grease will prevent it. A couple of winters ago we were called upon to assist in the operation of a new electric line in Manhattan. The superintendent, who received most of his education on horse-car lines where salt is the principal snow machine used, had general charge of the operation and maintenance. I sent a track foreman with some men to help him handle a light snow storm, cautioning both the foreman and the superintendent regarding the use of salt.

In a few hours his entire line was in bad shape from burnt-out plows. The superintendent denied using much salt and the re-

* Paper read at the twentieth convention of New York State Street Railway Association, at Caldwell, N. Y., Sept. 9, 1902.

ceiver, in whose hands the road was, severely blamed the electrical department for furnishing his road with poor plows. Investigation showed, however, that considerable salt had been used, and, doubtless, caused all the trouble. On overhead trolley lines salt does not cause much immediate damage, but I think many motors which show defects a few days after a snow storm have been injured by salt water.

For cleaning the conduit we use a rubber scraper similar in section to the conduit suspended from a small flat car drawn usually by horses, though sometimes hitched behind a car. At all switches the conduit is much smaller than on straight track, and a scraper has to be used that will pass the switches. It will, therefore, not remove all snow from the conduit but keep it sufficiently clear to allow passage of plows and leave the conductor bars clean. From the conduit the snow is scraped into manholes situated from 100 ft. to 200 ft. apart. These drain into sewers, but, after little more than 6 ins. of snow has fallen, have to be cleaned out. With the beginning of freezing weather we put a layer of salt in the bottom of the conduit and keep it thus salted all winter. This prevents the forming of hard ice, and enables us to keep the conduit clean. We have always used mined salt when we could get it and consider it the best for our purpose.

To comply strictly with the statute which provides that street railway companies shall remove all snow that falls on its track, between its tracks and 2 ft. outside, it would be necessary to stop operation of cars as soon as it began to snow, fence in the area and stop all trespassing, or else have some method of marking each flake for identification.

In Manhattan the street railways have always removed more or less of the snow from the streets, but, until 1896, there was no system about it. That year an agreement was made with the Street Cleaning Commissioner whereby the street railway companies were to remove all snow and ice from the entire area of certain streets or parts of streets, such area being as nearly equal as might be to the area they should clean under the statute, the Street Cleaning Commissioner agreeing to remove the snow from all streets having tracks upon them as promptly as possible.

This arrangement has proved of great benefit to the public, to the Commissioner of Street Cleaning and to the railway companies.

Previous to this arrangement, little attention was paid by the Commissioner to railway streets. It was, therefore, necessary to run horse cars doubled up; that is, four horses and two drivers to each car, electric cars and cable cars were badly blocked by trucks, passengers could not get on or off the cars without getting over their ankles in slush, and snow machines were kept running until the snow melted or wore away. These conditions often lasted more than a week, whereas now it is rare for us to be troubled more than 24 hours to 36 hours after a storm is over. In former days it required from 400 bushels to 500 bushels of salt per mile of track per season. Now I allow 275 bushels for horse-car lines and 415 bushels for electric, and nearly all of it is used in the conduit.

The prompt removal of snow enables the public to go about their business and pleasure with comfort, thus adding very materially to our traffic, so the expense we are put to is about made up in the additional receipts.

Various ways of disposing of snow have been suggested and tried, but, though the method may seem primitive, we have found no better one than hauling it by carts or trucks to the water front and dumping it overboard.

The Island of Manhattan is of such shape that most of the snow can thus be carted with an average haul of little more than half a mile.

Melting machines have been used experimentally by the city during the last year, but they are not practical for our conditions. A few years ago the late Colonel Waring, then Commissioner of Street Cleaning, thought that it would be a good plan to line sewer-manholes with coils of steam pipe, then shovel the snow into them, when it would melt and run away. We constructed for him a manhole for this purpose and gave it a trial. It took but a few moments to fill it with snow but an hour or more for the snow to melt. It is hard to overcome the fact that it requires 142 degs. of heat to make water out of snow or ice. Carting snow by cars has been suggested many times, and doubtless this method would be cheaper and more expeditious than carts and trucks, if there were proper dumping facilities and the street railway company could give up the use of its tracks for a sufficient time to allow snow cars to do the work. On our lines, cars are rarely operated on less than 2-minute headway, except between 1 o'clock and 5 o'clock in the morning, and even then they run on from 5-minute to 10-minute schedule, which would give no time for loading and handling of snow trains. A short time ago I estimated that were we to abandon the running of cars on Twenty-Third Street between Broadway and the East River between 1 o'clock and 5 o'clock in the morning, giving snow cars exclusive use of them, it would require, for a 12-in. fall, with two trains of four cars each, thirty-six hours, or nine such nights, to clean up this small portion of the city, whereas it is done with carts and trucks in about twenty-five hours to thirty hours, and, as these work both day and night, this means but one day or 1½ days.

Contractors are paid by the cubic yard of snow removed both by the city and by the railway companies, the latter using their own carts, trucks and men as far as they are able. This year, however, the city is to endeavor to let the work per inch of snowfall. Could this be done, it would prevent much fraud that is sure to be practiced under the yardage system, especially since work of this kind, coming but five times or six times in a year does not permit the maintenance of a proper organization of foremen, tally-men, checkers, ticket-men, etc., the city being obliged often to use ordinary laborers to act in such capacities.

The shrinkage of snow is so variable, however, that one making a contract in this way must be something of a gambler. The average shrinkage on our work last winter was 80 per cent, though the heaviest storm gave only 59 per cent; that is, of the quantity that fell on the area of streets we cleaned we removed, on an average, only 20 per cent, whereas, in the larger storm, we removed 41 per cent. This shrinkage is caused by the packing, wearing away by vehicles and melting of the snow, depending on the humidity and temperature of the atmosphere and the amount of snow that falls at one time.

Last winter the street railway companies of Manhattan removed the snow and ice from about 90 miles of streets, and with a total snowfall of 30 16/100 ins., hauled about 117,000 cu. yds. of snow. In the heaviest storm, which occurred Feb. 16 to Feb. 20, there was a fall of 12 2/10 ins., and we removed 68,787 cu. yds., at a cost of about 30 cents per yard, including superintendence.

The Handling of Accident Claims*

BY WILLIAM A. DIBBS.

The subject of accidents, from the claim agent's point of view, is a theme which may be most interesting, showing the characteristics of the different claimants and something of the study of human nature. To begin with, the claim department is something of an important factor. If well managed it will help materially in the showing of the annual statement. Its employees must be men of honesty, students or human nature, of glib tongue and pleasing address. The claims presented at our claim department are varied and numerous, even for the most trivial thing. They run from 5 cents to $150,000. Most of these are presented by the claimants; frequently a representative or friend other than an attorney is sent, but when we find that the supposed injured are able to be about, we request a call form them, or we send someone to see them—under no circumstances do we deal with the representative without first seeing the claimant. As a result of our investigation we have found out on many occasions that there was no injured party. Following the reception of a claimant we question him closely as to the facts, getting every minute detail possible. This is then transposed into the form of an affidavit. This method has saved us a considerable amount of money and time. Frequently the claimants state in their affidavits that the car did not stop while they attempted to alight or board, that they did not see it until it was but a few feet away when they attempted to pass or cross. After their claims are naturally refused many of them start for an attorney, who invariably writes us that he has charge of the claim. We get into communication with him, tell him that his client has no case, and read to him or show him, if necessary, the affidavit; with but few exceptions the attorneys then drop such cases. Those that do not say the client signed under a misapprehension, believing that it was a receipt for money, or else the claimant is a client of their office and they have to prosecute the claim. A claimant calling personally is usually imbued with the idea that he has an exceptionally good case, and that he is permanently injured, though he walks from the upper end of the city to the office. He starts in to demand, when asked, $1000. With this element, if the claim has some merit, we request them to call again in a few days. At the next call we have him examined by a physician, and if the examination shows any injury and the investigation shows it to be one for settlement we start to dicker. A good many times we have come in contact with those who put a figure for settlement, and no amount of arguing will

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budge them. We have found out, with one or two exceptions, that we can make cheaper settlements dealing direct with the injured party. If they are not able to present their grievance in person and a letter is sent, we then have our representative call upon them, obtain their statement in detail as much as possible, and from that follow up the case. When a lawyer writes a letter we acknowledge its receipt, look up the case, and if no report is on file call upon him and get what facts are obtainable, and if possible an examination by our doctor. If the case is not a bad one we let it lie dormant until the lawyer stirs it up again; frequently we never hear of it again. If it should not be a good one, from our point of view, we follow it up until some way disposed of. These cases, when adjusted, are a trifle higher than if settled direct. When a case is presented by a lawyer personally we handle it the same way as if the claimant had called, with the exception of getting an affidavit, and sometimes we get that. If the lawyer is known to us, and is of good repute, we deal directly with him. As to the other class, we demand the address and an interview with their client and doctor. As a conclusion to this part of the subject I would like to cite a few of the exceptional claims presented. An apparently intelligent man called at the office, asked if we had a report of his client, and we told him we had. He then said that he had given the case to an attorney and wanted from us the names of the crew and the names and addresses of our witnesses, so that he could prepare his case and have it in good shape when he went to court. He left, saying that it was funny that we did not comply with his demand. Another individual, an habitue of the Ghetto or East Side, came in one afternoon and said that he had received a transfer from one of the avenue cars to a crosstown car, that the crosstown car was blocked on account of a truck breaking down in front of it, that he had to wait several minutes, caught a cold and incurred a $50 bill, which we should pay. One of the self-important, pompus kind strolled in one day, hammered on the counter, which is in the reception room, and when asked what he wanted, he replied: "Is this what is called the morgue?" We told him it was not, but that one would think so, however, from some of the stiffs that came in. He laughed heartily, which apparently cured his injury, for we never heard from him again. He never presented his claim and walked out. The 5-cent claimant mentioned before was for an extra fare on account of trouble with a transfer. The $150,000 one was by a man worth about $18,000,000, and he lost three days from business; he was knocked down while crossing the street. That, however, was not paid. One of the East Side residents, with the proverbial small derby hat, flowing whiskers and cigarette, called last winter, and presented an old family heirloom in the shape of an antique cane. Through his tears he claimed that the car heater had scorched the paint out of the cane and demanded $5 for the injury. Again, a well-dressed man called, and claimed that while a passenger on a car the conductor, in ringing the bell, knocked the glasses from his nose, breaking them. He filed a claim of $14. When questioned as to whether the glasses had cost the amount claimed, he said: "No; they cost $4." "Then why do you claim $14?" "Why, I had my eyes examined by a specialist three years ago and paid $10; this, with the $4, makes the $14." It is needless to add that he had to "look" further. Still another case. A representative called upon a small East Side cloak manufacturer, who had his left thumb badly sprained in an accident. He explained at great length that he did all the cutting in his business, and was unable to use the cutting shears with the injured thumb. Our representative said that he failed to see how the thumb on the left-hand effected the right-hand. He instantly replied that he was "left-handed."

I have in mind a report received from one of the divisions. A motorman reported that while going through a rather dark street late at night he saw an object cross in front of his car. Before he could stop, his car struck the object. Then he found out that he had run into a two-ton coal truck. That case was settled.

We have in New York and Brooklyn, and no doubt in some of the larger cities of the State, a horde of what might be termed "blood suckers." I refer to the runners or ambulance chasers. This class is composed of all kinds of men and boys, and pretty shrewd ones at that. They congregate about Police Headquarters and watch the returns from the precincts as they are sent in. They are posted in a window. They immediately start out for the case; if an accident, go to the hospital or house. They start in to tell the injured person, if conscious or unconscious, what they have done in other cases, and the large amounts recovered. They show a printed slip citing the verdicts obtained against defendants. This is compiled to suit themselves. It does not matter to these sharks what kind of a case the injured may have, as long as they bring something into the office of the lawyer who employs them, and the names of some of these lawyers would surprise you, as they stand high in the profession. If they should get the case they enjoin upon the client absolute silence, to say nothing to anyone, particularly to the railroad men, and they start in to libel the road and everyone connected with it. If the man be ignorant he becomes prejudiced and it is pretty hard work even to get him to open his mouth, but after a while they come around and regret they ever had any dealings with these fellows. If the injured party is taken from the hospital and found to be but slightly injured, the lawyer to whom the case has been brought sends his own physician to attend. He then develops all the ills one can have, with several fractures thrown in. We have found out by experience that the less we have to do with the runner the better off we are. We now deal with none. If he presents the case, we treat it with suspicion and work it up accordingly. If this element were gotten out of the business there would be a big decrease in suits against the railroads and a decrease in the business of the courts, for many a man would not think of even making a claim or starting a suit were it not for the inducements offered by these people. They have often paid the claimant $5 a week while laid up and then deducted that from the verdict or settlement, if any.

Now we get down to the investigation of reports. Cases which are sent in as unknown parties, unless they be rendered unconscious, very seldom turn into claims. These we do not investigate until a claim is made. Cases which have been turned in with the injured party's name should, in our opinion, be thoroughly looked into. A good many, when their name is asked, make up their mind then and there to present a claim. To let these wait until a claim or suit is started—for they sometimes do not make a move for a year or more, might bring out a poor defense; your witnesses do not always remember the facts and sometimes forget them entirely. A point to bear in mind is to first call upon the police blotter witnesses—those that are obtained by the police, and put in their report, as a good many of our friends mentioned before, have access to the blotters and are likely to play upon the sympathy of the witnesses and get them to distort the truth.

We believe it advisable to get physical examinations whenever possible. A man might be treated by an ignorant surgeon who claims he has a broken arm or thigh, which, after examination, turns out to be a sprain or a bad contusion, or that he has some internal injury which we find to be some previous chronic trouble. After you show the claimant or lawyer that the injuries are not as severe as at first presented it usually means a big drop in the price of settlement.

A persistent defense of suits has given a reputation in the profession and among lawyers that it would be more advantageous to them to effect a settlement. When the reputation is gained as a hard fighter they do not care to expend time and money and take chances. This has been stated by the lawyer or claimant whenever they call at the office and has induced them to accept less for their claim than they otherwise would.

As a final subject, we can take up the liability cases, those of admitted liability. We have found that the sooner we have these cases in hand the better off we are and the quicker the settlement, the cheaper. Cases of this character should be followed up immediately, and whenever possible gotten rid of. If delayed, someone is sure to advise them to ask for a larger sum and get some lawyer friend, who then sees a chance for a good settlement. On the other hand, there are cases of this character that are allowed to drift and go into suit. Cases where the claim is exorbitant, after waiting a few months and finding out their injuries are not as severe as first supposed, and that the money does not come as quickly as expected, they take off several figures, and usually come to terms. Sometimes a settlement cannot be effected; the claimant is stubborn, as well as the lawyer; a large sum is demanded; a figure offered adequate with the injuries, but this is not accepted, but when they see the case is to be fought by the defendant they invariably listen to a proposition.

Sometime ago we arranged with the operating department to report to them cases of liability that were settled, stating in our report the name of the person, name of crew, what the crew said and what the witnesses said. Since this has been in vogue there has been a decrease of over 30 per cent in accident reports received at the claim department.

W. H. Park, of Youngstown, Ohio, and George Denison, of Cleveland, representing a syndicate of capitalists, formed to build electric railways in Cuba, have just returned from a trip to the island, and, as a result of their investigations, it has been decided to build on a broader basis than was originally planned. Grants have been secured for a line across the island, and the principal interurban line will extend from Havana to the south coast. The other terminal will be Barboa, an important seaport, a distance of 36 miles. Another line will touch Sand Beach, near Havana, where a hotel and casino will be established.

Discipline*

BY C. B. FAIRCHILD

Sometime since the writer was riding on the front seat of an open car, on a country road, where it was not against the rules to talk to the motorman, and in conversation with a thoughtful man, he remarked: "The repair men give, and are required to give, special attention to the controller and motor equipment of our cars, but they frequently neglect or only give a passing thought to the brakes. If I can not make a car go I certainly can do no harm or have an accident, but if I can make my car go and am not able to stop or control it I can do untold damage." Now, the subject of this paper is not brakes, but discipline, and I quote the above only for the philosophy that is in it. Managers and others in operating street railway systems strain every nerve, advertise and make their cars attractive, to induce patronage, or to get nickels into the hands of their conductors, but what are they doing to insure that all these nickels get into the treasury, or after getting them into the treasury what are they doing to prevent their escaping or being paid out to meet excessive accident and repair claims, due to the ignorance and carelessness of the conductors and motormen? In other words, managers select their motors and other appliances with great care, and then watch, shield, nurse, protect and repair them assiduously to prevent their burning out, bucking or kicking, but what are they doing to improve, protect, shield and enlighten the two human machines that operate on the two platforms of the cars? Do they never buck or kick? And how about those others who have charge of the track and car-house repairs, as well as the clerical force?

What if a motor or controller does go wrong? You do not usually discharge it or lay it off without pay, nor take a crowbar and jam it into it and tell it what a —— fool it is, that it ought to know better, had been told often enough. Isn't it in your book of rules? You are not a profitable machine for this company. You do none of these things, but you put an expert on it and have it repaired.

It is to these human machines that our subject "discipline" relates.

The word "discipline" is from the Latin *disco*, meaning to learn. The word "disciple" is from the same Latin word and has reference to a learner, or one who receives instruction from another. "Discipline" used as a noun means education, instruction, and usually comprehends instruction in arts, sciences, manners and due subordination to authority. "Discipline" as a verb means to instruct or educate, to inform the mind, or to prepare one by instruction in correct principles for a profession or any useful work.

Originally, these words applied only to instruction, but in ecclesiastical affairs, in the early church, when heresy hunting began, the word had reference, as well, to the execution of the laws by which the Church was governed, and the inflicting of penalties enjoined against offenders. So, in later times, the word means not only to instruct, but to correct, to chastise, to punish with a view to bringing the offender to repentance and reformation, and more attention is usually given to the latter meaning than to instruction, whereas the reverse should be the rule. For our present purpose, the word "discipline" will mean the rules and regulations by which a body of men are kept in a state of efficiency and order, and under complete command.

At once, it appears, that there are two related parties—the instructor and the learners, or the disciplinarian and the disciples, both human beings and of the same common stock, involving the principle of brotherhood with a common object in view, viz.: The efficiency of the service. The first recognition is this relation. The second, how best to impart the instruction and enforce its observance.

It was well remarked by a member of this association, at the last annual meeting, to the effect "that inasmuch as the machinery for propelling cars is decidedly in advance of the old type of machine (meaning horses), so the men who stand on the platforms of your cars must also be a decided improvement over the old street-car men." This is true, and it is also true that applicants for such positions, and in fact nearly all workingmen, are a different kind of men from those employed a decade ago, and they will not submit to the bossy and abusive treatment that was formerly supposed to be necessary in order to make men know their place, or to get work out of them, which was probably the outcome of the spirit of slavery then existing. For this reason a manager or superintendent must know the basic principles upon which the relation of man to man exists, and must base his action on these principles in order to insure satisfactory results.

Among these principles are the following: The brotherhood of man is fundamental from the very nature and constitution of man, hence one can not do a wrong to another or speak unkindly without doing a greater wrong to himself. For the thought of wrong is first generated in one's own mind, where it will do its corrosive work before reaching its victim. Again, mankind are indissolubly related by ties of a common nature and origin too deep for anything to put asunder; and, being so related, self-preservation demands that one should act kindly and do justice to all, including the meanest and weakest and most defenseless of his fellow-men. Again, since man's constitution is based on the principles of charity and good will to all, slavery of any kind is not the natural birthright of any one, and when a master puts a chain about the neck of a slave, the other end must, of necessity, fasten itself around his own neck.

These principles were recognized and well illustrated by one of the speakers at your Rochester Convention. He said: "I do not believe that any workman was ever made a better man by harsh or cross rebuke administered to him by his superior in the presence of his fellows. He feels that he is an inferior, if he is subject to such treatment, and whenever I have occasion to speak to a man, for any infraction of duty or violation of rules, or the neglect of his duty, I take occasion to take him alone and appeal to the better side of his nature. My experience has been that more than 99 per cent of mankind are subject to the better influences. There is a great deal of man in every man, and all that you have to do is to develop it, give him a chance, bring him close to you, for there is scarcely a man so dense but what he is open to an appeal to the better side of his nature."

Employees in whatever situation reflect the color of the mind which directs them; so courtesy will be found to be one of the greatest factors in success. The writer is aware that most of the managers and superintendents who are members of this association recognize and practice the above principles, but the duties of a manager or superintendent in this matter of treatment of men does not end in his personal treatment of his associates and employees, but should be followed up by careful inspection to learn if the heads of departments and foremen are co-operating with him. He should know that every man down to the lowest grade receives fair and just treatment from his immediate superiors. It is a patent fact that a gang of workmen will not be better than their foreman, and if he is overbearing, cross and profane, the men and their work will partake of the same low character. If a foreman gets angry and abuses his men, he puts himself on their lowest level and loses his power of discipline, and, by getting angry, wastes his own physical strength that might better be spent in the service of the company. Let your men all understand that they are free to complain, or report any ill-treatment on the part of subordinates without fear of being persecuted. Let your men understand that they are not to be serfs, and are not expected to submit to petty tyranny, but that they are to be independent and have the right to resent, in a proper manner, any unjust or ungentlemanly treatment. Let your foreman and subordinates understand that each man sets an estimate upon himself, and if he uses the language of a blackguard he must expect his men to do the same. Let him understand that one must first learn to govern himself, and that anger is a confession of weakness.

In the enforcement of discipline one should remember that no matter how stupid, ignorant or vicious a man may appear, he still knows some things that the superintendent would be the better or wiser for knowing. Even though you have decided to discharge a man, by keeping cool, and winning his confidence, you may, by adroit questioning, be able to get from him admissions or confessions that will prove exceedingly valuable in rooting out discordant elements among the men, or draw out some hint that will be of value to the service. In reproving or cautioning men, keep on their good side, and regard all your men as so many feeders or avenues for seeking and transmitting to headquarters knowledge that will add to the efficiency of the service, and all your men should be encouraged to plan and suggest.

In the matter of shielding employees, special attention should be given to the night men, whether car men or night repair men. The late night men are apt to be influenced unfavorably or debauched by the people who patronize the late night cars, and unless carefully watched will pick up careless habits or shady practices that will, in time, spread to the entire force. Men should never be required to remain too long on late night runs, or at night-work of any kind. In the business of street railway management there are three classes or parties to which a superintendent finds himself related: First, the employees; second, the

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public, and third, the stockholders; and in proportion to the attention given to the first class, does he benefit the other two classes. When the employees please the public, the public become liberal patrons and the stockholders get the benefit of the extra nickels.

So much for the relation, now for the instruction and its enforcement.

We often hear it remarked by the heads of departments in street railway matter: "If you knew the calibre of the men we employ, you would know they would never think of using such or such an appliance if we should adopt it," or "our men can never be brought to such a state of efficiency." One who says such things only confesses his own inefficiency as an instructor, for men will do, and all men will do well, whatever they are properly instructed to do. It is in them as a possibility; the question is how to bring it out, and make it actual. It is not enough to dismiss the subject, and say that it has been tried and failed, for, so far as the writer is informed, men working in the street railway field are not generally fully instructed, or rightly informed. Note the difference between instructed and informed. They may be well instructed in mechanical details, and as to their particular duties in particular situations, but have never received instruction along the higher lines, as how to develop and employ their own native powers, their own power to think, and act promptly and correctly, under any and all circumstances that may arise. A man may be familiar with all the rules, and yet not know them, and it is a mark of a good instructor so to teach that his pupils know the subject, can digest it and make it a part of their own immediate knowledge, always ready for use without taking time to fish about in their minds to recall the rule that applies to any particular case. Every mind is so constituted that it can acquire, if properly taught, and instruction is the only thing that will or can do away with the limitations that hamper street railway practice. Mere instruction, however, is only half, and the smaller half of the requirements. Every teacher knows that no matter how lucidly a subject is presented to a class of pupils, the learning is solely a mental act on the part of the individual pupil. The object of the teacher and pupil is the same, but the relation to the work to be done is different, and, as said above, the object can only be attained by the mental act of the learner, by his observing, remembering, etc. It is clear, then, that what he does, and not what the teacher does, is the essential part of the process; that is, the appropriation and assimilation of knowledge, by the mind, and can be performed by no one but the learner. The teacher can no more think for his men than he can walk, sleep or digest for them. The process of thinking, then, by which a pupil learns, being essentially his own, the teacher's part is that of a guide, director or superintendent of the operation by which the pupil teaches himself. The instructor can stimulate and direct, but he can not do the thinking necessary to give the desired results for his pupil. The teacher's problem is how to get his pupils to learn, how to get all his pupils to learn, the so-called stupid ones as well as the bright ones, and how to adapt his teaching to the calibre of the individuals, and see that they make the mental effort to learn. And he should remember that there is no need for haste, the only thing needful is accurate knowledge, to have something thoroughly, perfectly, immovably known, the same as is required of a machine, that it will work perfectly under all conditions. Even then the teacher's work is only just begun. Instruction must be followed up by continuous, persistent and careful inspection of the men when on or off duty, not with the view, merely, of finding if rules are being violated or for the purpose of administering reproofs and reprimands, but for the purpose of keeping acquainted, of watching their general conduct, and for the purpose of impressing upon the man the rightness and advantage of honesty, sobriety, and politeness. Let the reprimands and reproofs, if necessary, come afterward, when the individual offender can be called aside and warned, or instructed by himself. Indiscriminate censure, when anything has gone wrong, or is going wrong, only defeats good discipline. In the matter of inspection, remember, that if everything is found working smoothly one day, it is not an evidence or guarantee that it will be so running the next day, unless you make it so by your presence. Never take it for granted that your men or assistants are doing what you have told them, but watch and see; come upon them at odd spells day and night. Let them feel that you are omnipresent. In preparing a code of rules for the government of street railway employees it will be more expedient so to word them that they will all be constructive rather than prohibitive laws and penalties. It is much pleasanter and more effective to have laws that will tell men what they ought to do, rather than what they must not do. For instance, rules that read: "It shall be lawful and proper, etc.," rather than it shall be "unlawful and, etc.," "Said crime or misdemeanor or infraction of rules shall be punished by fine, suspension or discharge." Rules that read "thou shalt not" often serve as a challenge or suggestion, to certain minds, to do the forbidden thing, for the purpose of showing their independence, and that they can do it without being detected. It weakens the force of a rule to state it arbitrarily with must or forbid when its violation can not be enforced. For instance, "Indulgence to excess in intoxicating liquors when off duty is positively prohibited." "Spitting in this car is positively forbidden." A man might be discharged for intoxication, but there is no way that the company can prohibit a man from becoming intoxicated. The rule about spitting can not be enforced, for the passenger might spit out of the window or the door, or might use the coal box, or if he should spit on the floor, the chances are that the conductor would not see him. A better notice would be "Gentlemen: Please do not spit on the floor of this car." Or "the Board of Health has made it a misdeameanor to spit on the floor of a car."

A book of rules should have no reference to specific rewards or punishment. These matters should be left to the individual judgment of the one who is responsible for their enforcement. Incentives are better than penalties in the matter of securing obedience to the rules, but as there are always employees with whom incentives have no weight, penalties are sometimes necessary. They need not be severe, however, but reproof or punishment must be certain to follow any offense, whether injury has resulted or not, and must tend to instruct or train the offender, so that he will want to obey the rule. In no case should a disciplinarian threaten a man, or impose a penalty, and then let him beg off. Investigate carefully and be sure of your gronnd before imposing a penalty. The offender shonld be made to realize that reproof or penalty is imposed for neglect or disobedience, not simply because the manager is displeased and seeks revenge. Penalties, except in rare cases, should not affect the man's pay, for if it does his family or friends may be made to suffer, and the women of his household, not knowing the circumstances, are apt to blame the manager, and gossip and circulate reports injurious to the interests of the company, and the man himself, thinking he is unjusty fined, will be apt to seek or try some means by which he may get even with the company. It is gratifying to know that this matter of affecting a man's pay has already been settled by a number of companies in this State, as shown by the reports and discussions of your previous meetings. Merit and demerit marks may be used, but a record of these necessitates an endless amount of bookkeeping, and often leads to no end of misunderstanding and jealousy among the men, and is often attended by annoyances that defeat the end sought to be gained. The bookkeeping mentioned does not refer to the man's record. It is better to leave it to the manager or superintendent to devise some original method of reward to suit meritorious cases, without any previous promise made in the matter. In the whole matter, however, it is better to remember that formation is better than reformation, and that more attention paid to instruction and drill will save time and worry in the matter of punishment. It is conceded by prison authorities and others that punishment as ordinarily administered is not reformatory. In enforcing discipline let not authority be the impelling motive. Temper your attitude by imagining yourself in his place. Think that if you had had his heredity, his conditions and environments, you would be just like him, and this will furnish a good lesson in toleration. Interpret the man from his own point of view, and remember that until he sees the justice and truth of your action it is not truth to him. To convince him, find other points of agreement, and he will be led toward recognition and at length exclaim: "I see it." If you seek common ground you can always find it, and when found its area naturally increases. Hold the other man's view in respect and that will bring him toward yours. Your toleration will outlaw his law.

In the matter of correction, a distinction should be made between offenses from ignorance, indifference, reeklessness, carelessness and those where wilfulness or guilt are involved. So far as the company is concerned, a loss from carelessness or forgetfulness is just as bad as a loss where guilt is a factor, but the penalties can not be the same. The fact, however, should be impressed on the minds of all the men that loss from any cause is a serious matter, especially when it is accompanied with injury to life or limb, and that accidents are not measured by the money value only, but have an important influence on the general reputation and patronage of the road. Accidents do not happen, nothing happens, there is a cause for every effect. There are no unavoidable accidents. According to psychological laws, the cause can usually be found in the mental make-up of the man responsible for the accident. The mental attitude of some men invites accidents and all sorts of so-called ill-luck. The man who has one accident will have another and another, and will con-

tinue to have them, unless his mentality is changed. The best men never have any accidents, and all the accidents can usually be traced to a certain few men who, when known, should be discharged or transferred to some situation where they can not do much injury, either to themselves, to others or to property. It is a mistake to suppose that men must necessarily have accidents, violate rules or be a little reckless or careless at times, in order to learn street railroading. People learn to walk by walking and not by falling down. Mistakes or accidents are not instructive or reformatory, and a man is never better for them. The writer was surprised to hear the statement made at your last convention by a superintendent that he would have no objection to employing a man who had been discharged from another road for having an accident, upon the ground that such a man would realize the seriousness of his error and make a better man than before. Such reasoning is contrary to mental laws and contrary to all the information the writer has been able to gather on the subject in his fifteen years' continuous association with street railway men.

All the triumphs of skill which we observe are merely the shaping of things by the subtle power of thought. The grander the achievement, the grander and more masterly the thought that has embodied itself. The scientific work which calls for the praise and admiration of men is the result of the scientific thought of the worker. Man, then, being a master of thought and of all things through it, any desired object or condition becomes possible of realization. Once master of the principles of thinking, one can become a specialist in any particular line of invention or discovery that may be demanded by the necessities of the service. Once master of that kind of thinking which builds men, bringing into expression the ideal qualities that are essential to profitable street railroading, a manager can advance his service to an earning capacity beyond anything he has ever imagined. The question is often asked, "What is your experience in such a matter?" or "In my experience I have found so and so to be of advantage." Now, experience is merely what has been found out in practice, but it should be remembered that there is much beyond what has yet been so found out. A turn may come in street railway affairs, and sometime a wiser method of discipline may be suggested, productive of unheard-of results. So it is never safe to reason on the basis of experience, or on a basis that one knows all that is to be known on any subject, and so declare a new idea impossible or silly. It is not always experience, custom of practice that is to be followed, but some higher, advanced or better way. Those who are the great masters of commercial matters to-day are those who have dared to try something new that has come to their thought. An example is found in the matter of welding the joints of street railway rails. Engineers who were skilled in all such knowledge, when told of the idea, pronounced it impossible and silly, declaring that in the summer's heat the rails would hump up, pull the spikes and ruin the road, or in winter time the rails would pull apart by contraction. Their reasoning was conclusive, according to experience up to that time, but when the actual trial was made, the results were surprising. There was little or no trouble from expansion or contraction and it has become an almost universal practice. Those who declared such ideas absurd have, in this day, their companions. Prompt action is the secret of success in the line of new suggestions, but it should be action that is right in line with one's regular work.

We must not limit the possibilities of to-day by the attainments of yesterday; if we should do so, we would bring to an end all progress, and in the matter of discipline no advancement could be made toward the time when there shall be fewer accidents, less expense for repairs and when employees shall be more considerate of the rights and comfort of passengers.

In the matter of instruction, it is a commendable practice to provide schools or lectures for instruction and practice, as has already been done by some of the largest systems in our State. In these schools, oral instruction should be given in addition to printed rules, and when rules are provided, it is best not to put them into the hands of green men to study, at first. Not until they have had some opportunity to become familiar with the names of the parts of a car and the road's equipment. Even then it is better that the rules be first read and explained to the men, as some men, although they can read, find it difficult to comprehend written instructions. It was well remarked at the last convention that "so far as the question of training is concerned, it should continue so long as the man is in the employ of the company. The training of every employee should be continuous, as new questions and conditions are constantly coming up." This training can best be given by having schools for this purpose, as is already the practice with some companies, and through the business and social meetings, in connection with the benefit associations or other organizations. Schools of some kind are especially desirable for small companies, as it is usually found to be more difficult to give thorough instruction to employees on a small system than on large roads, for the reason that the superintendent is so burdened with details that he finds little time to devote to instruction. Thus it frequently happens that a motorman, for instance, receives his entire teaching from another motorman, who receives all his instructions from a previous motorman. The result is that the rules that the last man receives are only copies of copies of copies, and are likely to be very much distorted from the original. Again, when frequent changes are made among the men, a new man may be put on to learn from a man who himself was new only a short time before.

It should be borne in mind that, in the present state of society, it is of advantage to a company to provide instruction in schools or by lectures for the men, along lines other than those relating to their mechanical duty. In other words, some means to counteract the philosophy of the "bar-rooms" and make the men conscious of their own mental and moral powers. Not only the philosophy of the "bar-rooms" is to be counteracted, but that given at public halls, where the men listen to bitter harangues on society in general, attacks on property, on the Church and the institutions of our social fabric, when men blame everybody and everything except themselves and fire the souls of their hearers, as bad whiskey fires the body and for the same reason. Labor troubles arise from ignorance, and can only be avoided by bringing all the men to the same general knowledge of all the local conditions that the chiefs in the service themselves enjoy. Men can be taught to feel that their interests and those of the company are identical. Individual opinions are founded upon and colored by an innumerable variety of factors which have preceded, and if you expect men to think as you do and be actuated by high and lofty motives and loyalty to the company, they must be taught the same things which have made you what you are. As was said last year, there are bound to be seeds of passion, seeds of discontent and disloyalty planted in the minds of employees somewhere and somehow; hence, as a matter of self-defense, from a selfish or commercial standpoint, without any reference to ethics, morals or religion, street railway companies should undertake to fill the minds of their employees with seeds of truth, for truth's own sake. Men are tired of makeshifts, they do not wish to be bribed by gifts or abused by penalties, but they do want food for their minds, and when teachers are provided who will proclaim the brotherhood of man and the laws of mind, as founded on the very nature and constitution of man, men will crowd and throng the classes. Men must be shown that they have a higher nature, which is ever leading them on. That this nature has a tendency to evolve until they outwardly manifest in full their relations and possibilities, being filled with the hope and expectation of bettering their condition in life. When men are taught how to think, how to recognize and use their power to think, they will have the key to all problems, for thought is creative, and all creation and all progress of the race, as manifest in means for transportation, in printing, etc., has been through thought.

The principles above enumerated are not one-sided, are not for one class only, but are to be observed by the employees, as well as the employer, but it must be remembered that these principles can not be forced upon any class of people nor upon the public. For this reason these truths can not be put into practice until your employees are educated up to them, but the responsibility of teaching principles to what are known as the laboring classes rest with the higher or more advanced and enlightened, usually the employer. From the fact that street railways in their purchases are closely allied to almost every other industry, they have the opportunity, and it will be for their credit to take the initiative in this matter. It is often said by street railway men that they are not in the missionary business, but it is now known that any enterprise or industry is prosperous in proportion to its missionary work.

Some of the larger companies have formed schools for instruction. It would, doubtless, be to the advantage of the smaller companies if they would club together and organize schools in different parts of the State or subsidize and encourage private schools, where instruction can be given in all matters relating to street railway affairs, to which young men can go and fit themselves for the business or profession of street railroading. We have numerous commercial colleges. Schools of dramatic art, of music, etc., why not have schools for the science and art of street railroading and street railway management? Schools equipped with cars, motors, trucks and all the mechanical appliances, with a course of instruction in all the duties required of a street railway employee, embracing his relation to the public which he is expected to serve.

Power House Accountings*

BY R. E. DANFORTH

The records kept in our power stations generally vary from practically nothing but a time book to a system which requires clerks to maintain. The question for discussion to-day, by the association is: "What records should be kept in the power stations that the station may be intelligently operated to the best economy." The object of this paper is to provoke discussion, in order that the members of your association may learn your opinions and experiences, and therefrom determine the accounting system which seems best suited for each local condition.

Power station records are kept for a two-fold purpose—to show the cost of power developed, and to enable the management to locate the uneconomical features of the plant. The accounts should show the amount of power generated or distributed, and the varior items, more or less classified, which enter into the cost of such power. It is, for instance, important to know that your firemen generate steam with the proper amount of fuel per horse-power, that the engines and generators convert this steam into electric power, with the least possible loss, and that in each of these operations the machinery is not only being worked to maximum efficiency, but with a minimum cost for repairs. It is further important to be able to determine whether the various units are cut in and out of service at the most economical time, to the end that the proper kilowatt capacity, and no more, is at times being operated.

To obtain the information here roughly described, certain records must be accurately kept. The several items may be briefly stated as follows:

Weight of coal consumed.
Gallons of water evaporated.
Cost of labor in boiler room.
Cost of boiler cleaning and repairs.
Number kilowatt-hours current output.
Number of units in service and hours each are run.
Cost of labor in engine room.
Cost of engine repairs.
Cost of electrical repairs.
From which should be derived:
Fuel, per kilowatt-hour.
Water, per pound of coal.
Water, per kilowatt-hour.
Labor in boiler room, per kilowatt-hour.
Boiler repairs, per kilowatt-hour.
Labor in engine room, per kilowatt-hour.
Engine repairs, per kilowatt-hour.
Electrical repairs, per kilowatt-hour.
Total cost of power, per kilowatt-hour.

In addition to the foregoing a carefully kept log is of great service to the engineer in keeping track of the work done by and upon the various machines in his charge.

Regular and frequent tests of combustible, of flue gas and ash, the inspection of feed and blow-off pipes, steam mains and valves and engine indicator cards, must not only be made, but systematically recorded and studied, and their lessons heeded. Ashes should be frequently weighed to determine the quality of fuel being furnished by the dealer. It is sufficient to obtain a clean card from your engines, but the cards must be carefully analyzed to ascertain the condition of cylinders and valves. Steam leaks however small should never be neglected, as the waste through a leak invisible to the eye often represents a considerable amount in the coal pile.

There is another fact that must be borne in mind—small plants do not require as elaborate accounts as large plants, and the larger the plant the greater the probability of loss through the usual method of depending on the opinion or judgment of some individual, rather than upon systematic and intelligent study of the daily records.

One of the greatest aids in the study of engine service is found in a well kept load chart. Such chart may be compiled in a few minutes daily by the engineer, from recording instruments or from ammeter and voltmeter readings, taken at frequent intervals by the switchboard attendants. A fine example of such a chart was presented to your association two years ago by the Buffalo Railway Company, in connection with a paper on the Electric Storage Battery. On this chart was shown the number of engines in service at all times, and the work done by these engines, Niagara power and storage battery. At this station the engineer in charge consulted his charts in determining the most economical time to increase or decrease the engine capacity in service, and the proportion of peak load to be carried by the storage battery.

Concerning the blanks, forms and other details connected with power house accounts, engineers differ widely. A glance over the blanks and forms published within the last few years in the railway periodicals clearly shows a wide divergence. The writer has in mind also, sets of forms on file in his office, several of the blanks being huge sheets, calling for an endless amount of minor data, the compilation of which must be expensive and which is probably not used after being obtained; and of other sets of blanks which offer so little data that no idea of the work actually done can be shown thereon.

Each station or group of stations requires separate treatment in determining the details of the accounting system to be followed, but in the main the facts herewith briefly outlined cover the requirements.

* Paper read at the twentieth annual convention of the New York State Street Railway Association, at Caldwell, Sept. 9, 1902.

Outing of the New England Street Railway Club

The annual outing of the New England Street Railway Club was held at Hampton Beach, N. H., on Thursday, Sept. 4, 1902, and was attended by about 140 members and their friends.

A special train left Boston via North Station, Causeway Street at 9:40 a. m. and arrived at Hampton at 11:07. Here electric cars were taken to the beach, which was reached about 11:15. Soon after arrival at the beach a ball game was called, and two nines, captained by Messrs. P. W. Whittemore and F. O. Nourse, played an exciting game. Bowling alleys were also in operation, and a number of the party enjoyed the fine surf bathing which the beach affords.

At 1:30 p. m. a fish dinner was served, and President Farmington presided. In the absence of Franklin Woodman, of Haverhill, Mr. Hayden made a few felicitous remarks, and then the athletic features that had been arranged were run off. E. D. Miller, of Boston, was clerk of course, ably assisted by F. S. B. Sias, with J. E. Johnston recorder. The judges were D. L. Prendergast, of Boston; F. G. Henderson, of Newton, and E. W. Goss, of Milford, with C. H. Hill, of Boston, starter, and P. W. Davis, of Boston, timekeeper. Four silver cups were offered as prizes to those scoring the most points in the games, and they were won as follows: First, P. W. Whittemore, winner of hundred-yard dash; second, R. W. Covant, winner of high jump; third, Mr. White, winner of potato race; fourth, F. O. Nourse, third in high jump and potato race.

At 4:45 p. m. the club left the beach for Haverhill by electric cars, and enjoyed a superb ride along the coast and country to that city, from which a train was taken for Boston at 6:47 p. m. The committees were: Transportation, Messrs. Wattles and Millar; subjects, Messrs. Winsor, Reynolds and Ellis; banquet, Messrs. Stone and Hodges; sports, P. W. Davis chairman, Messrs. Nourse, Sias, Millar, Coolidge, Pestell, Hart and Winter. The subject committee is now taking up the winter's work of the club, and the next regular meeting will probably be held in October in Boston.

Legal Status of Reconstructed Steam Roads

An action has been commenced in the Superior Court by a taxpayer, at Cincinnati, to restrain the Cincinnati, Georgetown & Portsmouth Railway from entering the city over the tracks of the Cincinnati Traction Company. The suit involves the right of a reconstructed steam road to enter into traffic arrangements with an electric line. It is claimed that the interurban company can not enter the city without securing consents of property owners and being awarded the contract after competitive bidding for the route. It is claimed the Cincinnati, Georgetown & Portsmouth is a steam road under the law, although it is being equipped with electricity, that it can not enter the city over the tracks of a street railroad, so-called, and, being a steam road, that it can not enter the city without condemning a right of way through the city. A similar injunction suit will be brought to enjoin the Cincinnati, Dayton & Toledo Traction Company from entering the city over the tracks of the Cincinnati & Northwestern, an old steam road recently acquired by the electric company and now operated as a part of it.

The Strike on the Hudson Valley Railway

It is stated that the officials of the Hudson Valley Railway, of Troy, N. Y., have said that there will be no further negotiations with the striking employees with reference to a settlement of the trouble, and that the company will commence preparations to resume the running of cars. The conference at Glens Falls on Sept. 4 between representatives of the company, strikers and trades assembly, resulted in the drafting of a new agreement, which, when it was submitted to the men, was not accepted, and the conference came to an unsuccessful end.

Accidents on Electric Railroads—I*

BY C. R. BARNES

As a representative of the Railroad Commission I have officially come in contact with nearly every manager of electric railroads in the State. My relations with them, I think, without exception, are cordial and friendly, and I hope that condition to continue, but I think your chairman has designs on me and is endeavoring to rupture the friendly feelings which now exist between the officials of electric railroads and myself. In carrying out this idea he has notified me to present to this convention a paper on accidents—he notified me, not requested me, to do so. You have continued him in office so long, he has become an autocrat. When he orders around such men as Vreeland, Ely and the rest of you gentlemen, and you do not resent it, I do not see what else I can do but obey and wish I had a vote in the convention. Nero in his palmy days was not "in it" with this gentleman. I understand he is learning to play the fiddle, and I advise you to look out for your car houses and power houses.

But, seriously, gentlemen, the subject of this paper is at the present time a very important one. The author has had eight years' experience in the investigation of accidents in this State, and this experience has taught him the importance of the subject, and also how incompetent he is to present a paper on it before a convention of representative railroad men such as this. But to treat the subject in even my humble way, facts must be stated, and in doing this it is desired that every member of the association should know that there is no criticism on the management of any one particular road intended; but the general information in reference to the operation of all roads which has been obtained in my official position will be used in the hope that it may in a small measure aid in what you are all interested in accomplishing, namely, reducing the number of accidents to those which are incidental to the operation of an electric railroad and which experience shows to be practically unpreventable, even with reasonable care and foresight.

In the year 1898 there were 1,174.38 miles of electric railroads in this State; 4002 box, 3408 open, 10 mail and 208 freight, express and service cars operated. In that year there were 74 persons killed and 541 injured. In 1899 there were 1,225.16 miles of road; 4743 box, 3681 open, 139 mail and 631 freight, express and service cars operated. There were 126 persons killed and 589 injured. In 1900 there were 1,413.26 miles of road; 5098 box, 3666 open, 22 mail and 666 freight, express and service cars operated. There were 148 persons killed and 650 injured. In 1901 there were 1,548.66 miles of road; 5190 box, 3945 open, 10 mail and 558 freight, express and service cars operated, and 160 persons were killed and 867 injured. The complete reports of mileage and the number of cars operated for the year ended June 30, 1902, have not yet been received in the Railroad Commission office. In this year to June 30 there were 127 people killed and 823 injured. You are all familiar with the serious accidents which have occurred since June 30, one of which resulted in 14 deaths and the injury of 60 persons; another in 4 deaths and 20 or 30 injured; one where three were killed and several injured; two where one was killed, and several others where a number were injured.

These figures show that the death rate caused by accidents in reference to miles of road operated was .063 in 1898, .102 in 1899, .104 in 1900, and .103 in 1901. As stated above, these figures cannot be given for 1902. But, with the exception of the year 1901, in which year the death rate in proportion to miles of road was less than the year previous, there has been a continuous increase in the dath rate as compared to the mileage. This increase between the years 1898 and 1901 was .040, an increase of about 63 per cent. The percentage of passengers injured in reference to miles of road operated in 1898 was .462; in 1899, .480; in 1900, .450, and in 1901, .559. This shows a steady increase in the percentage of passengers injured in reference to mileage of road except in the year 1900, when the percentage was less than in the year previous. There has been an increase between the years 1898 and 1901 of .097, an increase of about 21 per cent.

These figures include the accidents on all of the electric railroads in the State, including city and other roads, and are compiled from the annual reports of the companies made to the Railroad Commission. It was the intention to have classified these accidents, and also to have made a percentage comparison based on car mileage, but the investigation of the number of serious accidents which have occurred recently has occupied so much time that I was unable to make as detailed a statement of accidents and as clear a comparison of them with the growth of the electric railroads as would be desirable in a paper of this kind.

While these figures include the killed and injured resulting from all classes of accidents, a large maiority of them are the result of head-on collisions, tail-end collisions, collisions at grade crossings of steam railroads, collisions at grade crossings of electric railroads, derailments and failures of bridges and trestles. The future consideration of this subject will be confined to this class of accidents. The accidents incidental to city operation, such as striking persons and vehicles on the street, passengers injured boarding and leaving cars, passengers thrown from cars, etc., will not be discussed in the following portions of this paper.

The greatest loss of life and injury to passengers on electric railroads in the last five years has been caused by rear-end collisions; the next largest loss of life and injury to passengers has been caused by head-on collisions, and in this comparative line of the causes of death and injury to passengers are the collisions at grade crossings of steam and electric railroads, the derailment of cars and the collapse ot bridges and trestles. The causes for this class of accidents are numerous, and to state only a small portion of them would be beyond the limits of a paper of this character. The more important ones will be briefly mentioned.

Head-on and rear-end collisions can be dealt with under one head, as the causes which produce them are in most cases similar. In the investigation of this class of accidents, it is found that motormen have two stereotyped excuses for their occurrenee; first, "When I saw the car ahead of me I applied the brake, but it would not work;" second, "I then put on the reverse, but it would not take." The testimony of all persons directly interested in the operation of the cars in collision is taken in the investigation of accidents, and in nine cases out of ten this evidence goes to show that the motorman's statement was not true. When a motorman has been running a car the greater part of the day, making his usual stops without trouble, and in such a manner that the conductor's attention has not been attracted to them, this being the case on the run on which the accident occurred, it is safe to infer that the motorman is mistaken when he says the brakes would not work. Of course, there is always the possibility of the brake giving out on the stop just before the accident; but in the investigation of this class of accidents the inquiry must extend further than the crew of the car; it must be carried to a thorough examination of the methods of operation, the physical conditions of the road, the kind of brakes used on the cars, and the equipment of cars, including sand boxes. In the investigation of the methods of operation of railroads in reference to accidents, the statement can safely be made that in a large majority of them the primary cause of the accident can be traced to inefficient management of the road, and while the motorman may be the immediate cause of the accident, it in all probability would have been prevented had the management been more systematic.

There has been a large number of tail-end and head-on collisions. The larger portion of these have been caused by motormen running past switches where they were due to meet a car. Several have been causd by misunderstanding of train orders transmitted over a telephone system; several by conflicting orders being given by different officers of the company; some by crews attempting to "steal" a switch; several by crews taking it for granted that a car which was due at a junction of two lines had passed that point; others by the failure of block signal systems; a few by cars getting beyond the control of the motorman on heavy grades and not stopping at a switch where they should have stopped; a number by facing-point switches on cross-overs on double tracks, and there have been two cases where motormen have seen cars approaching them on the same track, and have continued at full speed, with the intention of making the other car back up to the switch, the speed continued on both cars for the same purpose until it was impossible to stop either; two were caused by the running of special and work cars over a road without proper notice being given to the regular cars; one head-on collision was caused by an ordinary passenger car being used as a work car and not being placarded as such; a regular car met it on a switch where another regular car was due; supposing it was the regular car the crew ran out onto the main track, and the two regulars met in head-on collision. Among the causes of tail-end collisions may be mentioned the 500-ft. distance rule in use on a large number of suburban and interurban railroads; cars coming to a stop at points on the road where the view of an approaching car is limited; cars "running away" on grades and on wet and slippery tracks; regular cars running into work cars, standing upon the main track without protection; broken trolley wheels leaving a car standing on the track without lights; trains being run in sections without the rear end of the first section being properly protected, and a number of other causes.

* Read before the twentieth annual convention of the New York State Street Railway Association at Caldwell, N. Y., Sept. 9, 1902.

The accidents at grade crossings of steam and electric railroads and at grade crossings of electric railroads, are invariably caused by violation of the running rules of the company, for I do not know of a crossing of steam and electric tracks in this State, where there is any considerable volume of traffic on the steam road, but what the company's rules require the electric car to come to a stop and the conductor to go ahead and flag his car over the crossing. But some collisions have been caused by the power giving out while the electric car was going over the steam tracks, or by the trolley leaving the wire while this was being done, in this manner stalling the electric car in front of the steam train or engine. At nearly every crossing of two electric tracks the cars on one of them are required by the rules to come to a full stop before proceeding over the crossing.

The causes of derailment of cars are so varied that it would be almost impossible in the limited space of this paper to enumerate them. The principal causes, however, are: Cars going around sharp curves at too high a rate of speed; the spreading of tracks on curves; the irregularity and poor alignment of curves and lack of proper elevation on them; where the grooved rail is used, the groove being filled with stone, sand or other substances; frogs and switches not being properly placed; open switches; poor alignment and surface of track; broken flanges on wheels; axles out of line; loose wheels; wheels not properly gaged, etc.

There have been several accidents resulting from bridge and trestle failures. These in most cases have been caused by leaving old structures in the road and increasing the weight of cars operated over them without increasing the strength of the structures. There have been two derailments on bridges, resulting in serious injury to passengers, brought about by the custom of planking highway and street bridges flush with the top of the rail, without proper guards to prevent a car from going off the rails and over the side of the bridge. This planking flush-with-the-top-of-the-rail is almost the universal custom and is a very dangerous one.

These are the most frequent accidents occuring on suburban and interurban railroads and the principal causes of them. The question now to be considered is how to prevent their occurrence. The solution of this problem, to some minds, appears to be an easy one. Read any of the papers of the daily press after an accident has occurred, and the editor volunteers a ready solution of the question of preventing accidents on electric railroads. In some of these papers you will see that double tracking a road would prevent all accidents on it in the future; in others equipping the cars with John Smith's automatic brake would prevent accidents of all characters; in another, the adoption by the company of Bill Smith's block signal device would be a guarantee against accidents, and so on through a long list of suggestions, the writers being confident of their ability to judge of the merits of the different devices mentioned and their positive knowledge that the adoption of that device or plan would be the solution of the question under consideration. But you, gentlemen, who are more experienced and far more interested than the editors in preventing accidents know that accidents on electric railroads have multiplied in variety and number with the advances made in electric railroading. It is not a case of a sick child where a dose of paregoric can be administered and the disease will disappear. The present conditions result largely from the tireless efforts of manufacturers and inventors of electrical machinery to increase the efficiency, power and speed of their apparatus, and from the failure of electric railroad managers to keep pace with them in track construction, safety devices and methods of operation. This condition has been a growth of years, and the remedy for it must be found in the free use of safety appliances, in more perfect and complete construction and equipment, and more careful and systematized methods of operation.

It is taken for granted that every member of this association realizes that the electric railroad business is face to face with grave problems; that the numerous serious accidents, not only in this State, but throughout the country, are injuring the standing of the electric railroad before the public, and that if they continue, the revenues must be impaired for the reason that people will lose confidence in electric railroads and will prefer to patronize steam roads. Up to this time the electric car has met with favor by the public, preference being given to it for suburban and interurban rides, even when a destination could be reached quicker by the steam roads. The comforts of the electric service, including fresh air, freedom from smoke and cinders, the unobstructed view which can be had from the open car, and especially the combined pleasures of a ride on them through a country district have caused the public to patronize them liberally; but these frequent accidents are creating alarm and distrust. The confidence of the public must be restored, or you will not only drive people from the electric cars, but you will drive capital from investment in electric railways. These statements are intended to apply only to roads other than the distinctively city roads in the State. The city railroads are operated in a manner which reflects credit upon the management of them.

This condition of safe operation does not exist on all of the suburban and interurban roads and upon most of them the railroad commission has had to investigate serious accidents. Still, there are several of these roads which are operated under rules and regulations which compare favorably with steam railroad methods. On one of them there is a complete telegraph train dispatching system in use; on another, a train dispatching system, in which the orders are transmitted by telegraph and telephone; on several others there are train dispatching systems, the orders being transmitted by telephone only.

Of course, it is expected in a paper of this nature, after describing the character of accidents occurring on electric railroads, that suggestions should be made to prevent their occurrence, and this is the point where I realize my inability fully to meet the requirements of the situation. However, I will mention a few points in which my experience and observation have led me to believe that improvements could be made. As stated before, the investigation of accidents in a large majority of the cases shows a defect in the organization of the operating force and in the methods of operation. A well-organized operating force on an electric railroad can be compared to the motor, pinion and gear wheel of an electric car, the president being the motive force of the organization compared to the motor; the superintendent or general manager, through whom the president's policies are carried out, compared to the pinion; and the heads of the different departments, including motormen and conductors, to whom the superintendent issues his orders, represented by the different cogs on the gear wheel. The whole forms an unbroken line in the case of the organization from the president down to the motormen, conductors and other employees, as in the combination the pinion and gear transmit the power of the motor to the traction wheel. In the latter case each member must be in perfect working order, each one must be fully equipped and efficient in itself; any defect in one shows a defect in the whole. This is also true of the organization. If the president lacks in ability, sound judgment and common sense, he will interfere with the operation of the organization, and above all he must not reach over beyond the pinion, the superintendent, in carrying out his ideas and policies as illustrated in the case of the motor, pinion and gear; if the leads of the motor extend beyond the pinion and come in contact with the gear wheel, a damage is caused which results in the breaking down of the whole combination. It is not meant by this statement that the president must not come in contact with the employees of the road, but that he must not interfere with the operation of the road when it is in operation, except through the proper channel, the general manager or superintendent. When the machinery is at rest after the day's work is done, or when employees are off duty, the more he comes in contact with them, the better it is for everyone interested in the welfare of the road; but in the regular routine of business the president's duties consist in outlining policies and plans for the benefit of the road; the details of the execution of these plans and policies devolve upon the superintendent. The superintendent of a railroad should be a man of ample experience and capacity, qualified to take charge of the operation of the road in all its branches, carrying out the views and ideas of the president, but to all intents and purposes he should be the czar of everything pertaining to the direct operation of the system. The heads of the different departments, motormen and conductors, as represented by the gear of the combination, must mesh into the different apertures between the cogs of the pinion, and if one of the cogs of the gear becomes rusted and will not readily absorb the lubrication, which in the case of the organization is represented by the book of rules and special instructions, it weakens the whole structure, and if not removed will cause a breakdown. When a cog becomes worn out it must be removed from the system. In the case of the organization, when a motorman becomes too old for service, he must be removed from that position, and usually there are places on an electric road into which an old, faithful motorman can be put, where he will not be a detriment to the service. If a motorman becomes too large for his position, as in the case of the cog, he will not mesh into the aperture assigned to him, but will interfere with the smooth running, and must also be removed. This illustration might be carried further, showing that perfect organization is an essential thing to the welfare of an electric railroad. But the illustration clearly sets forth one point which to my mind is essential to the safe operation of any road; that is, the duties of the superintendent or general manager should be confined to carrying out the instructions received from the president in reference to the operation—and nothing but the operation—of the railroad. He should not be burdened with any additional duties, such as the supervision of construction of extensions, or the negotiation of stocks or bonds; his whole duty should be trying to earn dividends, not to negotiate the securities of the road.

(To be Continued.)

The Manhattan Elevated Company's Report and Grand Balance Sheet

The report of the Manhattan Elevated Railway Company, of New York for the year ended June 30, 1902, as filed with the Railroad Commissioners, shows:

	1902	1901
Gross receipts	$10,665,911	$9,416,888
Operating expenses	5,518,585	5,253,229
Earnings from operation	$5,147,326	$4,163,659
Receipts from other sources	$625,800	836,383
Gross income	$5,773,126	$5,000,042
Interest and taxes	2,699,670	2,677,706
Net earnings	$3,073,456	$2,322,336
Dividend (4 per cent)	1,920,000	1,920,000
Surplus	$1,153,456	$402,336
Passengers carried	215,259,345	190,045,741

The general balance sheet of the company, as of June 30, 1902, shows:

ASSETS	1902	1901
Cost of road and equipment	$76,826,427	$68,432,898
Cost of leases	14,014,000	14,014,000
Real estate	3,239,864	3,268,348
Sundries	26,613	240,557
Supplies on hand	556,273	347,908
Due by agents, traffic	753	392
Kuhn, Loeb & Company redeemable second mortgage Metropolitan bonds..	......	9,000
Due by others, traffic	14,835	9,361
Due by companies and individuals	44,208	203,207
Cash on hand	221,847	150,697
Loaned on collateral	3,763,522	9,604,416
Prepaid insurance	13,646	17,214
Central Trust Company, trustee, etc.	4,593	4,593
Estate J. Gould suretyship	......	300,000
Total	$98,726,580	$96,602,594
LIABILITIES		
Consolidated capital stock	$47,999,700	$47,999,700
Subject to income on capital stock	300	300
Funded debt	39,545,000	39,554,000
Convertible bonds and certificates	42,035	42,035
Interest on funded debt due and accrued	292,709	362,709
Manhattan 4 per cent bonds, special	......	300,000
Taxes in litigation	3,377,301	2,663,91?
Dividends unpaid	7,358	27,358
Sundries	56,351	36,038
Coupons due, not presented	60	60
Due for wages	114,559	80,288
Due for supplies, taxes, &c.	963,219	376,804
Open accounts	68,960	53,118
Profit and loss (surplus)	6,259,728	5,106,273
Total	$98,726,580	$96,602,594

An Electric Railway Between Rochester and Syracuse

The granting by the Railroad Commissioners of New York of the application of the Rochester, Syracuse & Eastern Electric Railway Company's application to build an electric railway between Rochester and Syracuse marks the close of a long and stubborn fight which the company has waged with the New York Central, the Rochester & Eastern Railway and the Monroe County Belt Line. The new road, when completed, will run through the villages of Brighton, Penfield, Fairport, Egypt, Macedon, Palmyra, Port Gibson, Newark, Lyons, Lock Berlin, Clyde, Savannah, Port Byron, Weedsport, Jordan, Peru, Memphis, Warner's, Amboy, Belle Isle and Solvay, and it will cross the New York Central five times. The capital stock of the company is $3,500,000, but this is to be increased to $5,000,000, it is said. The officers of the company are: Lyman C. Smith, of Syracuse, president; F. W. Roebling, of Trenton, vice-president; Charles A. Lux, of Clyde, secretary; A. K. Hiscock, of Syracuse, treasurer; Clifford D. Beebe, of Syracuse, general manager; Thomas H. Mather, of Syracuse, chief engineer.

Yellow Journalism and Railway Statistics

When the imaginative mind of the daily newspaper man is focused on the preparation of an article that relates to electricity in any of its various applications, one who knows is generally treated to a good laugh when the article finally makes its appearance. Of the many, many instances of the ludicrous in these cases the description, some time since, of a wattmeter by an enterprising newsgatherer of Philadelphia is far in advance of any other. But it is not only in trying to describe knowingly some technical point that the daily newspaper man causes those who know to laugh, for when he begins to juggle statistics he is equally as funny. Of late there has been a tendency to show, by comparison, the magnitude of the money returned to street railways through their conductors, and from a recent article in a paper in one of our Western cities, which is, by no means, as interesting as some we have seen, we quote:

"It is estimated that when the twelve months of the present year are at an end, Dec. 31, the street railway company's cars will have carried between 13,000,000 and 14,000,000 passengers. Last year, however, the 11,000,000 passengers are vouched for by the company's books and reports, and, taking this for a basis, some interesting comparisons may be drawn. Supposing that each of the 11,000,000 passengers had paid his fare with a nickel and the little coins carefully were hoarded. Put together in a giant scales, for nothing in the weighing machinery in the city or in the State could be found big enough to weigh them, it would be found that the coins aggregated a weight of nearly 160,000 lbs., or 80 tons. The limitation of the weight to be carried on the biggest freight car is placed at 40 tons carrying power, and it would, therefore, be seen that two freight cars of the ordinary design and strength could not safely transport the coins taken in by the company for the year 1901. Aggregating the nickels, as to value, the amount would reach more than a half a million, or, in exact figures, $350,000. This amount means that should it be distributed among the inhabitants of the city, every man, woman and child could take 122 rides on the local street cars. The total weight of 11,000,000 passengers, taking 130 lbs. as the average weight, would mean that the cars of the company carried no less than 1,430,000,000 lbs. of live weight, or, to make the figure more impressive, 715,000 tons. The building at the corner of (here intersecting streets are named) lifted bodily on to scales would probably weigh but a small portion of 715,000 tons. The weight is just about 715 times the total weight of all the electric cars in the city. It represents more tonnage than the combined tonnage of the United States Navy and the steamers of the trans-Atlantic liners sailing under the American flag. Place the passengers carried by the local cars in a line and allowing each passenger 1 ft. of ground upon which to stand, the line would reach from Grand Rapids to Denver, or, in miles, the line would stretch out unbroken for nearly 2000 miles. In handling this vast business each car of the local company would carry some 183,333⅓ passengers during the year, double the entire population of the city in which it runs, and would have to carry loads filling it to the platforms 3666 times, counting 50 passengers to a load.

Value of Texas Oil for Fuel

It is promised that reliable data upon the value of Texas oil for fuel will be forthcoming in a paper now being prepared by Charles W. Hayes, of the Geological Survey, for publication in the official records of the department. The paper will give the relative fuel value of Texas and various other oils compared with both bituminous and anthracite coal. A practical monopoly exists in anthracite coal, for the reason that its presence is confined to a few square miles in Pennsylvania, which are owned and controlled by a comparatively few persons through corporations. Small quantities of anthracite are found in Colorado and New Mexico, and some anthracite is found in Arkansas, but those fields are so small that they are not regarded as factors in the supply of hard coal. About 4,000,000 barrels of Texas oil were sold last year for fuel purposes. It was sold from 25 cents to 30 cents per barrel. No economical method has been discovered for refining this Texas oil for illuminating purposes, and its use is likely to be confined to purposes of fuel. Many attempts have been made to secure its adoption in large power plants, but thus far the cost of transportation and the lack of confidence in the supply has prevented the general use throughout the North.

Topics of the Week

Stimulated by recent deplorable accidents, the Massachusetts Railroad Commission has intimated to the street-car companies of the State that the time has come for them to equip all their cars with power brakes. It is said the companies are endeavoring to comply with the suggestion.

Electric roads centering at Columbus are agitating the question of asking the Legislature of Ohio to appoint a "State Inspector of Electric Railways" to regulate traction lines in the same manner in which steam roads are regulated. The idea is to have an officer supervise the care of tracks, cars, overhead wiring and other matters pertaining to the operation of the lines. The matter will probably be brought up at the coming special session of the Legislature.

A newspaper report from Toledo declares that a car on the Toledo & Monroe Railway covered the 17.4 miles from Monroe to Alexis, Mich., in exactly seventeen minutes. The car used for the trial was the No. 18 of the Lake Shore Electric Railway. It is equipped with four 125-hp motors. Mention of trials by this car have been made in the STREET RAILWAY JOURNAL. Its latest performance is claimed to have been the fastest run ever made by an electric car in this country.

An official notification has been issued by Commissioner of Health Lederle, of New York, directed to the Rapid Transit Subway Commissioners, advising them that the subway excavation must be cleaned of offensive matter, stagnant water and sewage; that steps must be taken to prevent the dumping of refuse into the excavation and to arrest any offenders in this respect; that in place of the present open sewers properly covered ones must be used and that provision must be made for the disinfection of the subway.

Two important facts about the World's Fair at St. Louis are related in an official bulletin recently issued by the publicity department, namely, that "the price paid for the Louisiana Territory was $15,000,000," and that the "total funds for the World's Fair to date, including the State and Government appropriations, aggregate $20,000,000," or $5,000,000 more for the celebration of the event than the original cost. Evidently, the importance of the acquisition and the value of the territory is more fully appreciated to-day than at the time of the purchase.

There has been considerable speculation as to the meaning of the work that is now being done by the Pennsylvania Railroad Company in Jersey. A shaft has been sunk in the North River on the line of the proposed tunnel from Long Island City to the Jersey shore for the purpose of ascertaining the supporting strength of the material in the bed of the river and the conditions with which the engineers must cope when the construction of the tunnel is undertaken. The shaft is in the North River opposite the Erie freight pier in Weehawken, about 700 ft. out from the wharf. It runs 100 ft. below the wharf level and 130 ft. into the bed of the river. Below that depth a screw pile has been sunk. The engineers for the Pennsylvania Railroad Company explained that this shaft was not part of the tunnel construction, but was put down as a test to supply them with information necessary before the building of the tunnel.

The Commissioner of Public Works, of Rochester, N. Y., has publicly commended the street railway company for its liberality and public spirit in meeting the requests of the city for paying the expense entailed in keeping the streets upon which the company's lines are operated clear of snow. "In view of the struggle we have in keeping up the street and sewer work," said the commissioner, "I am much encouraged by the attitude of the Rochester Railway Company. Some time ago I made an argument to the officials of the company that it would be proper for them to pay something toward the extra cost of removing snow from the streets accumulated through the cleaning of the tracks. Such a thing had not been done before, but it seemed proper that the company should meet us part way and help out somewhat. After mature deliberation on the part of the officials, they finally decided to give us $2,000. This is encouraging not only in the amount of money but as showing the spirit of the management of the company in liberality and being up-to-date."

An Old Accident Fakir Caught

In the arrest a few days ago in New York of William J. Doran the police of New York and Philadelphia believe they have captured the clever accident fakir, who, about a year ago, was run down by the claim department of the Union Traction Company, of Philadelphia, and who even now is wanted in the latter city to answer charges of fraud in connection with an accident that happened there a few weeks ago. Doran is well educated, and when he desires to enact the role of a gentleman he can deceive all who are not acquainted with him. He is an athlete of ability, and to his ability as a contortionist is credited his success in mulcting street railway companies. He is said to have first begun operations in 1900, and has had associated with him in his work accomplices equally as clever as himself. Even his wife did a turn for him in Philadelphia. It is said that in his latest exploit Doran threw himself from a car into the gutter, where he laid motionless until assistance reached him. In reality he was not injured in the least, but when he was picked up one of his ankles was out of joint—the result of a trick—and he said he was suffering great pain internally. The unsuspecting street railway officials are said to have settled this claim, paying Doran a liberal sum.

ENGINEERING SOCIETY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The next meeting of the Institute will be held at 12 West Thirty-First Street, New York, on Friday, Sept. 26. A paper will be presented by B. G. Lamme, of Pittsburgh, on "The Washington, Baltimore & Annapolis Single-Phase Railway." The following meeting will be held at the same place on Friday, Oct. 24, and a paper will be presented by Prof. Charles P. Matthews, of Lafayette, Ind., on "An Integrating Photometer for Glow Lamps and Sources of Like Intensity."

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED AUG. 26, 1902

707,591. Underground Trolley System; F. A. Howarth, Johnstown, N. Y. App. filed Nov. 22, 1901. The conductor is mounted independently in a flexible conduit, which is distorted by the trolley to carry the walls of the conduit into contact with the conductor.

707,606. Trolley for Use in Electric Traction; J. G. Lister, Sheffield, England. App. filed Dec. 14, 1901. The trolley wheel is pivoted to the upper end of a pole and controlled by a spring independent of that which acts on the pole.

707,640. Tramway Switch; A. B. Robinson, Dickinson, N. D. App. filed Oct. 1, 1901. A spear-headed lever is moved by a projection from the car to throw the switch point in any direction.

707,656. Truck Bolster; C. Vanderbilt, New York, N. Y. App. filed Feb. 17, 1902. The invention is a form of truck bolster built up of rolled metal beams, securely united and braced at their ends by the spring seat, which is of a form peculiarly serviceable for the purpose.

707,663. Rail-Bond; M. F. Whiton, Hingham, Mass. App. filed Feb. 3, 1902. The feet of a laminated bond are held solid by being dipped into solder and a rivet which passes through all of the laminations.

707,692. Brake Handle; H. W. Gibbs, Boston, Mass. App. filed June 20, 1902. The inner end of the crank handle has a cylindrical chamber provided with vertical ratchet teeth, and the upper end of the brake staff inclosed in said chamber is provided with a transverse slot in which is a horizontally sliding pawl adapted to be moved in opposite directions by the alternate contact of its ends with the ratchet teeth, whereby an end of the pawl will always be projected into a position to engage the ratchet tooth next in advance of the same when the handle is moved to set the brakes.

707,844. Electric Railway System; J. C. Henry, Denver, Col. App. filed April 9, 1901. The positive and negative conductors are housed and protected by the flanges of an I-beam arranged between the rails.

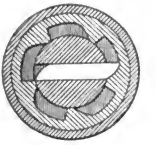
707,929. Switch Operating Device; F. S. Jones, Export, Pa. App. filed Dec. 14, 1901. The switch points are operated by projecting a shoe from the platform of the car to engage with levers in the roadbed.

UNITED STATES PATENTS ISSUED SEPT. 2, 1902

708,024. Coupling for Electric Motors; F. E. Case, Schenectady, N. Y. App. filed Feb. 15, 1901. A coupling for conductors between cars, one member having a pair of brushes which bears against a head carried by the other member.

708,036. Mounting for Electric Heaters; E. E. Gold, New York, N. Y. App. filed Oct. 16, 1901. A heater adapted for twin movable car seats, it being placed in the frame beneath the seats and adapted to move with the latter.

708,048. Trolley Harp or Fork; O. P. Johnson and F. P. Crockett, Kalamazoo, Mich. App. filed April 28, 1900. An improvement in the shape of the spring contact between the roller and the harp.



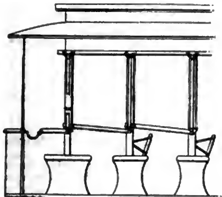
PATENT NO. 707,692

708,151. Step for Street Cars or Other Vehicles; C. W. Keyler and A. Matz, Cincinnati, Ohio. App. filed April 1, 1901. Details.

708,131. Attachment for Car Steps; J. H. Fassell, Nashua, and J. E. Warren, Greenfield, N. H. App. filed Jan. 25, 1902. The bottom step is carried on the end of a rod adapted to be moved in a diagonal direction to open and fold the step by gearing.

708,157. Controller for Electric Motors; F. A. Merrick and E. W. Stull, Johnstown, Pa. App. filed Jan. 2, 1902. A locking device whereby the series-parallel switch, normally held at its series position, can not be operated to connect the motors in multiple until the latter have been brought to a sufficient degree of speed by the operation of the rheostat switch.

708,158. Controller for Electric Motors; F. A. Merrick and E. W. Stull, Johnstown, Pa. App. filed Jan. 2, 1902. Electromagnetic devices of improved character for "blowing out" arcs at the controller contacts.



PATENT NO. 708,209

708,175. Suspended Railway Vehicle; W. Schmitz, Elberfield, Germany. App. filed Nov. 5, 1901. A peculiar arrangement of the masses of the structure to have the lines of gravity passing through the center of the rail-head.

708,198. Trolley; J. W. Brooks, Indianapolis, Ind. App. filed Jan. 16, 1901. An anti-friction knuckle joint in the harp to allow the wheel to follow irregularities in the wire.

708,209. Side Guard for Cars; J. H. Donnelly, Philadelphia, Pa. App. filed May 15, 1902. A bell crank is pivoted to the post at the end of each cross-seat and has a long arm adapted to close the exit opening. All levers are connected by a single mechanism to be moved at once.

708,462. Vehicle to Be Used in Electric Traction on Railways; G. Cawley, Westminster, England. App. filed June 3, 1902. A vehicle especially constructed to carry boilers, engine, dynamo and motors for electric traction.

PERSONAL MENTION

MR. H. H. WILLIAMS, master mechanic of the Brooklyn Rapid Transit Company, has handed his resignation to President Greatsinger, of the company.

MR. GEORGE F. McCULLOCH, president and general manager of the Union Traction Company, of Indiana, and his wife have sailed for Europe, where they will spend about two months.

MR. P. L. GRIFFIN, prominently identified with the Pennsylvania & Mahoning Valley Railway, at Niles, Ohio, has resigned from that company to become superintendent of a new road at Louisville, Ky.

MR. HARRY G. FOLTS, a well-known promotor of electric railways, died at his home in Salem, Ohio, a few days ago. At the time of his death Mr. Folts was promoting an electric railway from Salem to East Liverpool.

MR. GEORGE C. RICHARDS has resigned as manager of Reeves' Park, owned by the Toledo, Fostoria & Findlay Railway. Under Mr. Richards' able management the park has become one of the most successful of its kind in the country.

MR. CHARLES VADAKIN, formerly division superintendent of the Baltimore & Ohio Railroad, has been placed in charge of the work of rebuilding the Newark-Granville division of the Columbus, Buckeye Lake & Newark Traction Company's lines.

MR. MATHEW M. ROBEY, superintendent of the Tiffin Electric Railway & Power Company, died a few days ago at his home in Tiffin, Ohio. Mr. Robey superintended the building of the street railway lines in Tiffin, in 1892, and had been connected with the company ever since.

MR. E. L. JEWETT has been appointed general foreman of the surface shops of the Brooklyn Rapid Transit Company. Mr. Jewett has had valuable experience in the mechanical departments of the Twin City Rapid Transit Company and the Chicago City Railway Company, and he is exceptionally well equipped for his new duties.

MR. B. S. JOSSELYN, general manager of the Kentucky & Indiana Bridge & Railroad Company, has resigned from that company to become general manager of the Hudson Valley Railroad, of Glens Falls, N. Y. Mr. Josselyn has been general manager of the Kentucky & Indiana Bridge & Railroad Company for three years. He obtained his railroad training in the far West, and is well fitted for the position to which he has been appointed.

MR. W. G. WAGENHALS, at present general manager of the Millcreek Valley Railway Company, of Cincinnati, Ohio, which has been leased to the Cincinnati Interurban Company, will retire from the company on Oct. 1, when the lease becomes operative. Mr. Wagenhals, after retiring from the Millcreek Company, will devote his entire attention to supervising the building of an electric railway out of Cincinnati that is to be built by Cincinnati interests.

MR. HENRY L. CLEVERDON, chief deputy county engineer of Cuyahoga County, Ohio, who lives near Dover, was seriously injured a few days ago by being forced to jump from a bridge on the Lorain & Cleveland Railway, into a ravine, a distance of over fifty feet. Mr. Cleverdon was crossing the bridge on foot when a car backed towards him unexpectedly. Mr. Cleverdon was formerly engineer for the Lorain & Cleveland road, and superintended the building of the bridge on which he was injured.

MR. W. B. BROCKWAY, secretary of the Street Railway Accountants' Association of America, has severed his connection with the New Orleans & Carrollton Railroad, Light & Power Company, of New Orleans, La., and has accepted a position to represent Messrs. Isidore Newman & Sons, of 25 Broad Street, New York City, in their accounting departments of street railway and electric light companies. Mr. J. K. Newman, of the firm, was president of the New Orleans & Carrollton Railroad, Light & Power Company before the consolidation of that company with the New Orleans Railway Company. He has now decided to take up his residence in New York City to look after the many street railway and lighting properties in which he is interested.

MR THOMAS B. WHITTED, manager sales department, Denver office of the General Electric Company, has resigned to become consulting engineer for the electric and gas properties controlled by Mr. Joseph J. Henry. Mr. Whitted is one of the best-known men in the electric business in the West. Starting nearly ten years ago in the shops of the General Electric Company at Schenectady, N. Y., he worked his way, step by step, until three years ago he became engineer of the Denver office, and a year later manager of the sales department. His success, both as salesman and engineer, and his agreeable personality have endeared him to the business men of the community, all of whom extend their best wishes and congratulate Mr. Henry in securing such an able man.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Sept. 10, 1902.

The money market during the last fortnight has rapidly approached the situation which has been foreseen for some time past. Currency has begun to move in quantity to the West to supply the usual autumn requirements in the harvest sections, the Treasury has continued to withdraw large sums, chiefly on account of heavy customs collections, surplus bank reserves have declined sharply, and money rates have advanced. About half the New York institutions find themselves already below the legal limit of reserve, while the $4,000,000 remaining to the Clearing House Association in the aggregate is considerably the lowest for this period in recent years. The rise in money rates has been about what is to be expected under these circumstances. Time loans have been marked up generally from 5 per cent to 5¾ per cent, with lenders disposed to hold off for 6 per cent. Call money, meanwhile, commands an average 8 per cent on the Stock Exchange, with an extreme to per cent recorded in some instances. As yet the stringency has not grown acute enough to compel any general curtailment of loans. The Clearing House banks during the last few days have withdrawn their credits freely, but the deficiency has been supplied by trust companies and out-of-town banks, who, as usual, are the ones to reap the most benefit from the high-money premiums. It is evident that relief must be forthcoming very shortly for this rather critical situation. Such relief will probably be derived from at least three distinct sources—first, through decrease of local loans, either by the process of shifting already witnessed, or by direct recall; second, through expansion of bank-note issue, and third, through imports of gold from abroad. The first of these movements has been going on quite extensively for several weeks, and undoubtedly will continue. The second has also begun to some extent. Through the energetic co-operation of the intelligent head of the Treasury Department everything is in readiness to expand note issue as fast as the banks are able and willing to deposit the necessary security. It is unofficially stated that some $15,000,000 goverment bonds have been collected and will be turned in against new circulation, as the banks see fit. As for the third and most important source of relief, the recent sharp fall in sterling exchange is sufficient indication that the time for gold imports is not far distant. A further decline of 1½ cents in the pound sterling would bring rates to the point where gold could be profitably brought from abroad. As the foreign banks are unusually well off this season, and as Europe's own demands are comparatively light, it would not be surprising if we were to get between twenty and thirty millions from Europe during the next month or six weeks. This, with the expansion in note issues, and such natural loan contraction as there may be, will go far towards meeting the fall requirements. It is hoped that the assistance will be large enough to render any forced disturbance of credits unnecessary. But as a requisite to obtain this aid, it is obvious that money rates for some time must be maintained at their present high level.

The Stock Market

The uncertainty regarding money conditions is the absorbing point of interest in the current stock market. Cautious people see in this sufficient reason for refraining from taking any fresh risks, either in investment or speculation. But their attitude is not shared by the restless spirits on the Stock Exchange who have made vast fortunes by the rise in values during the last few years. The prevailing idea among this class of operators is that a money market stringency cannot last, and that a temporary stringency is not a serious matter. With a boldness and confidence which rivals anything in Wall Street history, they have kept on aggressively with their campaign for higher prices, and up to the present their efforts have met with conspicuous success. The average price level stands now at the very highest of the great upward movement, yet neither this nor the fact that the rise has been in progress almost without interruption for over three months, seems to be any deterrent. Old-time observers who see all former rules and precedents rudely overturned, are utterly at a loss to comprehend the present operations. The majority are inclined to analyze them as an exhibition of the gambling spirit running rampant. Yet whether or not this is the truth, it is certainly plain that real investment holders and the important financial interests, are in no hurry to dispose of their holdings. It is easy to account for the great buying power in the market, but it is less easy to account for the absence of selling, except on the often-expressed theory that the financiers who control the various railroad properties are afraid to sell lest they lose their controlling interest. Mr. Morgan's recent circular to the Southern Railway stockholders, asking leave to extend the voting-trust, and the reduction of the Reading dividend in order to prolong the voting trust in that company, are calculated to confirm this view. If relief should come soon to the monetary tension, it would leave no check upon the present campaign for the rise.

The local traction stocks have been governed mainly by the general speculative conditions prevailing. Brooklyn Rapid Transit appears to be in the hands of the pool which has figured most prominently in every recent advance in the book. Its operations have been noticeably more confident since the publication of the latest and relatively favorable monthly statement of the company's earnings. In Manhattan the late advance has reflected chiefly the quiet accumulation of the stock which has been noted for some time, with the addition of some forcing of the price by a number of the large professional operators. Metropolitan has merely moved up sympathetically with the others, not showing any special activity. Nothing has been done in Metropolitan Securities.

Philadelphia

It has been a period of generally advancing prices during the last two weeks in the Philadelphia traction stocks. American Railways again made a new high record, selling up to 53 on heavy trading. Discussion of an increase in dividends continues to be the main incentive in the movement. A new high level has also been reached by Philadelphia Rapid Transit, the stock selling as high as 15⅝ on Monday, with indications of fresh operations for a rise. Union Traction has not been affected yet by the latest move, and the shares have dragged around 47¾. There is nothing new in connection with the property and to all appearances the rise in Rapid Transit is merely part of a speculative campaign which has as its object to make a more attractive market for the stock. Railways General has shown fair activity at an advance to 6⅛. The deal in Fairmount Park Transportation is still on, but the public knows nothing more than that an offer has been made for the property, which has not yet been accepted. The stock rallied sharply from 31 to 34, and later reacted to 33. The only other sales in stocks were Easton Electric at 19½, Philadelphia Traction at 100¼, Consolidated of New Jersey at 69¾, and Union Traction of Indiana at 51. The feature of the bond dealings has been heavy trading in American Railways 5s, which sold up from 103¾ to 107¼, the advance being sympathetic with the rise in the stock. Electric People's Traction 4s have also been strong and active, selling "ex" the semi-annual interest of 2 per cent from 98 up to 98⅜. Other bond sales include Union Traction of Indiana 5s at 101½, United Railways 4s at 87½, Citizens' Passenger of Indianapolis 5s at 111, Indianapolis Railway 4s at 87¾, and Newark Passenger 5s at 115⅞.

Chicago

The influence of the general speculative revival has been felt in a sharp advance in Chicago Union Traction, the common gaining 2 points to 18½, and the preferred the same to 51½. It is said, however, that the gross receipts on the road for August were some 15 per cent over a year ago. The City Railway earnings are reported to be more than 16 per cent on the capital stock for the year, or enough to leave a surplus of $1,500,000 after payment of dividends. Elevated securities have been fairly firm and active, but with no pronounced change in prices. Metropolitan common is higher at 39½, and the preferred is strong at 90. Northwestern common has sold at 36½, and Lake Street at 10¾. Plans for the financial readjustment of the last-named company will not be announced until after the 15th, and possibly not until October. President Knight is now in New York, presumably in connection with this matter. Another new survey to Ravenswood, making four routes now under consideration, has been made by the Northwestern Elevated. It is officially stated that the company fully intends to build the extension, although it will be late in the fall, perhaps, before a decision is reached as to which route will be taken. The new Aurora-Wheaton line is contributing a daily increase of about 4000 passengers to the Metropolitan Elevated.

Other Traction Securities

Boston Elevated has been considerably more active during the late dealings than in some time past. The stock sold down to 152 a week ago, but rallied sharply to 157. Dealings were begun in the subscription rights to the new stock issue, with quotations ranging between 25 and 70 cents a share. Massachusetts Electric common has also been firmer, recovering from 38 to 39 on mod-

erate dealings. The preferred is unchanged, at 97. No change of consequence is to be noted in the leading Baltimore securities. United Railways stock holds steady around 16, the income bonds around 70⅛, and the general 4s around 95½. Other recent sales include City and Suburban 5s at 115. Nashville Railway certificates at 75⅛. Anacostia & Potomac 5s at 102½, and Nashville Railway stock at 6¼. The New York curb sales of traction stocks during the last fortnight comprise New Orleans Railway common (6000 shares) at 18¼ to 17¾. American Light & Traction at 44¾, San Francisco common at 22¾, and the preferred at 61⅞ to 61. Toledo Railways (5000 shares) between 38¾ and 40, Washington Electric 4s at 84 and interest, and New Orleans Railway 4½s at 87½.

Last week was another record breaker on the Cleveland Stock Exchange. Traction sales numbered 12,763 shares. Cincinnati, Dayton & Toledo led with 5070 shares. The demand at Cincinnati was very strong and many Clevelanders unloaded. The stock opened at 26 and advanced to 33 during the week. Monday it dropped to 30. The bull interests which have been booming Detroit United and other stocks have taken hold of this issue, and this was sufficient in itself to assist in the rise. Toledo Railways & Light was also very active, attributed to the fact that the stock has been listed on the New York Stock Exchange and that it was active there last week. Sales numbered 2180 shares. The first sale last week was 34½, and it advanced rapidly to 40, holding between 39 and 40 several days. Northern Ohio Traction common is again soaring. It opened at 53¾ and advanced during the week to 57½. Monday there was a phenomenal jump, and small lots sold as high as 60¼, with 63¼ asked. Only a few months ago this stock was offered at around 25. The new Aurora, Elgin & Chicago was a strong seller, about 1600 shares changing hands, opening at 33 and advancing to 37½. The prospects of this new line are so promising that few holders are willing to sell. Western Ohio moved in sympathy with Cincinnati, Dayton & Toledo. Sales numbered 900 shares, between 25 and 28¾, the latter the closing sale. Detroit United followed New York quotations, advancing from 95 to 95½. Only 200 shares sold in Cleveland, and as it is believed holders there have pretty well sold out. Cleveland City Railway made a new high mark of 115 on a sale of 100 shares. Lake Shore Electric preferred sold at 48, an advance of 3 points over last sale. A small block of the old Southern Ohio Traction was taken in 83½, an advance from 75½, the last sale.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Aug. 26	Closing Bid Sept. 9
American Railways Company	50½	52½
Aurora, Elgin & Chicago	..	36
Boston Elevated	a158	156
Brooklyn R. T.	67⅛	71
Chicago City	210	220
Chicago Union Tr. (common)	16	18½
Chicago Union Tr. (preferred)	48	51
Cleveland Electric	91¼	91
Columbus (common)	57	57
Columbus (preferred)	108	108
Consolidated Traction of N. J.	69	69¾
Consolidated Traction of N. J. 5s	111	111
Detroit United	86	a96
Electric People's Traction (Philadelphia) 4s	99¾	*98½
Elgin, Aurora & Southern	45	44⅝
Indianapolis Street Railway 4s	87¼	87¾
Lake Street Elevated	10½	10⅜
Manhattan Railway	135¼	137¼
Massachusetts Elec. Cos. (common)	39¾	38½
Massachusetts Elec. Cos. (preferred)	97	97
Metropolitan Elevated, Chicago (common)	39	39¼
Metropolitan Elevated, Chicago	89	89½
Metropolitan Street	147½	147⅝
New Orleans Railways (common)	17⅜	18
New Orleans Railways (preferred)	56⅜	57
North American	121¼	128
Northern Ohio Traction (common)	51½	61½
Northern Ohio Traction (preferred)	94	93⅝
North Jersey	35½	37
Northwestern Elevated, Chicago (common)	36½	36½
Philadelphia Rapid Transit	14⅝	15¼
Philadelphia Traction	99⅜	100
St. Louis Transit Co. (common)	32	30½
South Side Elevated (Chicago)	110	110
Syracuse Rapid Transit	..	28½
Syracuse Rapid Transit (preferred)	a75	71¼
Third Avenue	131	†131
Toledo Railway & Light	..	35½
Twin City, Minneapolis (common)	127	126½
United Railways, St. Louis (preferred)	84½	84
United Railways, St. Louis, 4s	87	87
Union Traction (Philadelphia)	47⅝	48
Western Ohio Railway	24	27⅝

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

Increasing imports of foreign raw material continue to be the main feature in the iron trade. So brisk is the American demand that prices have hardened on the other side, and foreign makers are not letting go as easily as they were. Still there is no trouble in securing abroad round lots of both foundry and Bessemer pig, and these importations have produced an easier tendency in our markets. Domestic quotations are still kept at the recent high level, but buyers are no longer so urgent in their demands for immediate delivery. Steel is easier under increased offerings, but sheets, bar and wire are firmer under an improving fall demand. Production of rails is being taxed, as usual, to the utmost. Quotations are $21.75 to $22 for Bessemer pig, $31.50 to $32 for steel billets, and $28 for steel rails.

Metals

Quotations for the leading metals are as follows: Copper, 11¾ cents; tin, 28.10 cents; lead, 4⅛ cents, and spelter, 5½ cents.

SAN JOSE, CAL.—The San Jose & Santa Clara Railway has been purchased by the Standard Electric Company, of San Francisco, and is now being operated by that company under the title of the United Gas & Electric Company.

COLORADO SPRINGS, COL.—The consolidation of the Colorado Springs & Suburban Railway Company and the Colorado Springs Rapid Transit Company as the Colorado Springs & Interurban Railway Company has been arranged. The announcement of the organization of the Colorado Springs & Interurban Railway Company several days ago created considerable discussion, for at that time the purpose of the company was not clearly defined.

MACON, GA.—The application for permission to consolidate the Macon Consolidated Street Railroad Company and the Macon Electric Light & Railway Company under the title of the Macon Consolidated Street Railroad is now pending before the City Council. It is said that the Macon Consolidated Railway, also included in the purchase of the street railways of Macon by the Williams syndicate, will be kept independent, in view of an alleged contract requiring it to buy the North & South Macon Street Railroad, a short line of about 2½ miles.

WAUKON, IA.—The Iowa Hematite Railway Company, which was organized a few weeks ago for the purpose of constructing an electric railway from this city to Lansing, has filed a trust deed with the county recorder of Allamakee County to secure $1,500,000 bonds of $1,000 each at 5 per cent, payable in twenty years. The road will also be extended from Lansing to Decorah, but the main object of its construction is to develop on a larger scale the iron mines in the vicinity of Waukon, where millions of tons of ore are easily accessible near the surface of the ground.

NEW YORK, N. Y.—The Interborough Rapid Transit Company has filed with the Secretary of State at Albany a certificate of an increase of its capital stock from $25,000,000 to $35,000,000. The proposed increase of stock, it is stated in the papers that accompany the certificate, is to be devoted to equipment of the Rapid Transit Railroad, to be operated in the subways now under construction in New York City.

NEW YORK, N. Y.—The directors of the Manhattan Elevated Railway Company have declared the regular quarterly dividend of 1 per cent, payable Oct. 1.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

July	1902	1901
Gross receipts	$1,236,400	$1,203,760
Expenses, including taxes	708,136	758,494
Net receipts	$528,263	$445,266

AKRON, OHIO.—The capital stock of the Akron-Alliance Connecting Railway Company is to be increased from $100,000 to $2,000,000.

YOUNGSTOWN, OHIO.—Stockholders of the Mill Creek Valley Railway Company and the Hamilton, Glendale & Cincinnati Traction Company have voted unanimously to merge with the Cincinnati & Hamilton Traction Company, preparatory to a lease to the Cincinnati Interurban Company. The new company, although its preliminary capital stock is only $100,000, will eventually be capitalized at $2,200,000, divided equally into preferred and common stock. It is announced that the officers will be: R. H. Hoffman, president; Bayard Kilgour, vice-president; Henry Burhold, secretary-treasurer; A. C. Becht, assistant secretary-treasurer; C. H. Kilgour, O. B. Brown, F. T. Homer and the officers, directors.

PORTLAND, ORE.—It is said that negotiations are being conducted for the consolidation of the Portland Railway Company and the City & Suburban Railway Company.

PETERSBURG, VA.—It was rumored that the Virginia Passenger & Power Company, which controls the street car lines in Richmond, Manchester and Petersburg, had offered $1,000,000 for the Richmond & Petersburg Electric Railway, which is operated between Richmond and Petersburg.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., July '02	81,190	40,648	40,542	......	......
	1 " " '01	66,898	33,484	33,414	......	......
	6 " June '02	318,937	185,362	133,575	77,556	56,019
	6 " " '01	268,967	161,458	104,510	63,494	41,016
	12 " Dec '01	617,011	*350,843	266,168	136,162	130,006
	12 " " '00	513,722	*317,475	196,247	141,130	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., July '02	140,200	89,013	51,197	23,866	27,331
	1 " " '01	134,370	79,638	54,732	......	......
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., July '02	23,200	11,106	12,094	......	......
	1 " " '01	22,490	10,152	12,338	......	......
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,296,597	3,572,899	2,896,350	676,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,139	3,915,496	1,862,643	937,206	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., July '02	1,235,400	*706,136	529,264	......	......
	1 " " '01	1,200,761	*758,195	442,566	......	......
	12 " June '02	12,780,706	*8892314	3,887,400	......	......
	12 " " '01	12,101,198	*7970835	4,130,363	......	......
BUFFALO, N. Y.						
International Tr. Co	1 m., June '02	271,215	147,614	123,601	97,048	26,549
	1 " " '01	402,306	182,265	220,041	94,198	122,843
	1 " " '00	218,738	106,174	112,564	65,348	47,217
	3 " " '02	790,220	430,915	359,305	290,361	68,944
	3 " " '01	952,752	485,899	466,854	272,664	194,190
	3 " " '00	631,371	333,957	297,414	221,844	75,601
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., July '02	48,569	30,509	18,060	13,617	4,443
	1 " " '01	40,067	27,021	13,046	13,099	5,407
	8 " " '02	313,787	172,009	141,778	67,707	74,071
	8 " " '01	290,964	181,849	109,115	88,062	†2,947
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., July '02	23,591	7,586	16,005	......	......
	1 " " '01	23,450	7,680	15,770	......	......
	7 " " '02	102,511	43,698	58,813	......	......
	7 " " '01	88,930	42,091	46,839	......	......
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	......	......
	12 " " '00	757,964	378,661	379,303	......	......
Union Traction Co	12 m., June '02	7,942,459	4,570,719	3,371,740	3,619,277	†247,528
	12 " " '01	8,158,809	3,942,194	4,216,615	4,058,040	158,575
CLEVELAND, O.						
Cleveland & Eastern Ohio Traction Co.	1 m., July '02	20,283	10,334	9,949	5,116	4,833
	1 " " '01	17,095	8,301	8,794	5,393	3,400
	7 " " '02	101,699	60,318	41,381	36,474	4,907
Cleveland El. Ry. Co	12 " Dec. '01	2,296,808	1,265,863	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., July '02	28,542	13,875	14,667	......	......
	1 " " '01	24,236	11,816	12,419	......	......
	7 " " '02	156,884	91,003	65,881	......	......
	7 " " '01	131,255	76,088	55,167	......	......
	12 " Dec. '01	249,290	136,985	112,304	57,023	55,371
	12 " " '00	179,694	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., July '02	22,649	10,435	12,213	......	......
	1 " " '01	19,143	7,749	11,394	......	......
	7 " " '02	102,196	55,135	47,061	......	......
	7 " " '01	84,292	43,278	40,814	......	......
	12 " Dec '01	164,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*69,592	71,520	72,500	†980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., July '02	77,886	*42,853	35,034	15,968	19,066
	1 " " '01	70,621	*40,021	30,599	15,417	15,183
	7 " " '02	500,098	*290,781	209,317	108,986	100,331
	7 " " '01	401,350	*261,874	179,365	109,321	69,464
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,516	66,583	57,963	32,863	25,119
	1 " " '01	116,367	62,966	53,400	31,304	22,196
	4 " " '02	481,348	261,118	220,230	131,256	88,972
	4 " " '01	435,207	236,915	198,292	125,622	72,750
	12 " Dec. '01	1,507,220	918,831	688,365	388,160	300,783
	12 " " '00	1,302,210	732,457	579,809	374,201	205,548
DETROIT, MICH.						
Detroit United Ry.	1 m., July '02	325,608	182,408	141,056	......	......
	1 " " '01	292,968	149,818	153,170	......	......
	6 " June '02	1,600,072	*907,041	693,031	395,789	297,822
	6 " " '01	1,364,181	*775,347	588,834	345,119	243,715
	12 " Dec. '01	2,919,171	*1560700	1,358,046	688,277	670,129
	12 " " '00	2,575,257	*1480009	1,136,219	616,408	519,731
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,588	461
	1 " " '01	28,577	18,062	10,515	9,894	1,124
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., July '02	58,680	34,985	27,647	9,666	17,988
	1 " " '01	45,903	22,117	23,866	9,218	14,647
	7 " " '02	298,059	157,398	140,640	67,529	73,111
	7 " " '01	254,622	141,739	112,608	63,994	48,615
ELGIN, ILL.						
Elgin, Aurora & Southern Tr	1 m., July '02	40,472	21,197	19,275	8,383	10,941
	1 " " '01	36,454	16,218	20,236	8,332	11,903
	7 " " '02	236,929	136,723	99,806	58,355	41,673
	7 " " '01	204,166	119,142	84,908	58,383	26,627
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., Aug. '02	24,340	12,083	12,307	......	......
	1 " " '01	16,849	9,025	7,824	......	......
	6 " June '02	111,972	60,828	51,144	......	......
	6 " " '01	80,340	51,464	28,876	......	......
LONDON, ONT.						
London St. Ry. Co	1 m., July '02	16,387	9,297	7,040	2,311	4,730
	1 " " '01	15,313	8,767	6,537	2,144	4,393
	7 " " '02	81,401	52,464	28,937	15,904	13,033
	7 " " '01	75,416	48,718	26,698	14,076	12,622
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., July '02	237,376	110,928	126,448	67,989	58,459
	1 " " '01	239,043	109,095	129,948	67,992	68,956
	7 " " '02	1,519,005	722,232	796,773	457,543	331,230
	7 " " '01	1,364,807	668,559	674,248	433,815	240,984
	12 " Dec., '01	2,442,341	1,185,534	1,256,806	755,139	501,669
	12 " " '00	2,226,608	1,139,787	1,080,911	694,663	386,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., July '02	337,452	142,369	195,083	58,733	136,346
	1 " " '01	290,648	135,349	155,299	57,830	97,475
	7 " " '02	2,004,862	922,740	1,081,188	410,266	670,895
	7 " " '01	1,748,186	823,683	924,501	357,548	539,964
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., July '02	198,656	93,960	104,696	19,920	84,780
	1 " " '01	174,180	91,464	82,716	14,142	73,575
	10 " " '02	1,648,647	940,866	708,977	164,228	538,749
	10 " " '01	1,583,306	981,932	601,374	104,409	496,965
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,089,485	1,404,971	1,683,469	758,185	890,289
	3 " " '00	2,738,598	1,340,696	1,397,902	749,857	668,045
	12 " Sept. '01	10,455,672	5,268,649	5,187,023	2,902,182	2,444,691
	12 " " '00	9,950,735	5,196,312	4,754,423	2,668,644	2,086,779
Metropolitan St. Ry.	3 m., Dec. '01	3,867,986	1,738,972	2,148,964	1,151,340	992,624
	3 " " '00	3,796,030	1,699,649	2,086,381	1,128,467	967,914
	12 " June '02	15,806,641	7,395,903	8,410,738	4,615,481	3,865,257
	12 " " '01	14,720,767	6,766,131	7,965,636	4,534,094	3,431,547
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., July '02	6,569	3,916	2,953	1,771	1,308
	1 " " '01	5,934	2,207	2,747	1,768	1,979
	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	54,018	28,298	25,790	16,755	9,035
PHILADELPHIA, PA.						
American Railways	1 m., July '02	119,870	......	......	......	......
	1 " " '01	89,658	......	......	......	......
	12 " June '02	1,009,509	......	......	......	......
	12 " " '01	844,298	......	......	......	......
ROCHESTER, N. Y.						
Rochester Ry.	1 m., June '02	89,236	46,809	42,426	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	537,743	298,006	239,737	148,608	91,129
	6 " " '01	495,286	306,966	188,320	147,157	41,100
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., July '02	62,571	34,365	28,206	19,025	9,181
	1 " " '01	58,433	31,020	27,413	18,971	8,942
	12 " " '02	693,281	364,263	329,019	238,246	90,773
	12 " " '01	621,299	340,880	280,469	225,918	56,580
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., July '02	131,490	62,316	69,174	27,854	41,320
	1 " " '01	121,013	53,613	67,300	24,479	42,920
	7 " " '02	809,776	414,097	395,679	264,888	133,191
	7 " " '01	719,941	357,016	362,925	170,304	192,621
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	*616,945	565,572	409,051	156,521
Lake Shore Elec Ry Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	6 m., June '02	56,635	35,622	21,013	25,000	†3,986
	6 " " '01	56,906	36,600	22,306	25,000	†2,693

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The New York State Street Railway Convention

It is always a pleasure for us to publish a report of the New York State Street Railway Convention, from the fact that the papers are always from practical men on points of timely interest, and the discussions on these papers are by operators who are recognized as at the head of their profession. It is only at conventions of this kind that it is possible to secure the combined opinions of so many experts on the problems under discussion. A successful street railway manager or an engineer who has achieved a high reputation in the design of steam or electrical appliances can write an article on some department of street railway construction or operation which represents his views on this subject and which hence is entitled to a great deal of weight. His opinion, however, may, and very often is, expressed in regard to one phase of the question only, while in a debate on the subject opinions on all sides of the question are usually elicited, and a proposition advanced by one person leads up to a further discussion of the same subject by another. In this way a topic is not only more apt to be rounded out in all its phases in a debate, but the solution reached has the additional advantage of carrying with it the weight of a dozen opinions instead of one. Another advantage derived by street railway companies in general from meetings of this kind is that the speakers are usually men of many engagements, who usually do not have the time to write long articles to express their views on any given topic, but when on their feet will give the same information. The greatest benefit from a convention of this kind can only be obtained from attendance at it, because a person then not only hears the words, but enters into the spirit of the meeting, can ask questions, or in private interviews can clear up any points upon which he may be in doubt. The next best course is to read the report. This is published in this issue, and in this connection we wish to express our appreciation, and that of the street railway field in general, at the broad policy adopted by both the State and American associations in giving freedom of access to the meetings to both the public and public press. This course is not followed by all technical societies and associations, many of whom reserve the report of their proceedings, as of course they have a perfect right to do, for the members of the association only. It is owing to the fact that this latter policy is followed by so many bodies that the generous act of the two street railway associations named above is particularly noteworthy.

* * * * * *

It is a well-worn expression to say that the convention held last week "was the most successful in the history of the association." This, however, fitly characterizes the Caldwell meeting, even in view of the excellent record which has marked the past meetings of the association. The papers were numerous and good, the remarks made during the discussions were crisp and exhaustive and the enthusiasm over the purposes and welfare of the association as great, if not greater, than ever before. To this should be added the attractiveness of the location selected for the convention, the excursions prepared for the attendants to the convention, including the ladies, and the hospitality which marked the entertainment of the association by its hosts, the officials of the Hudson Valley Railway Company.

* * * * * *

President Rogers was re-elected to the position which he has occupied for so long with marked ability, and presented an address which, as usual, was a very thorough presentation and review of the street railway affairs of the State for the preceding year. The president's address is always the feature of the conventions of the New York State Street Railway Association, and Mr. Rogers always succeeds in combining in his report a succinct statement of the important events of street railway interest which have occurred in the State within the previous twelve months. Good discrimination is used in the selection of topics treated, and if we were asked for a concise statement and review of the most important events in New York State during the past few years we could not do better

than to refer the inquirer to the series of addresses with which Mr. Rogers has treated the association during his incumbency of the position of president. In his speech last week he was particularly felicitous in bringing out the transformation which has occurred in the status of the street railway companies during the past ten years in their relation both to the public and to the financial world. From being owners of slow and comparatively inconvenient transportation systems, operating only in the cities, the street railway companies have now become most important agents in the improvement of social conditions and the augmentation of values and populations not only through the suburban districts surrounding the cities, but also through the country at large. Work like this, as President Rogers points out, should have the hearty co-operation of the municipal and State officials, and the companies should not be so burdened with taxes and annoying restrictions that they cannot properly carry out the services that would be possible otherwise.

* * * * * *

The most important problem now confronting the railway companies, if any distinction can be made between them, is probably that of accidents. This subject at the Caldwell convention was divided into three heads. Mr. Barnes, of the State Railroad Commissioners, discussed the general subject of accidents and methods of preventing them. Mr. Dibbs, of the claim department of the Metropolitan Street Railway Company, of New York, took up the second stage of the subject, which was that of taking care of the claims presented to the company, while Judge Daly discussed the treatment of the cases in court and presented a very able and convincing argument in favor of the treatment of such accident claims by judges rather than by juries. The statistics in Mr. Barnes' paper on the death rate from accidents on electric railways disclosed the important though somewhat unappreciated fact that, with the exception of one year, there has been a continuous increase as compared with the mileage, and that this increase has amounted to about 63 per cent during the past three years. The greatest loss of life and injury to passengers has been caused by rear-end collisions and next to that by head-on collisions, and the greater proportion of these have occurred on interurban railways. Part of this blame the speaker puts upon insufficient safety equipment, including that of brakes and signalling apparatus, but the greater part of the blame, in Mr. Barnes' opinion, lies in lack of effective organization and management. We have always taken the position that when it came to safety appliances, particularly signalling, the best is none too good. As Mr. Vreeland tersely pointed out, a head-on collision between two electric cars, each running at the rate of 25 miles an hour, is more dangerous to the passengers than one between two steam railroad trains each running at 40 miles an hour, because there is nothing between the cars to act as a buffer to the shock; and we believe that the sooner electric railway companies which run cars or trains at high speeds realize the fact that they must adopt as good, if not greater, precaution to avoid accidents and prevent collisions than their steam railroad competitors the better it will be for them and the public. If this care is taken the claim departments of the several railways will have very much less to do.

Accidents do happen, however, on steam railroads as well as electric, and the next most important question is how best to meet the situation when it does occur. Here is another case where prompt action on the part of the company counts for a great deal. We have published a large number of different kinds of accident blanks to be used in obtaining information in regard to accidents from the witnesses and even from the victim, but unless this information is obtained promptly, particularly from the injured person, it does not amount to much. We believe that many of the excessive demands made upon the railway companies for damage claims are not due entirely to the cupidity of the claimant, but also in part at any rate to a feeling of resentment over the fact that the injury was caused and that no attention is given him until he makes a legal demand for damages. This can be avoided by a visit of a representative of the company, either the general manager himself or his representative, or else, possibly, the company's physician. The latter is the one followed in Binghamton, and according to Mr. Clark is productive of ideal results. The physician can not only determine the extent of the injuries, but in his medical capacity he can have easy access to the person and can often get from him an impartial statement of the occurrence before friends or lawyers can persuade him that his injury and cause for damages are much greater than they really are.

Of Judge Daly's paper we cannot speak too highly. Judge Daly has established such a high reputation on the bench and as an authority on legal topics that his opinion cannot but carry great weight with the legal fraternity, and his recommendation to substitute judicial for jury trials is one which appeals to every sense of justice and may be a solution to one of the most vexing problems which now confront railway companies. The latter are often accused with being arbitrary in their disposition of damage cases, for contesting suits which are absolutely in favor of the complainant and for adopting unfair methods in litigation. This may in some individual cases be partially true, although we believe that the practice is very much exaggerated. Nevertheless, we are convinced that if railway companies were assured that they could get justice in trials their course of legal procedure would in many cases be entirely changed. Each case would then be much more likely to be judged on its merits than if the company felt that it could not afford to let a case go before the jury for fear of unfair treatment.

* * * * * *

Closely associated with the subject of accidents is that of discipline, on which a paper was presented to the association by Mr Fairchild, and a report on a closely related subject—i. e., of a standard set of rules—was rendered by the committee on this subject. These rules, owing to the lack of space at our disposal in this issue, must be held over until next week; but we might state here that they represent a number of modifications over those rendered by the committee at the last meeting of the association, as the result of suggestions made by managers in different parts of the State. It is characteristic of the interest felt in the subject of rules that two State associations, that in New York and that in Massachusetts, have committees for drawing up standard rules, while a similar committee is employed on the same work for the National Association. To our mind, this is a good sign, in spite of the fact that it may result in several standards. We believe that practically every company, owing to local conditions, will have to depart somewhat from any standard set of rules, but the major principles of railway operation are the same, and the fact that any rule or principle has received the endorsement of the national committee, as well as the committee of the State association, in which any particular company is situated, will be indicative of the correctness of the rule and be prima facie evidence that such a rule was the best which could be adopted. For this reason it is fortunate that so much attention was given at the Caldwell convention to the subject of rules, and we shall be very glad to see such a standard set receive the endorsement of the association and also of the Railroad Commissioners of the State, subject to such modifications in subsequent years by vote of the association or ruling of the commission, as future experience may dictate.

* * * * * *

Many of the rules in the draft as presented at Caldwell, like the majority of the Ten Commandments, are prohibitory in their wording and so would fall under the ban of the paper presented on "Discipline." On this subject Mr. Fairchild presented a very interesting paper, and his topic was one to which too much attention cannot be given, as it is undoubtedly true that the success of a railway proposition lies largely in the hands of the employees and depends upon the state of discipline enforced on the line. The class of men required to operate effectively the modern electric road is so much higher than that needed in the old horse-car days, when 6 or 8 miles an hour was the maximum speed obtained, that

a different sort of discipline is undoubtedly required. Higher motives must be assumed, just as a different class of work is expected. The ideal state of government of a railway company, like that of a country, would be to have an omniscient ruler, who, in the case of a railway company, could instantaneously read the character of every one of the employees, could detect and remember every fault as well as every meritorious act, and could properly balance these factors in determining the promotion or dismissal of the man. But, as such a human being does not exist, we believe that after making as strict an examination as is possible as to the acceptability of men, their physical condition and mental attainments, that some system of recording their acts, and of comparing their performance and relative standing by these records is the only way of avoiding injustice to the good men and the danger of keeping incompetent men on the force. Those who have used the merit and demerit system speak highly in its favor, and while this system may not be applicable to the largest roads and may entail too much bookkeeping and be unnecessary for the smallest roads, there is nothing derogatory to the men in its application. It is a system of marks and averages similar to the merit system which is employed in both the army and navy, as well as in practically every school and university in the country, and is not only a systematic and fair method of gaging a man's capabilities, but has also proved popular on the roads where it has been instituted.

* * * * * *

The methods of removing ice and snow from street railway tracks in the most southern city in the State, as well as in Rochester, which lies in the snow belt of Central New York, were described by Mr. Reed, of New York, and Mr. Danforth. The natural conditions in Rochester are very much more severe than those in New York, but the condition in the latter city is greatly complicated by the use of the conduit system, where little salt can be used and where, in addition to clearing the snow from the tracks, the conduit also has to be kept clear and the grooved rail has to be cleaned by special scrapers. It is extremely doubtful whether in any city where the snowstorms are heavier than they are in New York, or where the city street cleaning department is less prompt and efficient in removing snow, or the drainage is less good, it would be possible to use the conduit system at all, and Mr. Reed's paper shows that the problem of keeping the lines in New York in continuous operation in winter demands the utmost vigilance and expert management.

* * * * * *

The space at our disposal in this issue precludes any extended discussion of the valuable papers on operation by R. E. Danforth, whose subject was "Power Station Accounting," or that by T. E. Mitten, who treated "Car Despatching," or of the management of the supply department on a large road, which subject was handled in a most interesting manner by Mr. Tully. The discussion of Mr. Danforth's paper brought out the fact that while some of the smaller roads do not find it necessary to keep their records as completely as recommended by Mr. Danforth, some of the large roads go elaborately into the subject and find that the saving thereby accomplished is far greater than the cost of making the analyses and measurements required. Mr. Mitten's observations on car despatching were particularly interesting, as he discussed the practice followed on his Olcott branch, some 40 miles in length, the cars on which are run on a regular printed schedule and their operation directed at intermediate points by the head despatcher by means of the telephone. Mr. Tully's treatment of the methods of conducting the business of a large storehouse and supply department indicates that in this department, more than perhaps in any other, systematic methods and order make all the difference between success and failure.

* * * * * *

In closing these brief comments on the convention we wish to refer to the hospitality shown to all the delegates and other attendants by their hosts—the officials of the Hudson Valley Railway Company. The region about Lake George is one of the most picturesque in the country, and the natural attractions of the place of meeting afforded opportunity for many delightful excursions for the ladies and for the entire party. Mr. Colvin and his associates were most successful in their efforts to make the visit of the association at Caldwell a pleasant one, and their courtesy will long be remembered.

Result of Competition in Suburban Business

The most convincing proof that the electric suburban and interurban lines are cutting into the steam railway short-haul passenger business is found in the data furnished by the Interstate Commerce Commission. It is apparent from these statistics and from data gathered from other reliable sources that the trolley has made great progress at the expense of the steam lines, and that the latter are only just waking up to the fact. Some roads are taking steps to regain lost ground, but in many cases which have come under our observation the new order has made such a good impression upon the public that the only way the steam railroad companies can hope to regain their prestige is by instituting a modern electric service at much lower rates than were formerly charged on the steam lines. This, of course, will mean a large investment in electrical equipment, the abandonment of the old steam locomotives and coaches, much more frequent service and other innovations that are still considered of a revolutionary nature by conservative steam railway management.

It is a matter of common knowledge that the passenger transportation business of the country has been steadily increasing at a very considerable rate during the last ten years, yet in that time the statistics show that the steam lines have not progressed in this branch of their business in anything like the proportion that might reasonably be expected, and of late there has been an actual loss as compared with former years. For example, the number of passengers reported by the steam railroads of this country in 1900, a prosperous year and one decidedly favorable for the creation of passenger traffic, was actually less than the number carried by the railroads in 1893, a year of financial depression and general business stagnation. Nine years ago the number of passengers carried by the steam railroads of the United States was 593,560,612, whereas in 1900 only 576,865,230 were carried. The number of tons of freight, however, during the same period increased from 745,119,482 to 1,101,680,238. This contrast is all the more startling when the prevailing conditions in the two years, as illustrated by the difference in the freight tonnage, are taken into consideration.

In 1901 the steam roads made a better showing, 607,000,000, but this is far from favorable as compared with the progress which might reasonably have been expected. Further examination of the reports emphasizes the fact that the loss was due to the competition of electric roads, for while in 1900 the number of passengers carried decreased 2.8 per cent, the passenger mileage increased 12.7 per cent; in other words, the short-distance passengers, who once went to the steam railroads, are now being carried in large numbers by electric railways. The number of passengers traveling a long distance, however, has not been affected by this competition, passenger mileage, in the face of a decrease in passengers carried, showing an increase of 12.7 per cent. Many experienced steam railway men admit that this is as it should be, that the steam roads should develop their freight and regular passenger business, and leave suburban traffic for electric lines. It may be possible that they are pursuing a wise policy in this matter, but to an unprejudiced observer it would appear that with their facilities and experience they should be better qualified than any one else to take up this branch of transportation, which is growing more and more important year by year, and develop it properly. We are confident that the managers of the electric lines will not quarrel with them over this arrangement, and surely the traveling public can give no more emphatic sign of its approval than is shown in the manner in which patronage is being distributed at present.

Cars for the New York Subway

The Interborough Rapid Transit Company is experimenting with two cars which it had built as samples from specifications of its engineers for use in the subway. These cars in general appearance differ materially from those in use on any other system in the country. They are considerably longer, for instance, than the Manhattan elevated cars and are not so high. The car tapers toward the top to conform to the subway, and this makes it look even longer than it really is. One of the cars (No. 1) is named August Belmont and the other (No. 2) John B. McDonald. It is the purpose of the company to operate five and eight-car trains, and it is also intended to have parlor cars and ordinary coaches. Car No. 1 is finished as a parlor car and No. 2 as an ordinary coach. The constructive features in both are identical, but in many details, such, for instance, as doors, windows, seats, lighting arrangements and minor features, they differ materially. The company has had several classes of furnishings installed for purposes of comparison. These are seen in the views above.

The most important consideration in the general design and construction of these cars is the factor of safety. Special precautions have been taken to make the car bodies fireproof and to protect the wiring so as to guard against electrical fires. The framework is particularly heavy, and it is believed that the structure is as nearly indestructible as can be attained in the present condition of the art.

The longitudinal sills are of compound construction, with center cross-trussing between the steel needle-beams, and the platform end sills are of steel, fitted with heavy steel anti-telescoping plates. The side framing of the car bodies is of white ash, doubly braced and very heavily trussed.

The platform posts are of compound construction, with anti-telescoping posts of steel bar sandwiched between heavy white ash posts at corners and centers of vestibule platform. These posts are securely bolted to the steel longitudinal sills, also to steel anti-telescoping plate below the floor and to the hood bow, which serves to reinforce it and is of heavy steel angle in one piece, reaching from plate to plate and extending back into car body six feet on each side. In case of accident, where one platform rides over the other, eight square inches of metal would have to be sheared off in the posts before the main body of the cars would be reached. This would afford effective means of protection.

The floors are double with asbestos roll fire felt sandwiched between and the floor sheathing is of white pine completely covered on the under side with 3-16 in. asbestos transite board. All

SIDE VIEW OF THE "AUGUST BELMONT"

INTERIOR OF CAR NO. 1

INTERIOR OF CAR NO. 2

parts of the car framing, flooring, sheathing and the like, are coated with fireproof paint. One car has the ordinary clere story roof and one has the half empire roof, with a light-colored ceiling. The ventilator sashes in both cars are arranged to be opened by a lever, those on each side being divided into two parts. The front half admits fresh air in the forward end of car and the sash in the rear end of car permits the foul air to escape. Both cars are fitted with automatic coupling draw-bars, continuous platforms and platform buffers, electric lights and heaters.

The dimensions of the interborough cars and those of the Manhattan are given herewith, and a comparison will show that they differ materially in many respects:

	Interborough.		Manhattan.	
	Ft.	In.	Ft.	In.
Length over platforms	50	1	47	1
Length over car body	42	7	39	10
Length center of bolsters	36	0	33	2
Width over window stools	8	11⅝	8	9
Width over sheathing	8	9¾	8	7
Width over deck eaves' moulding	8	6	8	9½
Height, top of rail to center draw-bar	2	5	2	5
Height, top of rail to under sills	3	1⅝	3	3¼
Height, top of rail over platform	3	8	3	9
Height, top of rail over roof	12	0	12	10½

Probably the most important departure from ordinary practice in the general design of these cars is the arrangement of the platforms. The cars are vestibuled, and when made up into trains each car can be closed so as to be entirely distinct or a passageway may be opened throughout the train. An extended buffer attachment is employed in connection with the swinging draw-bar.

Several forms of doors have been introduced on these cars in order to test their respective merits. The vestibule doors on one car are of the Gibbs type; the side doors are arranged to slide into pockets in the side framing, thereby giving up the entire platform to the passengers. Another form of door swings in and is operated by a lever. A third type, which resembles those on Pullman sleeping cars, is a folding door in two parts, hinged in the middle and doubling like a jack-knife. The principal advantage in these is that they can be handled much more readily with crowded platforms than full swinging doors.

On the door leading from the vestibule to the body of the car is a curtain that can be automatically raised or lowered as the door is opened or closed to shut the light away from the motorman. Another novel attachment to the door is the peculiar handle on the sliding door between the vestibule and car body. This door is made to latch so that it cannot swing open with the swaying of the car, but the handle is so constructed that the pressure on it to open the door unlatches it with the same movement.

END VIEW OF CAR NO. 1

SIDE VIEW OF CAR NO. 2

In one car the lower windows are stationary and the upper windows are arranged to raise; in the other car the upper and lower sash are arranged to raise; the windows in one car have ordinary double-thick sheet glass and the other 3-16 in. polished plate, while all doors in both cars have ¼-in. polished plate.

Both cars have Pantasote curtains, with pinch handle fixtures. One car has cocoa mats and one linoleum floor covering. The parlor car has six clusters of five lights each on upper deck ceiling and the other has single incandescent lamp fixtures, a row of six down the center on the upper deck ceiling and five on each side deck ceilings. Head linings in both cars are of triple veneer. The interior finish is of mahogany of light color in one car and medium dark color in the other.

The seating arrangements are similar to the Manhattan cars, but as these coaches are longer there are four additional seats on each end. The total seating capacity of each car is fifty-two. The seats are all finished in rattan, but there are four distinct patterns shown. The seats are designed for rapid loading and unloading and their outlines are rounded to the slightest curves. Stationary crosswise seats, after the Manhattan pattern, are placed in the parlor car, but the other coach is equipped with reversible seats. The seating arrangements are similar in other respects. Four styles of the latter are shown in the car to illustrate the different devices that may be used for the purpose. In one car the space underneath the seats is open; in the other it is closed.

One car is painted white and the other chrome yellow; neither color has been selected as the company's standard car color, however. The cars were built by the Wason Manufacturing Company.

of Springfield, according to specifications of George Gibbs, consulting engineer of the Rapid Transit Company.

Plan for Relieving Brooklyn Bridge

The Rapid Transit Commission has under consideration a plan proposed by Neils Poulson, president of the Hecla Iron Works, of Brooklyn, and submitted to Mayor Low by the committee on bridges and tunnels of the Manufacturers' Association for the relief of the congestion of traffic at the Manhattan terminal of the Brooklyn bridge. The fundamental idea is the rearrangement of the trolley tracks as well as those of the elevated structure on the second floor and the approaches so that more room will be available for loading passengers and handling cars. The capacity will be about doubled, according to the engineer's estimate. The accompanying illustrations are reproductions of photographs and plans showing the most important features of the proposed changes and affording means of comparison with the present facilities. These photographs and plans were submitted by Andrew F. Wilson, chairman of the committee which waited upon Mayor Low, together with a statement explaining the plans in general. The association believes that the most urgent and important thing is to relieve the crush during the rush hours on the trolley service, for which a plan is submitted. The drawing is made to show particularly the immense amount of space wasted in the present system and the danger of crossing tracks on entering and leaving the cars. The plans show the number of square feet the building occupies, the number of square feet used for car service and the number of square feet of standing room between the cars, likewise the unused space, both on the ground floor and elevated structure, as follows:

GROUND FLOOR

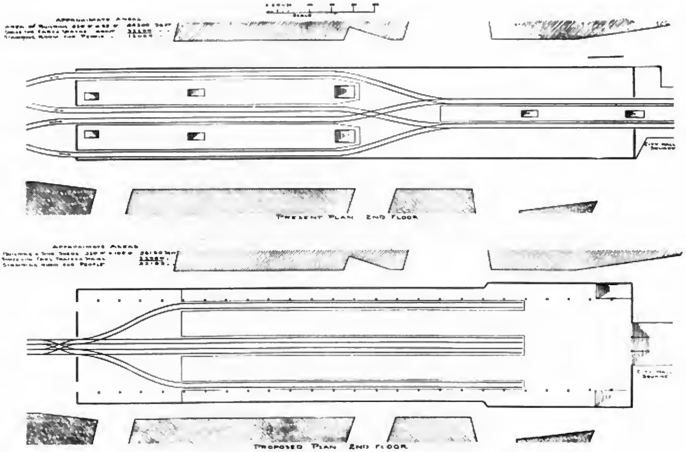
Present plan—approximate areas.
Area of building, 520 ft. x 85 ft.—44,200 sq. ft.
Space for car service, 100 ft. x 80 ft.—8000 sq. ft.
Standing room for people, 4500 sq. ft.
Proposed plan—approximate areas.
Building and one-story side sheds, 520 ft. x 108 ft.—56,160 sq. ft.
Space for car service, 520 ft. x 108 ft.—56,160 sq. ft.
Standing room for people, 30,500 sq. ft.

SECOND FLOOR.

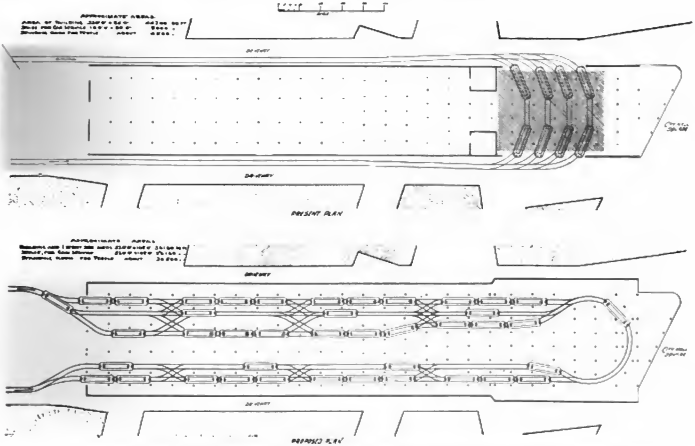
Present plan—approximate area.
Area of building, 520 ft. x 85 ft.—44,200 sq. ft.
Space for car service and tracks, 32,200 sq. ft.
Standing room for people, 12,000 sq. ft.
Proposed plan—approximate areas.
Building and side sheds, 520 ft. x 108 ft.—56,160 sq. ft.
Space for cars, tracks and stairs, 22,980 sq. ft.
Standing room for people, 33,180 sq. ft.

ENTRANCE TO BROOKLYN BRIDGE, SHOWING PROPOSED INCLINED APPROACH TO ELEVATED LINES FROM CITY HALL PARK

The proposed plan for the trolley cars includes the one-story sidings taking up the space occupied by the tracks of the present trolley lines from the eastern end of the building to the western end next to Park Row, giving over 56,000 square feet, which is all used for car service, and over 30,000 square feet is left for platform. The loop being elevated, no tracks will have to be crossed and there will be no moving cars to dodge. By this plan the cars would enter the terminal, coming from Brooklyn at the eastern end, discharge all the New York passengers on the outside and,



CHANGES PROPOSED FOR ELEVATED TERMINAL OF BROOKLYN BRIDGE



COMPARISON OF PROPOSED PLAN WITH PRESENT CONDITION OF BROOKLYN BRIDGE TROLLEY TERMINAL

when empty, switch over to a parallel track on the inside, then make the loop and go to its respective station either on the outside or inside track on the opposite side, where it will take on its load of passengers, switch over to the center trunk line and then proceed to its destination. The plans submitted are drawn to show the columns as they are in the building. Looking at the two plans together it can be easily seen that the congestion is all at one point and that by the proposed plan use can be made of the large amount of space in the building which is now apparently wasted. By relieving the congestion at one point and distributing the crowd the crush at the bridge would be relieved. Another thing, by putting the loops lengthwise instead of crosswise there will be plenty of room for loading and unloading passengers, and there will be no tracks to cross.

To secure larger terminal facilities for the elevated service, provision is made for material changes from the present system. There are three platforms, of which only one is used during the rush hours for passengers to Brooklyn, and that platform contains about 5000 square feet. It was necessary to have the switching done at the Park Row end of the building when the cable system was instituted, but now that the electric system is substituted, it is pointed out, the switching can be done at the other end. This will give a platform space of over 30,000 square feet, as against 5000 square feet at present. Under the proposed plan there can be four trains of six cars each in a station at one time standing still for loading.

CITY BUILDING, BROOKLYN BRIDGE ENTRANCE AND ELEVATED RAILWAY TERMINAL

It is contended that this alteration can be made very quickly and at no great expense, and that an important advantage will be derived in that it will also make it more easy for the trolley system below, as there will be no galleries in the way. At the Park Row end of the building it is proposed to build a platform of about 100 ft. x 115 ft., and from that platform there can be as many stairways as are wanted; but it is believed that it would be better to have an incline promenade from the elevated floor to the City Hall Park, as is shown by the illustration herewith. This would distribute the crowd and the elevated passengers would be separated from the trolley passengers at City Hall Park. If passengers should want to enter the building from the street below to reach the elevated the present stairways may be left. As here proposed, there are three distinct plans, one for the trolly service, one for the elevated and one for the promenade.

It is claimed that it would simplify matters to change the elevated and trolley systems at the same time, and then the lower floor can be used entirely for the trolley service, no change of grade being required. The material, beams and girders of the gallery floor when removed can be used for the structural part of the promenade. The advocates of this plan say that the whole scheme can be put into practical use in a few months before the cold weather sets in and before the crush commences when the closed cars are used.

Speed of Cars in Massachusetts

Ever since the accident to President Roosevelt in Pittsfield there has been considerable inquiry in Massachusetts as to the power of the Railroad Commission to regulate the speed of electric cars, and during a recent hearing Chairman Jackson issued an informal statement as to the board's position regarding speed and the powers needed by the board in order to cope with the existing street railway problems in a proper manner.

At the hearing the Berkshire Railway Company was asking for an increase in its stock, and in reply to an inquiry by Chairman Jackson H. W. Ely, of the Berkshire Company, stated that the speed of electric cars in Western Massachusetts usually did not exceed 10 miles per hour in the country districts unless the cars ran over private rights of way. Chairman Jackson stated that the board had always taken the attitude that safety should not be sacrificed to speed and that the trouble lay in the fact that the board had no jurisdiction in the matter, the control resting with the local authorities along the towns traversed by the roads. The superseding of the old horse railways by electric lines had made the speed question greater than a local matter, and the speed question has developed just as the through location question has. Last May the board was granted jurisdiction over through locations, and another step in progress was the granting of authority to require certificates that each new line is safe for operation. At the last session of the Massachusetts Legislature the board had asked authority to regulate the speed of cars, but nothing came of it.

Under the existing law steam railroads are prohibited from crossing highways at grade and cities or towns from laying out streets crossing the railroads at grade without the consent of the board. The electric car must by force of circumstances often be, and by regulation always ought to be, restricted to a speed consistent with the safety of other travelers upon the highway. The same car moving over private land or upon a right of way of its own approaches a highway under practically like conditions with a railroad train. The law, therefore, restricting the grade crossings of railways should be extended to the crossing of railway and highway. Where such crossings can be avoided at an expense which it not too burdensome this should be done and suitable safeguards provided in instances where the outlay would be unreasonably great.

Ex Senator Post, a director of the Berkshire Street Railway, stated that the country electric roads would be glad to have some such authority over speed regulation centralized in a body like the Railroad Commission, and gave it as his opinion that if the commission had had authority over locations at the time of the laying out of the grade crossing where the accident to the President's carriage had occurred such a crossing of the highway would never have been allowed. In regard to the speed question, he stated that his road would not object to having a reasonable speed limit fixed by the commission, to cover the whole territory through which they run, rather than to be subjected to the variations in speed regulation imposed by different towns en route.

Efforts to hold up public improvements of great value to the community by property owners who may be disgruntled or dissatisfied are not encouraged nowadays by the courts. In dismissing a recent application for injunction to restrain the subway contractors, Judge Lacombe, of the United States Circuit Court, said: "The complainant has failed to persuade this court that there is a reasonable probability that she will be able, upon the trial, to show that the State of New York, by any of its instrumentalities or agents, has deprived, or is threatening to deprive, her of her easements as an abutting property owner, and for that reason, without examining into the extent of such easements, her application for preliminary injunctions is denied."

Proceedings of the Caldwell Convention of the New York State Street Railway Association—I.

An account of the social features of the convention of the New York State Street Railway Association, held at Caldwell Sept. 9-10, was published in the STREET RAILWAY JOURNAL last week. Below will be found an abstract of the discussion on Sept. 9, with all of the remaining papers. The proceedings of Sept. 10 will be published next week, together with the report of the committee on standard rules.

TUESDAY MORNING'S SESSION.

The meeting was called to order by G. Tracy Rogers, of Binghamton, N. Y., president of the association, at 10:45 a. m. After the calling of the roll the president stated the first paper to be presented was on accidents, by Mr. Barnes, engineer of the State Railroad Commission. This paper was read by Colonel Cole. It was published in part last week, and the conclusion will be found elsewhere in this issue.

Mr. Clark: I move that the paper be received and spread upon the minutes and that the thanks of this convention be extended to Inspector Charles R. Barnes for the exhaustive, complete and full treatise on this important subject.

Seconded and carried.

Mr. Clark: We have adopted the system in Binghamton of looking after accidents which perhaps it is due more to good fortune than good management, has been, we think, successful, and we think that much of our success in looking after accidents and the ensuing negligence actions which arise has been the prompt attention that we have given to accidents when they have occurred. Our employees, motormen and conductors, particularly, are instructed in case of an injury to person or property to report to the first inspector, or by telephone to the office, or to me personally if I can be reached, the character of the accident, the extent of the injury and the location of the accident. I have instructed them next to summon by the nearest telephone our company's surgeon, and in that connection I desire to state that our experience has proven that a surgeon, competent and of good judgment and of sound common sense, has proved the most essential adjunct and claim agent to a small road that we can imagine. He is employed by the year. His business is to respond promptly and look after the injured parties, and if in his judgment they need or require hospital treatment to see that they receive it, either at the charge of the railroad company or otherwise, to be determined afterwards. While caring for their injuries and looking after their physical wants, he is instructed to get from them their side of the story, which he immediately submits to the office upon a statement blank prepared for that purpose. Our experience has proven very satisfactory in that respect, inasmuch as the statement which is generally secured by the surgeon at that time and under those conditions is the unprejudiced and unbiased statement of the injured party or his immediate friends before they have seen their legal adviser, who possibly would tell them to say nothing, or before the busy neighbor has dropped in and told them they ought to have five or ten or fifteen thousand dollars from the railroad company, as the case may be, and before perhaps the bruised spine has become thoroughly broken or a contused limb has been badly wounded. We have found that these statements given to the surgeon by the injured parties have saved us from many an important negligence action and been of great value to us in the settlement or adjustment of claims. Therefore I believe that for smaller roads in particular it is very important that a company's surgeon be employed, one who is in touch with the business interests of the company and one who is qualified to look after not only the physical wants, as I remarked before, but also able to secure an unbiased and unprejudiced statement which will be of great assistance to the general manager or the claim agent in arriving at a disposition of the claim.

I believe that the next important thing to do, and it should be done simultaneously with the care of the injured, is that the scene of the accident should be visited at once, such measurements taken as may be necessary to help prepare the case if litigation should ensue, and secure, so far as possible, all the circumstances surrounding the accident, and, in connection therewith, the place where it occurred, how it happened, distances, measurements and everything that might be of assistance in the preparation of the case. I consider this very important. I think it is almost useless for me to call attention to these procedures, because they are probably so stereotyped and so generally adopted that it is not necessary. I think the next thing to do, inasmuch as there are two distinct characters of accidents, one to the person and the other to property, is that they have to be treated from different standpoints. In an accident where there is not much involved, if a speedy settlement can be reached right upon the spot or very soon thereafter and a proper release obtained there is no question but that is the best and proper disposition of the case, because in two or three or five or even ten accidents, where possibly the evidence is of sufficient importance to be a question of fact for the jury to decide if the case comes to a trial, in nine instances out of ten the verdict will be against the corporation. That is true even of the provincial cities, and it is more true of the larger cities and the more important ones. Therefore a speedy and quick determination and settlement of any injury, particularly to property, that may arise through an accident, even if a question of innocence or negligence on the part of the company does not stand out as clearly perhaps as you would wish it might to justify you, it is my opinion that the best and most economical disposition of that proposition is a speedy settlement.

In the case of injury to the person quite another condition confronts us, and, as I said before, if the injured party can be seen promptly, and if the surgeon has performed his part well, it is best, if there is any question of negligence on the part of the company and reasonable surety of freedom from contributory negligence on the part of the claimant, to settle the case upon the best possible basis, if an equitable settlement can be reached. Those, in my opinion, are the three most essential steps to be taken in case of injury either to person or property. I can readily see that in cities like New York and Brooklyn and other larger cities, where the system spreads over a vast territory, where the company's surgeon would not be as available or the inspector or the office could not be reached as easily and where the injured party could not be so swiftly cared for, that different methods probably would have to be pursued; but with smaller roads I am a firm believer in giving immediate personal attention to the injured party, seeing that a surgeon is sent and, perhaps, hospital care and attention is given. I know from my own personal experience that paying a small bill for drugs and a doctor's visit or two has saved us in a great many instances a negligence action which might have been troublesome and possibly expensive, and therefore I believe that it is highly important in case of accidents that speedy, prompt and vigorous investigation, examination and care be given immediately upon the receipt of the first information of the accident.

Another all-important proposition in connection with this subject is the preparation of the case for the attorneys. I believe in a great many instances attorneys are pushed in negligence actions on the part of railroads when they should not be and when they would not be if they knew the exact situation of the affair. I consider it highly important that your attorney be informed in relation to every detail, not perhaps just prior to the date of the trial, but as soon as the accident has occurred, so he can have all the circumstances in mind, and well in mind; and I believe that the general manager and the claim agent and those who look after the department of accidents can be of invaluable assistance to the attorneys by giving close and prompt attention to accidents when they occur.

In closing, I simply say I believe the most important thing in connection with an accident is prompt investigation of all the facts, caring for the inju ed and notification to the general officer or proper authorities of the road at the earliest possible moment.

Mr. Connette: I don't think I can add anything to what has already been said except the old saying that an ounce of prevention is worth a pound of cure. Mr. Barnes' paper has dwelt upon the question of the prevention of accidents, while Mr. Clark's remarks apply particularly to the cure of accidents after they have occurred. Both are good. I was very much impressed with Mr. Barnes' paper, for I am always seeking after knowledge toward the prevention of accidents. I realize that the expense of this particular part of the operation of street railways is a very serious one, and one in which not only I but all of us are interested; and I believe that the mind of this association ought to be directed to the adoption of every device and every possible scheme that can be secured toward the betterment of the service as a tendency toward the reduction of the number of accidents which occur in the operation of our roads. Not only the use of mechanical devices should be adopted, but I think that a thorough co-operation of all employees would have a tendency toward reducing this expense. I believe that when men are in a frame of mind where they take an interest in their work, where they thoroughly co-operate with their employers, where they feel almost that the interests of the company are their interests, they work more faithfully, more diligently and more zealously toward the more perfect operation of the railroad, and by this means, I think, rather than in any other way, we can reduce the number of accidents.

Mr. President: We will now listen to the reading of a paper by William A. Dibbs, claim agent of the Metropolitan Street Railway Company on "The Method of Handling Claims."

This paper was published last week.

Mr. Fassett: Our road, the Albany Traction Company, has used the same form that was used by the old Albany road, a road of about half the size, with more or less success for a number of years. Our road to a large extent is handled by inspectors, and our inspectors take the place of the ears and eyes and hands of the superintendent. Each inspector on the road has a large number of cars which he looks after absolutely. The main work of the inspector is to represent his portion of the road and see that the cars are properly spaced, that the motormen and conductors are doing the duties required of them, and in case of an accident to go immediately to the place and assist the conductor and at the same time to get the names of witnesses to the accident other than those who were on the car. In that way the inspectors get what names they can and send them to the chief inspector, with their addresses. He sends to each of the inspectors who are in different wards or different districts of the city in which the various witnesses live blanks on which the inspectors get the statements from those witnesses, so that, as a general thing, if an accident happens at any time on a certain day the next day at 9 o'clock the superintendent has the advantage of having the report of the conductor and motorman with the statements of all the witnesses. Of course, in the case of a larger road than ours, perhaps the claim department has to be handled in a different way. Our claim department does nothing until a claim has been actually presented. The reports are in the hands of the superintendent and inspectors until the claim is made. For a road of our size we have found that has worked advantageously. The inspectors at the same time are given authority to employ a physician and state to the physician that the first call is paid for by the company. After that it is a question which the doctor has got to find out for himself, but the care of the injured at the time and the work of procuring the statements of the witnesses are entirely in the hands of the inspectors. That has been our system for some time, and we have found that it works very successfully. A great many people have criticised us for the number of inspectors that we employ. On a road which employs about a thousand conductors and motormen we have an inspection list of over fifty. The inspectors are on duty night and day. We have, say, thirty day inspectors and twenty night inspectors, and all fifty are on duty between 5 o'clock and 6:30 o'clock in the evening, which is the time of the heaviest travel on the road. They look after a district of about half a mile, and on some of our lines they look after about six or seven cars. If for any reason our regular timetable is delayed in any way these inspectors, knowing just where each car should be placed—because a man has only ten or twelve cars to look after—can see how the road can be quickly straightened out by turning his cars in different places and looking after his cars and paying no attention to any others. In that way, in case of large fires, which tie us up frequently, our road is straightened out and moving in fifteen minutes after the blockade is removed.

Colonel Cole: I want to bear testimony to what I think is a very excellent system of inspection of the United Traction Company, of Albany. I have ridden, I think, on almost all of the city electric lines in the State, as well as many of the interurban lines, and I have never seen any line on which the men appear to be paying more practical attention to their duties than on that line. It is really a very worthy service. Every man seems to be as deeply interested as though he was responsible for running the whole road. I have never seen a careless inspector along the line of that road. I have never seen skylarking or the doing of nonsensical things. Every man seemed to be as diligent and faithful in the service as though he really had a large property interest in the company and in its welfare. It must be expensive to employ as many street inspectors as the United Traction Company does on its mileage in the city of Albany, but I imagine it is a good paying investment. It holds the car crews up to their work and keeps them at all times under the view of an inspector of that line within the city.

Mr. Vreeland: I don't think that I ever listened to a paper of more value to the railroads of New York City or of the United States than the one that was presented by Mr. Barnes. The statistics and figures presented by Mr. Barnes are only available to him, and they certainly should be of very great value to the gentlemen who are operating railroads in the State. His recommendations are valuable. I had occasion to say a year or so ago in connection with this proceeding at this or the American convention that there was no necessity for interurban high-speed roads gathering their own experience in connection with the operation of their single track roads. It cost the steam railroads of the United States billions and billions of dollars to get a scientific and safe method of operation as far as practical with human agencies to carry it out. The idea seems to be in the mind of the average electric railroad operator that two cars approaching each other at the rate of 30 miles an hour on single tracks possess no element

GROUP OF ATTENDANTS AT THE CALDWELL CONVENTION

of danger as compared with two railroad trains with locomotives approaching at the same rate of speed. The accidents that have occurred on steam railroads with head-on collisions cannot be as serious as those in electric railway operation. In the case of steam roads you have two enormous bodies of steel coming together which take the shock before it reaches the passengers in the car. With electric cars you have got absolutely nothing between the passengers and the actual crash except in many instances a very light framework at the front of the car. One of the troubles which Mr. Barnes has stated, and which I have noticed in many parts of the United States, is that while the men who build electric roads get the very best lawyer they can to arrange their franchise and charter rights, first-class financial men to make their financial arrangements and technical engineers to build their railroads, they often think the road can be run by some track foreman. A man who has shown some ability in handling construction men, or an engineer who has exhibited ability in engineering, but has never had one day's experience in operation or operating methods, is not necessarily the best man to put in charge. In many instances the railroads around the country are being operated by men who have had absolutely no operating experience at all. I have had the good fortune during my career to be connected with practically all the departments of a railroad, and I have found in my experience that the operating and constructing departments of a railroad are entirely distinctive features. I am speaking more of the larger systems now. There is no man who can give his time and study to engineering for eight or ten years and then the next day operate a railroad satisfactorily. There is no track foreman, no matter how well he can ballast a line of track, that will make a good manager of a railroad the following day. The success of the steam railroads in the United States in operation is due to the fact, and has been due to the fact, that they have good material to select from, efficient men in the various branches of business; and they have also had a well-trained force of engineers and conductors.

Mr. Barnes spoke of the impossibility of getting a man on a single-track road educated up to the knowledge that obtains in a steam railroad system. I agree with him on that point. A man has got to be a brakeman or a fireman for a series of years; he has got to understand the train rules, the method of operation, everything connected with the operation of a railroad, before he is allowed to run a train. His education is not that which is simply required to go through the train and pick up tickets; he must get a thorough knowledge of the methods of operation before becoming a safe man to handle passengers. In our business we have the untrained force, and we have to have trained men to handle them and a master mind.

Another point Mr. Barnes spoke of was this question of the men understanding the various regulations. What I consider the most efficient thing in connection with operation is the system of bulletining, not posting on bulletins violations of the rules by men with whatever punishment that goes with it, but that such a man was reprimanded or such a man's record was made against him for violation of Rule 59. There are in use now about 125,000 miles of steam railroad, and you never see an order put up that John Smith was reprimanded because he ran over a railroad crossing without stopping, because that does not attract attention, but it goes up on the bulletin that John Smith was reprimanded for violation of Rule 59. I know what I am talking about, for I have run trains for years. When these bulletins are put up in the conductors' rooms there are, for instance, twenty-five conductors there who see the bulletin and who say "What is Rule 59? I see Bill Smith has been suspended for violating it; I don't know what it is." Some one gets a book of the rules and reads it out loud. The same thing applies among the engineers and the same among the brakemen. In that way I think you can keep the men better posted on the rules and regulations. I think that is the best method, because when a man's job is involved in the question of what rule he has violated he is going to hunt it up and see what the rule is.

Mr. Danforth: We have a system of looking up accidents similar to that used in other cities of the same size. We use the steam railroad's methods of handling interurban lines. In despatching we use the steam railroad regulations, and are operating with a fair degree of success along those lines. We find the greatest need in our interurban lines is more efficient despatching or block signaling. We are using the telephone in place of the telegraph and using the double-written order system. On our interurban lines we have the block system or interlocking block system, which makes it absolutely impossible for two cars to run in the same block without receiving the signal from the despatcher's office. A good many of the accidents we have heard of in the last few months might have been avoided. In the matter of investigating accidents there is not much to say. We have our claim agent assisted by the chief inspectors, who make the necessary visits in order to obtain statements of witnesses. Where the company is liable the claims are settled at the earliest possible moment.

The President: We will now listen to a paper to be read by Hon. Joseph F. Daly.

Judge Daly's paper is published elsewhere in this issue.

Mr. Clark: I move that the paper just read be received and spread upon the minutes and that the thanks of this convention be extended to the Hon. Joseph F. Daly for the able paper he has presented.

Motion seconded and carried.

Mr. Werden: It seems to me that the question which naturally arises in considering the paper just presented by Judge Daly is, Would a system, or court of claims, such as he suggests, remedy the evils pointed out and accomplish the results desired? It has been my privilege to be connected with the municipal court department of the Metropolitan Street Railway Company for the last three years. During that period we tried something over 1100 cases. While many of these were jury trials the most of them, about 75 per cent I believe, were tried by the court alone, for in the municipal court the right to a trial by jury is optional and in many instances no jury is demanded. We never demand a jury in any of our accident cases where the plaintiff has failed to do so. The trial of these cases has afforded, it seems to me, an exceptional opportunity to observe the working of a system similar to the one outlined or suggested by Judge Daly. The results of my experience and observation along the lines suggested by Judge Daly are, in a general way, these: First, that individual judges are quite apt to equalize the amounts of their judgments for similar injuries. That is to say, a case is tried before a judge to-day involving certain injuries and he awards the plaintiff a judgment of $100. Next week another case is tried before the same judge involving injuries of a nature similar to those in the first case. Now, this judge is very apt to recall the prior case, and his judgment in the second one will in most instances, if in favor of the plaintiff, be about the same in amount, and in trying these cases from day to day he gradually establishes a scale of value, so to speak. Secondly, that the decision of different judges in different districts in cases involving similar injuries are more uniform in amount than are the verdicts of juries in like cases. For instance, say a case tried before the justice of the Seventh District involving a certain injury results in a judgment for the plaintiff of from $75 to $100. We have found that other cases in which there are substantially the same injuries, tried before the justice of the Ninth, Tenth or some other district, generally result in judgments of approximately the same amount. On the other hand, a case tried before a jury in the Seventh District may result in a verdict of $50, while almost the same case, both as to fact and injury, tried by a jury in a neighboring district will result in a verdict of $250. This tendency upon the part of judges to be uniform in the amount of their judgments has enabled us in considering the advisability of settlement to tell pretty closely what the amount of a judgment would be in case of defeat at trial.

Again, the decisions of judges are more in accordance with the law and evidence and come nearer doing justice between the parties than the verdicts of juries. Judges also get to the point of the case at once, and thus much valuable time is saved. The opening of counsel, long cross-examination, the summing up, the judge's charge, can all be done away with, and a large amount of evidence can safely be omitted in a trial before a judge which would necessarily have to be placed before a jury. All this expedites the trial, which is an important factor.

If some system like that suggested by Judge Daly could be established unequitable verdicts such as he points out, viz., a $5,000 verdict in one instance and $500 in another for the same injury, would be unheard of, and the company would be in a position to know about what every case was worth if it became advisable to settle.

Mr. Ely: I move that the following telegram be sent to T. J. Nicholl, vice-president Rochester Railway Company, who lost his mother at St. Paul yesterday:

"T. J. Nicholl, Esq., Rochester, N. Y.

"The New York Street Railway Association, in convention assembled at Lake George, learns of your great affliction with sorrow and regret and extends hereby the deepest sympathy of all its members.

(Signed) "G. Tracy Rogers, President."

Motion seconded and carried.

The convention then adjourned for luncheon, to meet at 2:45 o'clock p. m.

TUESDAY AFTERNOON'S SESSION.

The meeting was called to order at 2:45 p. m. by President Rogers, who then read his annual address. This was published in the last weekly issue.

Secretary Robinson read the report of the executive committee and report of the secretary and treasurer.

Mr. Connette: I move that the report be approved.

Motion seconded and carried.

The President: The first paper to be read this afternoon will be "Store Keeping and Lost Property," by A. C. Tully.

This is published elsewhere in this issue.

Mr. Connette: I would like to ask Mr. Tully what methods the Metropolitan Street Railway Company pursue in gathering together scrap material which accumulates in the various departments, how the quantities are checked and how it is disposed of.

Mr. Tully: The material is weighed on our scales and signed by the weigher or superintendent or the person in charge of that department, who also certifies to the weight.

Mr. Vreeland: I have frequently been interrogated in connection with this subject by gentlemen operating railroads in other cities of the country. As we are organized, the president cannot buy a lead pencil for the use of his office unless he pays for it himself; everything has to be bought through the purchasing agent's office. It is the same with the construction department. The purchasing agent and general storekeeper is in charge of purchases for both the construction and operation departments. If a new piece of railroad is built or if new cars are purchased the accounts go through his office. If motors are bought, the same method is followed. There is absolutely no transaction of any character connected with the expenditure of money, outside of the fixed charges of the company, but is made part of the purchasing agent and general storekeeper's account. In a system like that in New York where, as within the last four or five years, as high as $12,000,000 have been expended in operating and construction requirements, it is absolutely necessary that there be a complete record in some one office of all the transactions.

Mr. Fassett: There is nothing in the system as outlined by Mr. Tully different from ours except that our road, being much smaller, does not require the same number of employees, but the handling of the storeroom account is practically the same in a limited way, except the storekeeper has nothing to do with it; that is taken care of by the general office.

The President: We will now listen to a paper by R. E. Danforth on "Power House Accounts."

This was published last week.

Mr. Connette: Our system is similar to that described, except that possibly all the details are not pursued as vigilantly as they ought to be. For example, I suppose that very few power houses keep an account of the water evaporated. The number of pounds of coal used each day is, of course, carefully recorded, but the water in a great many instances does not cost anything. The only object of keeping an account of the water evaporated under such circumstances would be to ascertain whether the boilers are efficient or not, and this can be done by individual measurements.

Mr. Starrett: Our method follows closely that outlined in the paper. Perhaps we go into the matter a little further than is ordinarily done, because we are operating a larger power house, and the results to be obtained by the methods outlined in the paper are more valuable. We take a sample from every load of coal that comes into our Ninety-Sixth Street station and analyze it especially to determine the fixed carbon in it. This is necessary on account of the varying qualities of coal which we get in the New York market and their varying smoke producing constituents. We have had more or less trouble with the health authorities on account of the smoke, although we have not had the trouble that others have had. We also take samples of the gas from the boilers at certain times through the twenty-four hours and analyze those gases to determine whether or not the proper amount of air is being supplied for perfect combustion, whether too much or not enough. Records are kept of these analyses, and we can 'etermine whether the individual stokers are giving the furnaces proper attention and whether we are getting the best results possible. We also analyze samples of the ash from the boilers during the three watches to determine the amount of combustible which remains. We find that we have reduced the amount of the combustible in the ash, which at times has been as high as 34 or 40 per cent, to about 12 or 14 per cent. We save a good many tons of coal a day in that way alone. The total saving amounts to more than ten times the cost of keeping the records and making the tests. Of course, we keep engine room records as well, and from these and the boiler room records and repair charges we make out our daily expense records. These are brought together at the end of the month in one sheet, showing the cost of repair of every part of the power house equipment, total cost for the month of the total kilowatt output, etc. In the engineering department we keep power house records of our own which are separate from the other sheet and served to check the other at the end of the month. Our records are kept not with special reference to the total cost, but more as a check on the cost of the various items and as a check on the cost of repair of various parts of the equipment.

The President: If there is no further discussion on this subject we will listen to a paper to be read by Mr. Fairchild on "Discipline."

This was published last week.

Mr. Smith: We endeavor to formulate our rules so as not only to bring about good discipline, but also good feeling toward the company on the part of our employees. The rules should be simple and of a character that in their enforcement they will not make the men lose their self-respect. We have found that if the enforcement of the rule is left entirely to the subordinate officers they are likely to blow hot and blow cold. One day a rule is enforced strictly, the next day it is allowed to go without enforcement. We therefore endeavor to lay down a line of policy which we try to follow at all times. First, we try to make a position on our road worth having; then we endeavor to show the employee that he will not lose that position if he makes an effort to keep it. We never permit a discharge on the system with which I am connected without a hearing by the head of the transportation department. We very seldom bring the men to the general office for discipline, preferring to deal with them through the road agents, or, as we call them, supervisors. If a man is noticed as not doing that which he should with his car or with his passengers his attention is called to it again and again; if he pays no attention, then he is sent to the general office, where he is talked to by the head of the transportation department, the error of his ways is explained to him and he is told that such things cannot continue. The men seem to appreciate that sort of treatment. If a man becomes careless we go a long way in trying to make him a good man rather than discharge him and try a new applicant. We have not gone into the school question as extensively as perhaps we may in the future, but it seems the trend is in that direction—in the direction of the engagement of the best class of labor. We are very particular in our requirements in engaging men as to their age, former business, method of living, and all that. In this way we expect to get good material first, then by proper treatment and careful instruction a good, loyal employee; then by careful supervision that good discipline which we seek.

Mr. Allen: I would like to hear something about the pension system recently introduced in New York City and its working.

Mr. Root: Before taking up that subject I would like not exactly to take issue with the gentleman who just spoke, but to explain the theory on which the Metropolitan Company operates its road in relation to its employees so far as the discharge of them is concerned. I consider that the principle which has just been laid down will necessarily eliminate to a large extent the usefulness of any division superintendent, or you may call him supervisor, superintendent of transportation or general supervisor, or whoever may be the transportation head. He must do one of two things. He must either tell the division superintendent or supervisor that he is responsible for the operation of the road, and if he is not operating it satisfactorily he will have to get some one else, or else he must assume himself the responsibility for that operation to a large extent. As soon as you take away from a division foreman the power to discharge men within certain limitations, then you limit the responsibility to a large extent of people individually in your system. In other words, John Smith is operating a line of 2000 employees, carrying 150,000 or 200,000 people a day. He sees a man whom he considers he has disciplined or taught to the extent where he thinks that the employee will never make an efficient man, and he considers that that man should be discharged. If this man should be sent to the superintendent of transportation or any higher authority than himself, and if in the opinion of such superintendent of transportation that man should be retained in the service, then the superintendent immediately assumes the responsibility for the operation of that line. In other words, the division superintendent, under such circumstances, in my opinion, is perfectly justified in saying in answer to any criticism: "You would not let me discharge this man; you would not let me hire this man; you are the man that is laying down the policy, and the effect of that policy is shown in the very thing which you are cri'icising me for doing."

So far as the pension system is concerned, it is a matter which Mr. Vreeland has had in mind for several years and about which he has often talked to his subordinates, and the system which was finally evolved was the result of four or five years of study on that subject. It is merely carrying out to a logical conclusion the Employees' Mutual Benefit Association which was established on

the Metropolitan system some five or six years ago. It is now arranged so that an employee who enters the service of the company and remains in it is practically taken care of from the time that he enters until he dies. After an employee has been in the company for three months he is eligible to join the association, and unless he is very unfortunate or has long periods of illness the benefit from the association will carry him through the average period of life. But there is a time which comes to a man when he is 65, 68 or 70 years old when he is unable to perform any active duties—unable to make a living for himself. It is to bridge over this period, from this time to the time of his death, that we have established the pension system. The idea which naturally comes to the average man in hearing of the system that has been adopted by the Metropolitan line is that an employee will not remain long enough to receive the benefit of such system. If the methods of ten years ago were still in vogue in street railway companies I should say that that criticism would be perfectly justifiable, but I believe that when enough years have elapsed to show the results of the discipline which is now maintained throughout the street railway companies of this State there will be a very considerable number of men who will remain in the company through the twenty-five or thirty years which is necessary for them to get this pension. Under the system which we have adopted men are retired under two classes, one class necessarily so—the men that have arrived at the age of 70 years; it is compulsory that these men should retire. The retirement between 65 and 70 years depends upon the physical condition of the man and the ability to perform his duties.

The amount which a man receives when retiring under this pension system depends upon his years of service. If he has been in the service of the company thirty-five years he receives 40 per cent of his annual average wage for the previous ten years of his service. If he has been in the service of the company thirty years he receives 30 per cent of his average annual wage for the previous ten years, and if he has been in the service of the company for twenty-five years he receives 25 per cent under the same conditions. There are a great many more points to this system, but these are the fundamental principles underlying the pension system, and we have found that this system has been universally accepted by the men in a spirit of deep appreciation, and especially so when they learned that the company had reserved absolutely all such positions as transfer agent, watchman, janitors and those positions which formerly were held by the efforts of politicians for employees who have reached 45 or 50 years of age and who would not be eligible for the pension system; and we keep these men in these positions where the labor is not so hard until such time as they are able to retire on a pension. The practical result now is that a man entering the service of the Metropolitan system can feel assured as long as he does what is right and remains in the company he will be taken care of during his entire life, even if he is unable to work.

Mr. Ely: I would like to relate a little incident that has come within my knowledge within the last six months that seems to me to illustrate a prolific cause of failure on the part of well-intentioned men toward their employees. I have a friend who is the managing officer of a large manufacturing company. The goods produced are manufactured from iron and steel, and in such manufacture there is a great deal of dust created, and the men come forth from work in the evening, or at the hour of quitting work, in a very dusty condition. This friend of mine was a man of loveliest character and a gentleman in every sense of the word, and he saw this condition of affairs and said that he regretted it. He then went to work and provided a fine, splendid room, fitted up with all kinds of baths, with plenty of room for the men to retire to after ceasing work in order to get cleaned up and in that condition emerge from the work. The thing was put up in splendid shape. Then he destroyed the entire effect of the enterprise by publishing a statement in the works that a lavatory had been provided for the use of the men, and that no man would be allowed to leave the works until he had gone there and washed himself. It almost caused a strike.

Mr. Barnes: I want to call attention to the first paragraph which the able gentleman has presented on discipline, in which he states that he was riding on an open car and had a talk with the motorman. If that was on Root's, Fassett's or Mitten's railway that man would get fifteen days as a breach of discipline.

Mr. Danforth: Concerning Mr. Root's remarks about taking authority away from the foreman or supervisor by referring the final action in regard to the employee to the general superintendent of transportation, it struck me that this was rather in conflict with his later remarks concerning the pension system. If we leave to subordinates the opportunity, perhaps in the heat of passion, to discharge an employee, we may have cases where an injustice is done, and done to an employee who has been in the service a long time. The general superintendent reviews the case calmly, gladly hears both sides and acts in accordance with the general policy of the company. I cannot see that he is taking away from the division superintendent any of his legal authority, if it is understood by the employee that a visit to the general office means something of considerable importance to him and that the wishes of the division officer are very liable to be followed. From the fact that the division officer is a general officer, and his action is final, he not only to my mind strengthens the position of the supervisor, but protects the company to a large extent against the outside influences which so many of us feel in dealing with our men. Concerning the discipline of the employees, I think the matter has been very well covered. Few of the roads to-day, so far as I can learn, deal rashly or unkindly with the men. The principal feature in administering discipline is fairness and firmness. I believe that has been very well shown on our larger systems.

The President: I will appoint as nominating committee Mr. Allen, Mr. Fassett and Mr. Mitten.

Mr. Vreeland: In the line of some remarks I made last year I would like to say that this has been one of the best attended and most interesting meetings of this association since I have been a member of it. Last year at the American Street Railway Convention in New York City it was said to me a number of times by gentlemen who are members of that association and of this that if the same interest in the business meetings of that association could be secured as in the meetings of the State association of this State it would be in the interests of the railroad men throughout the United States. The attendance has been large and the discussions have been carried on by some of the younger men connected with the smaller and growing systems, and it certainly has been very pleasing to me, and I know it has been very gratifying to the president and to the other members of the executive committee that are here. As I said, last year the executive committee and officers of this association gave freely of their time and attention to the affairs of this association. No meetings of the executive committee of the association have been called except when absolutely necessary, and the only times there have been any members absent from the executive committee meetings have been through illness. Since I have been connected with it these gentlemen come from any distance, give the whole afternoon and evening, if necessary, to the discussion of the important affairs of this association, and if the members of the association want to show their appreciation of the work that the officers and executive committee are doing they cannot do it in any way more gratifying to the officers than by such an attendance and such interest in the convention as we have witnessed here to-day.

Mr. Clark: If I may be allowed just a word in addition to what Mr. Vreeland has so well said and along the same line I think we all agree with him regarding the attendance and interest displayed in the convention this year and last year particularly, and I think that it has been largely due to the announcement of one or more important subjects to be divided into sub-topics to be taken up for discussion at the next ensuing meeting. If I remember correctly, Mr. Vreeland has suggested subjects for two years, and I think the discussions on those subjects has added very materially and very largely to the interest of the meeting; secondly, the sending out of invitations that those subjects would be generally discussed under different sub-headings has given all those in attendance an opportunity to prepare themselves to discuss it, and not to make a motion, but simply as a suggestion, I would like to have Mr. Vreeland select between now and to-morrow morning two subjects to be divided into two, three or more sub-topics, as he sees fit, and present them for consideration and action of this meeting, to be taken up and discussed at the convention next year.

The convention then adjourned until Wednesday, Sept. 10, 1902, at 9 o'clock a. m.

As the meeting on Wednesday morning was devoted almost entirely to a discussion of the rules, and as the space available this week precludes the publication in this issue of these rules, both rules and discussion will be omitted from this issue, but will be published next week.

Tom Johnson has evidently begun to take himself seriously, and he expects others to do likewise even in the great one-act circus with which he is now enlivening the Ohio campaign. In Fremont a few nights ago girls laughed and giggled during his speech and thereby greatly annoyed the star performer, who so far forgot his customary chivalry as to rebuke them, saying: "If I was not so hoarse I would undertake to out-talk all the giggling girls outside of Heaven, but I am hoarse and I wish you would tie a can to your giggling." The girls withdrew and Tom enjoyed the rest of the evening.

Accidents on Electric Railroads—II*

BY C. R. BARNES

From personal observation it is known that every one of the managers of railroads in this State is interested in reducing accidents to a minimum. The Board of Railroad Commissioners is doing all in its power to bring about this condition. Their expert has inspected nearly every foot of track in the State of New York, also the equipment of cars; examined into the methods of operation, and the board has investigated nearly every serious accident that has accurred in the past five years, and on all of these inspections and investigations recommendations have been made with a view of preventing accidents. These recommendations have in most cases been received by the companies in a proper spirit. A large number of them have been complied with, but there are some instances where the managers have thought that, while the recommendation if carried out would be a benefit to the road, the possibility of accident involved was so remote that they have delayed compliance with the recommendation from time to time in order to keep down the operating expenses for this year and intending to comply next year or in the near future. A large number of these recommendations apply to the protection of crossings of steam and electric railroads at grade. It has often been said to me when a suggestion for protection at a crossing of this character is made: "We have operated that crossing for ten years and never had an accident on it. Our men are all instructed to flag their cars over it, and it is impossible for an accident to occur at that point. These are all old men, all live here in the town, and most of them own their homes; they are a good, steady, industrious lot of men, and I know each of them personally." Now that manager was sincere and honest in the statement. He could not be led to believe that there was any danger at that crossing for the reasons which he stated. The fact is, no matter what class of motormen are employed, or what wages paid, an accident is likely to occur at a crossing of that kind unless it is so protected that the car crew is obliged to come to a stop, the conductor going ahead on the steam track before the motorman can proceed over the crossing. As an illustration of what motormen and conductors may do: On an inspection tour I visited a certain town in this State, arriving there about noon. I called up the road superintendent by telephone, told him my business and arranged to call on him at his office after lunch. At that time I boarded a car, and on the way to his office we met another car on a switch. The conductor of that car entered the one in which I was the only passenger, and looking at me, and seeing no other person in the car, called out to the crew of the car: "Boys, be sure and flag the crossing, as there is a railroad commissioner in town this afternoon." From that remark I drew two conclusions; one, that it was not customary to flag the crossing; the other, that I did not look like a railroad commissioner. No matter how long motormen and conductors have been in the employ of the company, or how reliable they may be, accidents will occur at crossings which are not properly protected. The commission's efforts to prevent accidents on electric railroads cannot be effective without the willing and ready co-operation of every person interested in the operation of these roads, and while a large majority of the managers of roads are in hearty co-operation with them we find that there is not a proper realization of the danger connected with the operation on the part of some of the officials.

In stating the number of accidents which have occurred on electric roads in the past five years, a partial classification of them was made. In suggesting means of preventing their occurrence it is not necessary to consider each class of accidents by itself. The remedy which will prevent the occurrence of a head-on collision would be a remedy for almost all of the other kinds of accidents; this remedy is a proper organization of the operating force of the road, proper discipline of employees, proper track construction, proper equipment of cars and proper methods of operation, and this statement is applicable to all roads, no matter what the extent of them. For proper organization and discipline of the operating force, so as to prevent head-on collisions, only competent and properly qualified men should be motormen and conductors. It is not meant by this statement that none but experienced motormen and conductors should be employed, but it is intended that a better class of men would be secured if more care was taken in investigating their past records and physical condition before employment. In order to do this, proper printed blanks, furnished by the company, should be filed out by the applicant, these giving all of the necessary information in regard to their previous employment, reasons for leaving it, references as to character, etc., and in addition a thorough physical examination, especially as to eyesight and hearing, by a doctor employed for that purpose by the company; more care should be exercised, and a more thorough system of "breaking in" or instructing motormen than is the custom at present on most roads. It is found that the general custom on a majority of the interurban roads is to take a man, no matter what his previous occupation was, put him on a car with an old motorman and let him run ten days, then make one or two trips with the superintendent, inspector or master mechanic, after which he is reported qualified and is given charge of the front end of a car. This easy method of making motormen was all right in the early days of electric railroading, with the 16-ft., 6-ton car, but is all wrong with the heavy equipment of interurban roads of the present time. It is inviting accident to place such a man in charge of an 18-ton or 20-ton car, loaded with fifty or sixty passengers, descending 5 per cent grades with sharp curves, such as exist on almost all of this class of railroads. The motormen should not be compelled to serve the apprenticeship which is required of the steam railroad engineer, but should receive a training by which he would have some general knowledge of the construction and operation of the apparatus under his control.

Another matter of importance which devolves upon the management of a railroad is the matter of discipline. The first step in this direction is the compiling and furnishing to employees of a complete set of rules. It is the usual custom to require motormen and conductors to learn the rules before they are given permanent employment, but very few companies require these men to remember them. In investigations of accidents the question is asked a motorman: "Are you familiar with the rules contained in the company's book of rules?" The usual answer is: "I knew them when I went to work for the company, but don't know as I could repeat them now." The discipline and efficiency of employees in the United States mail service is as near perfection as possible. In that service employees are required to pass an examination at stated intervals, based on their knowledge of the business and the rules governing it. Motormen and conductors should be obliged to do likewise. These rules should be made as explicit and clear as possible, covering every emergency which can arise, leaving as little to the judgment of the motorman or conductor as possible. The importance of proper rules cannot be overestimated in behalf of safe operation of a railroad. As an illustration of this: An accident recently occurred on one of the roads in this State where fourteen persons were killed and sixty injured. This accident might have been prevented had the conductor of the car used proper judgment and set the rear brake after the front one had become disabled by the breaking of a brake rod. When asked why he did not do this, he answered, "Because I did not receive four bells from the motorman," and he considered it would be a violation of the rules for him to do it without that signal even in an emergency. The rules, among other things, should especially provide for the safety of trains when operated in more than one section. Usually the book of rules prescribes a 500 ft. or 1000-ft. spacing distance. Experience has shown that this rule alone is not sufficient to insure safety of operation where one car is following another, as the construction of country roads is such that in many cases the view is limited to less than this distance. There should be a rule compelling the conductor of the head car to protect the rear end by means of fuses or in some other way while in motion and by a flag or lantern while standing still.

Next in importance to rules and discipline is the question of train dispatching, block signal or telephone systems. The ideal method of operation on any suburban or interurban railroad is the running of cars under a telegraphic train dispatching system. On most of the roads in this State this is impracticable, and the telephone is in a number of cases substituted for the telegraph, the motorman or conductors acting as operators. A reliable block signal system, the cost of which would place it within reach of electric railroads, is something which is much needed, and it would be an important factor in reducing accidents. There is no such system in extensive use on any of the railroads in this State. Improvements have been made within a short time on several of the roads in the method of handling train orders by telephone. Formerly either the motorman or conductor would call up a train dispatcher, receive from him an order to run to a certain point, he would repeat this back, and receive "O. K." from the dispatcher. Several serious accidents occurred through a misunderstanding of orders, and this system has been changed on some of these roads. Now a motorman receives the order from the dispatcher and writes the body of the order on a printed blank; this is manifolded, a copy given to the conductor, who then repeats it back to the train dispatcher, giving the name of the motorman and conductor, he receiving "complete" and time from the dispatcher. Another important matter in connection with the safe operation of an

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electric road is a proper timetable. The management of every road, no matter how many cars are operated on it, should prepare and have printed a proper timetable, showing the time of each car at the terminal and at every turnout switch or station on the line of the road, the meeting points shown in prominent type, with rules governing the movements of cars, based on steam railroad timetables, shown on it. This matter of telephone equipment and time tables is one to which the managers of some of the smaller roads object. In replying to a suggestion of this kind some have said: "I consider that unnecessary, as in our regular operation we only run two cars." This is not a valid excuse for not equipping a road with a telephone system and running cars under the authority of a timetable, for it takes only two cars to cause a collision, and the results of a collision on a road of this character may be as serious as on a road where a larger number of cars are operated. This is illustrated in a collision which recently occurred on a road 4 miles in length, where in regular service only three cars were operated. This collision resulted in the death of fourteen persons and the injury of sixty.

The question of derailment of cars is one on which it is not necessary to occupy a great deal of the time of the convention. Derailments are caused by defects in track or equipment, or by carelessness in the operation of cars. Defects in track are so apparent that the manager of a road is aware of their existence and knows the poor spots in his road better than anyone else. These are often not repaired, not because he does not know that they add to the possibility of derailment, but in a number of cases on account of the financial condition of the company. It has been stated to the representative of the Railroad Commission after an inspection of a railroad:

"I know that that derailing switch should be put in; I know that that track should be raised up; I know that this section should be ballasted, and I know that that curve is in bad condition, and I have asked our folks for the money to do this work. I am glad you have made the recommendation for it, as they think that we can get along without it for another year." This is poor policy, as the putting in of a derailed switch at the foot of a grade might prevent a runaway car from going around the curve below it and tipping over. The raising and ballasting of the track, the alignment of a curve; any one of these might prevent a derailment which would place the road in the hands of a receiver.

On the question of failure of bridges and trestles, the Board of Railroad Commissioners have made an examination of nearly every bridge and trestle in the State over which electric cars pass, and in case of apparent weakness, have made recommendations for the strengthening of the structure, or its replacement by a modern one. In cases where there was any question as to the strength of the structure, it has recommended that it be examined by a bridge expert. These recommendations have been generally complied with.

Another important matter relating to accidents on electric railroads is the brake equipment of cars. This matter has been so thoroughly discussed and everyone is so familiar with the subject that it is not necessary to do more than to say that, on country roads, and by country roads I mean the suburban and interurban roads in this State, it is almost criminal carelessness on the part of the management to operate the class of cars which are usually operated on these roads with only a single chain hand brake on them. There are very few of these roads on which there are no heavy grades; most of them have grades running from 2 per cent to 10 per cent, and in some cases more than that, and there are sharp curves on nearly all of them, these frequently occurring at the foot of the grades. Cars on these roads should be equipped with the best braking appliance obtainable in addition to the ordinary hand brake, and in cases of extreme heavy grades and sharp curves, they should be equipped with additional emergency brakes, and all cars, both open and closed, should be equipped with a sand box on each end.

Accidents are less likely to occur on a double-track road than on a single-track one. The number of accidents would be reduced if all suburban and interurban roads in this State were double track. The financial condition of the majority of these roads will not permit the construction of a second track, but where physical and financial conditions are such that this can be accomplished it should be done. All extensions of old roads and the construction of new ones over which cars are to be operated at high speeds, should, as far as possible, be on private right of way. The reduction in the accident account will more than pay the interest on the investment required for this purpose.

In addition to the above suggestions in reference to improvements in methods of operation, discipline of employees and equipment of track and cars, to reduce the number of accidents occurring it is necessary that managers of railroads make a study of the business in which they are engaged. There are some roads in this State on which the Railroad Commission is seldom or ever called upon to investigate an accident. When we visit the manager's office of these roads we invariably find a business office, everything indicating that the man in charge is attending to his business and is thoroughly posted in it. One of the indications of this is that, somewhere in the office, you will see on file one or more of the different periodicals devoted to electric railway interests. On the other hand, the manager's office of railways on which a large portion of the time of the Railroad Commission is spent in the investigation of accidents is devoid of anything in the shape of literature pertaining to electric railway operation. The successful managers of electric railroads have been found in attendance at the street railway conventions for a number of years past; the managers of the roads on which most of the accidents are occurring are rarely or ever met at these conventions unless the convention happens to be held in a city near which he is located. This is justification for the advice to managers to be in touch with the business in which they are engaged, by keeping posted through the electric railway publications and by attending the conventions of this association and entering into the discussion of the different subjects presented. And on this line this association owes a duty to the public, which as the representative of the railroad interests of the State of New York it should fulfill.

First—The Railroad Commission recommends to every railroad company the adoption of a book of rules based on the standard rules. When the companies ask the Commission for a copy of the standard rules they are unable to furnish them, as there are no official standard rules. There should be a standard set of rules adopted by this convention immediately.

Second—In nearly every head-on or rear-end collision which occurs one of the cars telescopes the other. This is caused by difference in heights of buffer and difference in construction of cars. This association should adopt a standard set of specifications for the construction of the various sizes of cars, all to be of uniform height of buffer and uniform construction for each size of car.

The recommendation has been made to railroad managers to keep posted on the current literature affecting their interests. One word to the editors of journals devoted to the interests of electric railroads; they have a duty to perform as well as others intersted in the safe operation of roads and to some extent are responsible for the conditions which exist to-day that make possible the number of serious accidents occurring. While they have been the means of educating a large number of the managers of our railroads, and are to-day keeping them posted on the improvements in appliances and methods of operation which are being introduced in different sections not only of this, but of the old countries, once in a while they allow an article to creep in which adds to the fancied security of electric railroad managers whose roads are operated without sufficient safety devices or proper precautions in methods. As an illustration of this, a short time ago there appeared in one of the most influential electric railroad publications of the day an article describing a train despatching system for interurban work. This was a telephone system. The article set out by discarding the telegraph system as being too cumbersome to meet the requirements of an electric road, and, continuing, the writer said: "It has been urged against the use of the telephone in train despatching that there is more chance for error in receipt of message than by telegraph. It is hard to see that this objection has much weight. If desired, messages can be written down and repeated back for approval to guard against errors, as in telegraph messages. However, these points are hardly worth arguing, because the telephone has now become generally used and recognized as the proper instrument for despatching on electric interurban roads." This article, therefore, resolves itself into a review of the methods of using the telephone in train despatching. Then follows a description of the system, occupying three columns of the paper, all of which demonstrate the merit of the system, which is summed up in the fact that a train can be handled in ten seconds. Articles of this kind appearing in a publication of the standing of the one in which it was printed are likely to result in the adoption by electric railroad managers of a system of train despatching such as is described. This would be a step in increasing, rather then diminishing, the number of accidents. The ideal method of train despatching for electric railroads is that which, after years of experience, has been adopted by the steam railroads of this country. The expense of maintenance of operators at different points along the road prevents its general adoption by electric railroads. The closer this principle of train despatching is followed the smaller the number of accidents which will be caused by errors in handling train orders, and any method of handling such orders where only ten seconds are consumed in transmission is a dangerous one, and should not be employed by any railroad in this State.

The disagreeable portion of this paper has been written. Let us now turn with satisfaction and pride to the operation of the city roads of this State. These are managed and operated in a manner to challenge the operation of steam railroads. During the year 1901 there were 1,162,614 passengers carried on electric railroads in this State, and 81,909,000 on steam roads. The record of fatalities and injuries shows that passengers are relatively safer on these electric roads than on the steam railroads. The everyday transactions of the metropolitan street railroad, carrying the immense number of people which they daily do, with the small number killed and injured, is one illustration of the safety of operation of electric railroads. The comfort, convenience and safety with which the large crowds at the Pan-American Exposition were handled by the Buffalo Traction Company last year is another illustration of the careful operation of an electric railroad. That the managements of city roads realize the importance of reducing accidents to a minimum is shown in the case of the Brooklyn Heights Railroad. For some years past a large portion of the time of the Railroad Commission was occupied in investigating accidents on this system. At present the large crowds going to and from the summer resorts on Long Island are handled in comparative safety and very few persons are killed or injured, as compared with the number riding. There are summer resorts located near all of the smaller cities in the State, such as Rochester, Syracuse, Utica, Albany, Binghamton, Elmira, Jamestown and Auburn, to and from which there is unusually heavy traffic during the summer season. These crowds are carried and managed in such a manner that it is very seldom that a person is killed through any defect in the method of operation or the equipment of these railroads.

In conclusion, I may express the hope that, through the combined efforts of all inerested, next year's convention will find your lines throughout this State equipped and operated in such a manner that the confidence of the public will be restored in the safest and most comfortable of all methods of transportation, the electric railroad.

Economical Methods for Removing Snow and Ice*

BY R. E. DANFORTH

Those of us who are connected with railways in Northern and Western New York, find our "great problem" in handling snow. The question of removing it from our tracks to allow for the passage of cars, and often in keeping open cuts between small mountains of hard wind-packed snow, is usually more serious than that of caring for it after we have heaped it up along our lines.

We congratulate our more fortunate brethren who not only live where a milder winter climate prevails, but who are furnished with an equipment of snow-handling machinery, and we regret our inability to adopt their methods and obtain their results.

Many roads, having an average passenger car headway of 7½ minutes to 10 minutes, do not often have the number of plows or sweepers required to maintain over the system a headway of even 60 minutes. This fact, together with climatic conditions, render the problem of snow removal in our smaller cities and towns, and also in all cities and towns of Northern and Western New York, one of serious importance.

With us it is a question of ways and means; a question of number and types of plows, of capacity of rotaries, of strength of sweeper brooms, of means of throwing the snow over banks, from 5 ft. to 15 ft. high, and of providing electric power to operate both plows and cars.

In our towns we cannot haul all the snow off the streets, because there is too much to possibly handle; we therefore confine our efforts in this respect to the business centers, crosswalks and junction points. Along the remainder of the lines the snow is piled up between curb and walk, or spread between track and curb, as the locations warrant. The snow we do remove is hauled away in sleighs, and sometimes on flat cars.

In considering our snow-fighting equipment we find that all types of machines for removing snow are useful. We even require horse-plows or walkaways for leveling back banks of snow thrown out by the plows and for cutting down drifts and opening gutters—work which cannot always be readily done by a track-plow.

In localities where winter commences early in December and lasts until April, where storm follows storm, and where a "thaw" means a rise in temperature slightly above 32 degs., and closely followed by more snowstorms, severe cold and usually high winds, the accumulation of snow from one storm almost never disappears before it is buried beneath another. In the outskirts of the cities and on the suburban lines, the high winds continuing for days are the cause of most of the trouble, as huge drifts of hard sandy snow are formed as rapidly as removed, and successfully defy ordinary snow-plow apparatus.

To combat our local conditions we have drifted away from rattan brooms and followed, more or less intelligently, modern steam road practice. First we dragged a board along the track; but finding this little better than our sweepers, we placed the board ahead and shoved it along. The board soon changed its form from a vertical plank, placed diagonally across the track, to a warped surface shear, tending to cut, lift and then roll a mass of snow along its length.

Finding this snow-plow ineffective in banks over 5 ft. or 6 ft. high, an ingenious friend produced an electrically-driven boring machine, and called it a rotary track cleaner. With this machine we are able to cut our way slowly but surely through banks of snow of almost any depth and of any condition, short of hard ice.

We have, also, placed upon all our passenger cars track cleaners or scrapers, which will, without difficulty, remove snow from the rails to the depth of 4 ins., unless the snow has been packed down to this depth by the street traffic; and it may be well to say that scrapers which will remove even hard-packed snow are in use in Toronto and elsewhere.

Each type of plow has its place and cannot economically be used in any service for which it is not adapted. It is as improper to attempt to remove 6 ins. of snow with a rotary as to attempt to cut through 2 ft. of snow with a rattan sweeper. In either case the feat may be accomplished, but in neither case with the greatest economy.

Considering first, the removal of snow in cities, it may be said that experience in Western New York has shown that, with the equipment at hand, the work should be performed about as follows:

On the appearance of a snowstorm, when the streets are free from snow, light plows and sweepers should be gotten in readiness and should commence work when not more than about 2 ins. have fallen. If the storm continues and the snow falls so rapidly that there is a probability that the accumulation between trips of the plows and sweepers will exceed 3 ins., the heavy shear-plows are sent out. When the ridges formed by the plows and levelers approach 24 ins. in depth, walkaways are used to level off the same, and shovelers are sent out to clean all crosswalks. At the commencement of a storm a force of trackmen are sent out to clean switches.

In storms of recent years, when snow has fallen to depths of over 30 ins., it has been found impossible to depend upon the light plows and sweepers to do more than follow after the heavy plows, and to clean the street to the pavement. The work of the rotary commences when the banks of snow on either side of the tracks become so high that the plows can no longer shove them back.

The rotary is a slow-moving machine, because of the power limitations of the ordinary street car motor, but its work is positive and effective. As our storms are usually accompanied or followed by high winds, the new-fallen snow is soon piled in drifts in the thinly settled portions of the city. The snow thrown out by the rotary is spread over a large surface and does not materially add to the height of the bank until the snow has become wind-packed and sandy, and then, for the reason stated, the height of the bank is only slightly increased. Teams and shovelers commence the removal of snow at junction points as soon as it accumulates. When the storm is over the work of removing the banks of snow in the business section, thrown up by the plows and from the sidewalks, is undertaken by the railway and city forces jointly.

When the storm ceases our work has just fairly begun. Although there remains little to be done in the centers of the city drifts are being rapidly formed in the outskirts, and plows and rotaries must remain in constant operation for days to keep the lines open.

Suburban lines which cross the line of prevailing winds and those which are run along the highways require constant, and at times heroic, effort to keep them open. When snow fences are liberally used and properly placed along the exposed portions of the line the saving in snow expense is marked.

The Rochester snow-plow equipment consists of eight antiquated sprocket-driven mould-board plows, equipped with Westinghouse No. 3 motors, three combined rattan sweepers, one double track four-motor Wason nose plow, one double-end tin fan rotary, two single truck heavy shear plows and six walkaway or horse-plows. With this equipment was kept open, throughout the severe storms of last winter, 100 miles of track, including 25 miles of side or boulevard track, placed between rows of trees on one side, and hydrants, stepping stones and hitching posts on the other, with less than 10 ft. between the two. This peculiar location of tracks

*Paper read at the twentieth annual convention of the New York State Street Railway Association, at Caldwell, Sept. 9, 1902.

renders the use of wings or levelers impossible, and the snow is therefore soon piled up close to the tracks and the cars are operated in a cut, the width of the car body. Under these conditions the removal of snow is made difficult and expensive, and because of the narrow space between rails and sidewalk the number of shovelers and the expense of snow is greatly increased. The cost of removal of snow and ice for the winter of 1901-1902 in Rochester was $90 per mile, a large percentage of which may be attributed to the 25 miles of boulevard tracks. A double-track line, 5½ miles long, between Ontario Beach, Charlotte and the Rochester city line, and running north and south, lies on the west side of the highway, between the curb and fence lines. The hedges and line fences form a snow fence, which stops the drifting snow and heaps it up to great depths on the tracks. This line has been kept in continuous operation for eight years by two to four men with a rotary plow. During the most severe weather cars are obliged to closely follow the rotary over the line, but are never stalled. Although this plow is equipped with small motors (four G. E.-800), it has been operated for three seasons without a burn-out. A section gang of four men has been used to clean switches and crossings on the 11 miles of track.

The Rochester & Sodus Bay Railway, operating about 40 miles of line, mostly along a highway, is kept open by two rotaries and ten shovelers, but with considerable difficulty. The location of this line is peculiarly favorable for its obstruction by snow drifts, which form along almost the entire line, often higher than the roofs of the cars. The plows on this line are overtaxed and require a considerable expenditure for their maintenance. Under the conditions existing on this line each car should be provided with a pilot plow—a heavy nose-plow with long side wings or levelers should be provided for use through the villages, and the rotaries should be the single instead of the double-blade pattern, so as to be able to lift the snow higher.

The cost of removal of snow and ice during the winter, 1901-1902, along this line was $2,300, or $57.50 per mile.

When the average life of a rattan-filled broom is considered, as with its extreme flexibility, the additional cost of a steel broom, properly reinforced by steel plates, is more than made up. Those who have operated steel brooms, driven by 50-hp motors, know that they will cut through drifts of moderate depth and sweep the track clean, with no apparent injury to the brooms. For comparison it may be well to state that the steel brushes cost $42 per set, and last from two to five years with ordinary care. A sweeper thus equipped will readily go through 2 ft. of loose snow and at good speed, and will cut all packed snow to the pavement, when properly operated.

Storekeeping and Lost Property*

BY A. C. TULLY

In the preparation of this paper I have not recommended any particular method in the handling of supplies, for the reason that every storeroom of a railroad must have its own peculiarity of construction and arrangement, resulting from location and the material to be handled. I have, therefore, confined this article in a mere outline of the system adopted in the Interurban Street Railway Company, omitting details, as the president of the association asked me to make my paper short.

The general storeroom was constructed not only for convenience, but also with a view to safety and security from burglary and sneak thieving. This is one of the things we are obliged to guard against in a thickly inhabited portion of a large city. No one can enter an office in the storeroom without being admitted by a clerk, and no person, wagon, truck or car can be admitted on the ground floor without the door being opened by a store-tender, which is immediately closed after entrance. All the floors have fire protection in the shape of fire hose, fire pails filled with sand, and fire extinguishers, all judiciously placed; and during the night each floor is patrolled by a watchman, an electric watchman's clock being used as a check on the stations he is directed to visit.

A storeroom should be kept clean. We do not allow any material used for packing, which comes out of boxes or barrels, to remain on the floor. Iron waste cans with covers are provided for all such material. Waste paper from the offices is collected every evening and consigned to like receptacles. Our storeroom is swept every night and dusted in the morning, and we are never in a condition where we are obliged to go at work and clean up for a tour of inspection by any officer of the company.

I believe in a place for everything and everything in its place. After arranging the articles we have never changed their location to a different part of the storeroom, so that each store-tender becomes familiar with their location, and could go in the dark to the place where he wishes to find any article. We do not allow any article to be placed on the shelves in front of an article of a different character.

The store-tenders are changed on the two principal floors each day, so that they are familiar with the material on each floor.

The stationery is kept in a separate room, and the closets and shelves are arranged particularly for the size of the forms in use, which number over five hundred. The closets beneath the shelves are used for the very large forms, such as receiver's sheets and the large books used in the different departments. Above the closets the shelves extend to the ceiling with sliding glass doors and rolling step-ladders. Every form in use has a number, and this number is indicated in large figures in front of the form and in numerical order. Similar cases also contain the stationery supplies, blank books and typewriter material.

The general storeroom is the source through which all supplies must pass, both in material received and the distribution of same.

The line of supplies kept in stock are for three systems, viz.: The underground electric, storage battery, and the horse-car lines, with over five thousand horses, each system having its own peculiarities of equipment.

The purchasing agent has his office in the general storeroom and also acts as the general storekeeper. This enables him when requisitions are made for material to ascertain at once what is in stock and what is necessary to be purchased.

Every order for the purchase of supplies is printed in copy ink and numbered by the printer consecutively, and copied consecutively in an impression copy-book, so that it is practically impossible for a clerk to make a mistake in numbering an order, and a missing blank could at once be detected. When the order is sent, a duplicate billhead is enclosed for the firm from which the material is purchased, and this duplicate is filled out by the firm and returned with the original invoice, and becomes a record in the office of the general storeroom for future reference, being filed alphabetically and bearing the number of the order, by whom examined, in what book and page entered, and the list number when the original was sent to the auditor.

The invoice when received is first checked with the impression copy, and if found correct is then passed to a clerk, who checks up the material to ascertain if it agrees with the invoice. No invoice for supplies can be passed without a formal order having been made.

All ordinary supplies when received are first taken to a receiving room, where they remain until checked. After this is done and the price verified every article is priced with a cost mark, and is then placed in its proper location. No article is delivered without an order from a superintendent or head of a department, and this must state for what purpose it is to be used or to what account to be charged.

A receiving book is used which gives full particulars as to the description of material, when and from whom received, quantity or weight; and this book is checked with the purchasing agent's order number, date and amount of invoice and any memoranda relating thereto.

When material is delivered in quantities to our division trucks or freight cars an itemized list is made in a triplicating book, the pages beng numbered consecutively. The original is kept by the storekeeper, and the two duplicates are sent with the material to the department ordering the supplies. One is signed and returned to the storeroom and the other retained by the party who ordered the material.

Everything is received on the first or ground floor. All the heavy material, such as castings, bolts, nails, etc., are kept on this floor. A platform of proper height enables us to load and unload from trucks and freight cars, and an overhead trolley, with differential pulley blocks, and chains, enables one store-tender to take heavy barrels or boxes to any section of the floor without extra help. An electric elevator, of 2 tons capacity, with a platform 7 ft. 10 ins. x 14 ft., is located in the center of the building, as the most convenient place for loading and unloading and carrying material from the first to the fourth floor.

The distribution and accounting for all material used, whether for power houses, car shops, track, buildings and offices, is done in the office of the general storeroom, and the statement rendered each month to the auditor.

LOST PROPERTY

The lost property found in the cars of our street railway system is a part of the work of our general storeroom.

The Legislature of the State of New York, in 1899, passed an "Act authorizing the sale of property left in Street Surface Rail-

*Paper read at the twentieth annual convention of the New York State Street Railway Association, at Caldwell, Sept. 9, 1902.

road cars, and the disposition of the proceeds thereof." This act became a law, with the approval of the Governor, on May 2, 1899. One year ago, at the convention held in Rochester, I was surprised to find that some of the railroads, even in our larger cities, had not organized a department in conformity to this law. The act is short and explicit, and reads as follows:

It shall be the duty of every street surface railway corporation doing business in this State which shall have unclaimed property left in its care to ascertain if possible the owner or owners of such property and to notify such owner or owners of the fact by mail as soon as possible after such property comes into its possesion. Every such corporation which shall have such property not perishable in its possession for the period of three months may sell the same at public auction after giving notice to that effect by one publication at least ten days prior to the sale in a daily newspaper published in the city or village in which such sale is to take place, of the time and place at which such sale will be held, and such sale may be adjourned from time to time until all the articles offered for sale are sold. All perishable property so left may be sold by any such street surface railroad corporation without notice, as soon as it can be, upon the best terms that can be obtained

All moneys arising from the sale of any such unclaimed property, after deducting charges for storage and expense of sale, shall be paid by any such corporation to the treasurer of any association, composed of the employees of such street railroad corporation, having for its object the pecuniary assistance of its members in case of disability caused by sickness or accident, and where no such association of the employees of any such street railroad corporation is in existance at the time of any such sale such moneys shall be paid to the county treasurer of the county in which such sale took place for the benefit of such county.

Immediately after the passage of this act, President Vreeland directed the general storekeeper to take charge of the lost property, and as the Metropolitan Street Railway Company had a flourishing benevolent association, it was not necessary to turn over the proceeds to the county treasurer.

It may be interesting to know a few facts connected with the lost property of a street railway in a cosmopolitan city, and the system under which it is managed. The results arising from this organization have been, I think, a surprise to the officers of the company.

All property left by passengers in the cars, if found by the conductor, is taken by him, on the completion of his run, to the receiver's office, where it remains until the next day, so that passengers who detect their loss can go to that office and obtain the same. The following day all unclaimed property is sent by a messenger to the lost property room, which is located in and is a part of the general storeroom.

Each receiver is provided with a book, with coupons printed and numbered in triplicates, and each set of coupons is numbered consecutively, the original remaining in the book, the duplicate being attached to the article, and the triplicate being sent in an envelope to the lost property clerk. The conductor fills out the coupons, giving the date, number of run, direction of run, badge number, the hour, description of article found, and signs the same. A space is left for the name and address of the owner, who must always sign after identifying the article and proving the ownership, and this duplicate is filed as a voucher. The triplicate coupon is copied into the lost property book, according to consecutive numbers and with all data relating thereto, a space being reserved in the book on the same line which states what disposition is made of the article, and thus an accurate record is kept of each transaction, and any article can be readily obtained in the storage room by reference to the number of the coupon, the articles stored being arranged according to months. Each coupon, after being copied in the lost property book, is filed according to the number.

When property is delivered by the receiver he must send the duplicate and triplicate coupons, properly signed, to the lost property clerk. As these coupons are all copied consecutively a missing coupon is at once detected.

When anything reaches the lost property room that contains any information that indicates the address of the owner, we send a printed postal card, of which an impression copy is always taken, requesting the party to call relative to lost property, and to bring with them the postal which states the hours during which the office is open, and also that articles are only kept for three months. The card does not indicate the nature of the article, leaving that for the person to describe who brings the card, so that if the postal came into the possession of another party they could not describe the property that had been lost. Certain letters and figures are written on the card, which are only understood by the clerk, and these have a reference which enables him at once to refer to the page in the record book and the location of the articles in the storage room.

The property accumulates so rapidly that we are obliged to have a second storage room, where all articles are stored after the lapse of three months and until we dispose of them at public auction.

Our auction occurs twice in a year, and generally lasts without intermission from 10 a. m. to 8 p. m. The auctioneer opens each package, assorts the articles and arranges them according to his judgment, and has full charge of the sale.

Rewards are frequently given by parties recovering their property, and are given to the conductor who found it, taking his receipt for same; and a record is kept of all such rewards. These rewards have run from 25 cents up to $1, $2, $3, $5, $10, $15, $25, $35, and in two instances $100 and $250.

Since the organization of this department we have returned in cash to the owners the sum of $12,608.39; there has been paid into the treasury of the benevolent association unclaimed cash amounting to $5,011.60, and from auction sales, $2,440.54. The rewards for conductors have amounted to $1,091.81. So that the total cash transactions have amounted to $21,152.34, not taking into consideration the value of merchandise and articles returned to the owners. We receive on an average about 1200 articles each month, and return to the owners about 500.

The articles found on street cars in a city like New York comprise a heterogeneous mass, and may be termed "good, bad and indifferent." We have received in live stock a monkey, puppies, kittens and canary birds.

Trunks lost from express wagons during the night have been picked up on the street and returned to the railroads that had them in transit.

The large amount of clothing and wearing apparel of every description, and the number of satchels, dress suit cases, pocketbooks and umbrellas would surprise most of you.

We have sent articles to the owners living in the West and as far South as Texas.

Valuable jewelry when found is generally sought for by the loser, and the larg st rewards have come from the return of this class of property.

It is a difficult department to handle, as the clerk comes in contact with many unreasonable people, and we are obliged to act almost continually on the defensive to protect the company from delivering articles to unauthorized claimants. It has its pathetic as well as its humorous phase. The clerk is obliged to listen to tales of woe, and endeavor to pacify the excited and explain to the unreasonable. We come in contact with remarkable cases of forgetfulness and the peculiarities of the working of the human mind relative to locating articles which have been lost. A lady left her pocketbook, which contained quite a large amount of money, in a car—some papers in it gave the information as to her address. When she brought the postal card notifying her to call she gave an accurate description of the contents, but insisted she had not left it in the car, for she knew she had it in her hand after leaving the car and had lost it walking home. A detective from another State left his satchel on a Broadway car, which on being opened was found to contain a revolver, a box of cartridges, a pair of handcuffs, and a requisition from the Governor of that State on the Governor of New York for the return of a fugitive from justice. Not having been called for after several days, we notified the Governor's office of that State, and the answer came that it was important, and giving the name and address of the sheriff of the county to whom the document had been issued, and asking us to communicate with him, which we did, and a telegram came in reply to send all at once by express C. O. D., with any expenses attached.

A bank messenger, on completing his tour of collections, reached the bank before he missed a satchel which contained $1500 in bills. His last recollection of it was that he had it in his possession on a car on one of the main lines of the company, but could not give the number of the car or conductor. The bank kept the telephone busy every few minutes making inquiries relative to it. The conductor on the completion of his run turned it into the receiver's office, and the bank received their property the same day.

It requires the employment of one clerk whose time is fully occupied each day answering questions, keeping record of the articles, replying to correspondence, and sending out postal cards. In addition to this one clerk it has been found necessary to keep two other clerks from the office thoroughly posted as to the records and the manner of conducting the system adopted. This is done so that they can act as relief clerks in case of sickness or absence.

The question may be asked why the receiver of any division could not attend to the delivery of the articles found and avoid a separate office and the employment of a special clerk. The answer to this is, that on account of the great number of articles lost in a large city and the persons frequently not knowing to a certainty where it was lost, they commence in a day or two to think what store they visited, what place of amusement they attended, and what line of cars they traveled on; and then make a tour of investigation, and as all missing articles are not lost on

street cars the great number of people calling and the time consumed in answering questions would so seriously interfere with the receiver that he could not attend properly to his duties without the aid of a clerk. On the largest divisions of our system it would also require a separate room for the storage of articles lost, so that on the question of economy it is advisable to have one central place where persons can call.

I have consumed considerable of your time in an outline of lost property, which to some of you may be something new in connection with operating street railways, as the result shows that where in a smaller road lost articles might be deemed a trifling matter, yet in a large corporation like the Interurban, a close watch of such articles in a thorough system of record shows an aggregate of such proportions as to yield a revenue to a benevolent association and is a protection to the company.

Accidents on Street Railways from the Legal Point of View*

BY HON. JOSEPH F. DALY

When it is considered that, notwithstanding the extreme care exercised by the management the claims of all character presented to the New York city surface railway system exceed seventy-five for each working day, it is manifest that from a lawyer's point of view the possibilities of fruitful litigation assume vast proportions. That these opportunities are not neglected is evidenced by the number of actions annually commenced and the time consumed in the courts of disposing of them. During the year ending June 30, 1902, there were 4170 suits for negligence commenced. This shows that of the numerous complaints or claims made less than one in fourteen resulted in a law suit, the remainder being satisfied by adjustment or abandoned. Of the suits brought 1161 were settled without trial in the same period. This seems to me to be extremely creditable to the company, as indicating a desire to deal equitably in such matters, and it further appears, from the results of the cases which are contested, that the legal department is justified in referring them to the courts for decision; for out of 1189 causes tried in the same period there were 695 judgments for the company, as against 494 for the plaintiffs. There were but twenty-eight appeals taken from judgments in favor of the company, and these appeals resulted in but eleven reversals.

The extraordinary proportion of judgments recovered by the railway unquestionably shows that very many suits commenced against the company are induced by the hope that the natural sympathy of jurors for the injured will help a weak case and support it against evidence which in an ordinary commercial action would prevent any recovery. At one time in the early history of street railroads and "accident suits" a verdict for the plaintiff was a foregone conclusion, and many amusing stories are told of the defiant attitude of the jurors and the attorney for "the company" growing out of the invariable character of the verdicts. It is related of one counsel, after a succession of exasperating defeats by the same panel, that he happened finally upon a case which required a verdict in his favor, and that he began his summing up, "Now, gentlemen of the jury, *I've got you!*" The jury, after some deliberation, acknowledged that he had.

The number of verdicts for the defendant now rendered in accident cases proves that the old-time reliance upon the sympathy or prejudice of jurors as a substitute for that measure of proof which the average mind requires in ordinary cases must be abandoned; but there still remains an uncertain quantity to be dealt with in the deliberations of juries in negligence cases, and which may affect plaintiffs and defendants alike. An instructive instance is found in the case against a butcher whose wagon, driven by a very young boy, ran over a child playing in the street. The proof of gross carelessness or incompetence on the part of the driver was clear, for the injured boy with his companions was playing in the gutter, and the wagon had the rest of the street unobstructed to pass in. The negligence imputed was not only the act of the driver but the employment of so youthful a servant in such a responsible service. Eleven jurors were immediately for the plaintiff, but the twelfth calmly met all their arguments with the remark: "It's no use, gentlemen; I have been in the retail butcher business myself and I know that the profits won't afford a man to drive!"

Now, in that case the solitary juror believed that the infliction of injuries was an incident of the business, and was the share which the public ought to bear of the inconveniences growing out of the economic conditions of the industry. But was he doing more than unconsciously offsetting, for the benefit of his trade, the theory we hear advanced that employers of labor, especially common carriers, in all cases of accidents in their business, whether the fault of the party injured or not, ought to make compensation as part of the operating expenses, on the ground that accidents are the unavoidable concomitants of the business.

While it is satisfactory to reflect that jurors are not yet given over to such theories, it is nevertheless extremely difficult, if not impossible, to obtain, in the jury box, a proper appreciation of the rule as to contributory negligence, which precludes a recovery where the injured party is in any degree to blame for carelessness or inadvertence. It is doubtful whether a verdict in favor of the railway company is ever rendered in a case in which the jury is satisfied that both parties are in fault—and yet the law requires a verdict for the defendant in such a case. Notwithstanding the explicit charge of the judge that any negligence of the injured party, no matter how slight, which contributes to the accident will preclude a recovery, the verdict depends upon the defendant exonerating its employees from blame. This, of course, throws the whole responsibility upon the defendant, and though opposed to law must be reckoned with in considering claims for accidents; for it may be set down as a certainty that no matter how rash and careless the injured party may have been, if the evidence shows that the defendant's employees were also careless the result of the trial—if the case is left to the jury—may be foretold with certainty. In short, it is to be feared that the doctrine of contributory negligence prevails in the deliverance of the court, but finds little favor in the jury box.

Notwithstanding this fact the courts feel bound to cling to the theory that juries, although satisfied that the defendant was negligent, turn from that side of the case to weigh the proof as to the contributory negligence of the plaintiff. Practical experience of counsel will, I think, fail to recall instances of respect for the theory. The utmost that can be hoped in such cases is a failure to agree upon a verdict. It explains the cases of verdicts so grossly inadequate that the courts have been compelled to set them aside.

In order to sustain verdicts for claimants rendered in the face of the clearest proof of contributory negligence, the attempt has been made to extend a principle applicable to a few special cases to all actions for negligence. This is the doctrine that, notwithstanding negligence on the part of the injured party, he may recover if the defendant, after such negligence occurred, could, by the exercise of ordinary care, avoid inflicting the injury. The doctrine was applied in Weitzman's case (33 App. Div.) where a child, negligently attempting to cross the track, was caught on the fender, carried a long distance and rolled under the advancing car, which might have been stopped before the child rolled off. It was properly applied in Totarella's case (53 App. Div.) where a child stumbled and fell upon the track at such a distance that the approaching car could have been stopped in time to avoid injury. But the court refused to apply it in Goodman's case (63 App. Div.), where a boy negligently stepped in front of an approaching car; and in the Catto's case (70 App. Div.) it was pointed out that the principle is only applicable where, after the occurrence of the accident to which the negligence of the plaintiff contributed, a new situation or condition is created calling for the exercise of care appropriate to the new circumstances.

This decision was most salutary, showing a firm adherence to the established doctrine of contributory negligence, a doctrine which could always be evaded by the claim that owners of vehicles could always use such care as would relieve pedestrians from the necessity of looking out for themselves. As well might the defendant urge that accidents would be impossible if pedestrians were always on the alert to prevent them, and therefore there should be no recovery in any case, as the wayfarer is always to blame.

It frequently happens that the weight of evidence in these cases so overwhelmingly disproves the charge of negligence on the part of the defendant that it is manifest that if a verdict should be rendered against such preponderance it would be the duty of the trial judge to set it aside; and it has been contended, with much reason, that in such a case it is equally the duty of the judge to dismiss the complaint, if not to direct a verdict, and thus relieve the jury from the formality of deliberating upon an issue which can be legally resolved in only one way. The court of last resort has, however, decided that the proper course is to submit the case in the first instance to the jury, and if they find against the weight of evidence, then to set their verdict aside and order a new trial before another panel.

The submission of the case in every instance to the jury is in accordance with the English practice and the theory of the jury trials; but it ought to be considered that English judges exert

*Paper read at the twentieth annual convention of the New York State Street Railway Association, at Caldwell, Sept. 9, 1902.

a very decided influence upon their juries, and do not hesitate, in a plain case, to indicate upon which side lies the strength of the proof; the very opposite of the American practice, in which the judge studiously refrains from giving the jury any of his own impressions. It has been said that it certainly is a serious question whether in a case which is altogether one-sided, and which logically requires a verdict for that side, it is fair to the jurors to leave the matter to them as if there were room for a fair difference of opinion. Experience shows that in many such cases the jurors are mislead by the practice, and are surprised by the subsequent strictures of the court upon their want of intelligence in disagreeing or giving the wrong verdict in a plain case.

The practice of leaving every case of obvious preponderance to the jury and then setting aside their verdict if against the weight of evidence, in the expectation that another jury, upon the same evidence and with a colorless charge from the court, may do better, is likely to lead to great cost in time and money to the community as well as to the individual suitors, who are thus tossed like shuttlecocks from one jury to another, with no hope on the part of any person that any logical result will be finally arrived at. While it must be conceded that the practice favored by the court of last resort is warranted by precedent, it cannot but be admitted that the former practice of the trial courts was in the direction of speedy justice.

As under the present system the granting of new trials will be multiplied to the great cost of the public in the time wasted in mistrials, the delay in clearing the calendars and the expense to the litigants; it is probable that if, in order to avoid these evils the trial judges should exercise greater freedom in discussing the weight of evidence in the charge to the jury, any disinterested person will be likely to complain.

The number of accident suits in the city of New York, which is greater than ever before, is undoubtedly due to the enormous increase of travel induced by the advantages offered by the consolidation of the metropolitan lines. The first fruits of consolidation was the transfer system, which for a single fare enabled the passenger to travel on several routes formerly operated by distinct companies; but from the increased travel in every direction and the haste, bustle and crowding, have resulted mishaps which would never have been experienced if the increased accommodation to the public had never been offered. Of course, the novelty of the electric system is responsible for many accidents, which will become less frequent with familiarity with the new order. It may be set down with certainty that no community will tolerate a return to antiquated systems because accidents will be less frequent. The comfort of street railway travel at the present day is largely due to the feeling that it is not purchased by the suffering of beasts of burden pulling the crowded car up hill in sweltering midsummer or ploughing through wintry storms.

And accidents were in the same proportion in the days of horse cars as now. Then, as now, the plaintiffs asserted that the car, invisible to their careful eyes as they stepped upon the track, swooped down with lightning speed and overtook them before they could clear the other rail; then, as now, the car started with a terrific jerk before the alighting passenger could complete the descent, and just as the ascending passenger had one foot on the step; then the jingling horse-bell was as inaudible as the motorman's gong in these times. In short, in the days of the old jogging horse cars, with their wearied steeds, the swift and deadly approach and the precipitate start, were the themes of forensic eloquence as they are now.

The number of suits commenced against the street railways without justification, as the result of litigation show, far exceed the proportions in other classes of cases. The cause of this indiscriminate suing may be found in the fact that there is a so-called "accident bar" or group of lawyers whose business is practically confined to the bringing of negligence actions, and who have corps of assistants engaged in seeking retainers in such actions. Not only is a person who has sustained an injury pursued at once by a persistent agent for a law firm, but practically all the "accident firms" run him down, some displaying printed lists of large verdicts obtained for personal injuries. No opportunities for litigation can possibly slip through the meshes of this commercial system. It is stated that in the case of one street accident nine attorneys started for the game. Four rushed to the hospital and four to the "blotter" at the station house. The ninth wisely saved himself and everybody further trouble by rushing to the office of the railroad with a summons. Every accident, whether the facts will support a claim or not, is made the subject of an action, in the hope that in the weak cases the company may find it cheaper to settle than to fight, and with the certainty that in every case the "50 per cent" basis of dividing the recovery will amply pay for the attorney's trouble.

It is not necessary here to repeat the strictures which have from time immemorial been passed by judicial writers and the highest authorities of the profession upon those members of it who make it their business to incite litigation for a share of the proceeds. Many grave abuses have resulted from the practice so condemned. No one will argue that there is any impropriety in taking a just case upon a contingent fee; but when that fee is so large as to become a temptation to the lawyer and his agents, or an injustice to the client or an injury to the adversary, the evil cries for remedy.

In a late article in a legal publication it was suggested that the knowledge which has now become familiar to juries that the lawyer will get a large share of the recovery in the case may influence the verdict and make it, perhaps, double what the jurors would otherwise deem a "just compensation for the injury." In such a case the injustice to the defendant in compelling him to pay double damages for an injury unwittingly inflicted is too manifest to dwell upon. As to the remedy for the propensity of certain professionals to make an unconscionable contract of this kind there is room for a difference of opinion. The loss of character in the profession, the exclusion from honorable association, the rebukes of the bench may not suffice. One suggests itself as practical, and that is to empower the court in every case to add to the verdict what is a fair reward to the attorney and counsel in lieu of the "extra allowance," which is now but a mere addition to the exorbitant share of the verdict which the speculative attorney expects to get. If this plan will prevent the evil of having the jury swell their verdicts by attempting to provide for the lawyer as well as the client it will be of substantial benefit. The damages in such a case being exclusively for the benefit of the client might be paid into court.

Viewed from the standpoint of the lawyer, who has other interests than those connected with accident suits, the multiplication of the latter seems to have so engrossed the time of the courts as to delay other issues beyond reasonable limits. The number of such suits, brought by infants and administrators, which have a preference, adds to the unreasonable obstruction of the calendars. To these conditions are largely due the necessity for devising some means of relieving the courts and clearing the calendars, which has appealed for legislative satisfaction. The appellate divisions and the courts of appeals are now well abreast with their business, and cases are now speedily reached in those tribunals. It is in the trial court that the block of cases produces delay. This is owing to no fault of the trial justices, who do all they can to expedite business. If their calendars were relieved of all the "speculative" litigation their task would be easy. Every accident case, if contested, is stubbornly litigated, and for a very good reason, as results have shown. Every such case must be tried before a jury, and trial by jury is a tedious process in the preliminary qualification of the panel in order to eliminate bias; in cross-examinations, prolonged on old lines familiar to the practitioner but novel to the novice in the jury box; and in the long summing up and charge, with its line of requests, exceptions and modifications.

There can be no suggestion for relief to the crowded calendars which will not be open to some exception, but much is to be said in favor of having a special tribunal to deal with the great mass of accident cases which now oppress the courts. What that burden is may be inferred from the bringing of 4170 suits against the street railways of one city. And street railways do not cause all the accidents. In a column entitled "Run-over Accidents in One Day," in a recent daily paper there were six such casualties, and only one caused by a "trolley," the others, if I remember rightly, were charged to a brewery wagon, an automobile, a delivery cart, a mail cart and an express wagon. It may be imagined how the accidents in all branches of contractors' work, in factories and workshops, where machinery is used, and in crowded tenements, swell the list of speculative cases and add to the crowded calendar. Under these circumstances it would seem that a special tribunal might be constituted for the speedy and economical disposition of these cases. There are practically no questions of law now remaining to be settled in such cases, and for the cumbersome machinery of the law courts might be substituted a court of claims. If relief lies in that direction a constitutional tribunal could be enacted consisting of a presiding legal member and two lay members, to take cognizance of the so-called accident cases against individuals as well as corporations. Such a tribunal could dispose of five cases in the time now spent in trying one with judge and jury. Trials would be speedy, and the injury caused by the death and dispersion of witnesses would be avoided. It is reasonably certain that the awards of such a tribunal would be neither excessive nor inadequate. They would at least be consistent. It is within our experience that appellate tribunals have been called upon to affirm one day a verdict of $5000 for the death of a child and the next day $500 for the same

injury—and in both cases because "the question of damages is for the jury." We have seen courts disapprove of verdicts which constitute a capital affording provision for life, and leaving an estate for the heirs of a party who never in the best of health could have accumulated such a fortune. We have seen a trial court compelled to order a new trial because a jury found a verdict for defendant with a recommendation that the company give the plaintiff $300! In short, in no respect is the imperfection of the present system of disposing of such cases more apparent than in the matter of award of damages.

If such a special tribunal as is suggested were authorized it could be so authorized as to inspire the same confidence in its decisions as is now deservedly felt for the rulings of our judges. Its members could be elected by the people for fixed terms as long as the judicial tenure, and be removable for cause by the Legislature, and could be compensated in proportion to the important duties to be performed. Whether this is the proper solution of the problem of relieving the courts or whether a more efficient substitute for the present system can be devised there is no question that the conditions call for improvement. I have not been solicitory to inquire whether interests of the legal fraternity will be unfavorably affected by a change, but I know that the Bar generally will favor such a plan as benefits the community.

Car Dispatching on Interurban Lines*

BY THOMAS E. MITTEN

Since the introduction of high-speed electric service between cities there has been a great demand for a satisfactory method of car dispatching on interurban lines. So many lines of this description have been constructed within the past few years, either independently or in connection with existing city systems, that the subject has become one of common interest; there has, however, up to the present time, been apparently little, if any, concerted action, the management of each road having adopted some method with a view of meeting the particular requirements of the line to which applied.

Theoretically, the ideal system would be that controlled by an automatic block, operated independent of trolley circuit and absolute in its action, which would permit of but a single car or train upon a section of track at one time. Up to the present time such a system has not, to my knowledge, been satisfactorily worked out as applied to electric lines.

Experiments with electric signals, operated in connection with the trolley circuit, have been made from time to time, and some lines are now being operated, relying almost entirely upon the protection afforded by such signals. This practice, however, seems to be confined to the shorter lines where but a few cars are operated, the results obtained not seeming to have been such as to warrant its general adoption.

In the operation of the longer and more important lines, where high speeds are attained, and cars run with greater frequency, the disposition is rather in the direction of following steam railway practice, and it would seem that much might be gained by a careful study of the system in general use by steam railways, representing, as it does, the result of much thought and many years' experience.

The accidents occuring on interurban lines have shown that as we more nearly approach the speed of steam railway trains, we become correspondingly subject to the same class of accidents. It would, therefore, appear that we should make our rules looking to their prevention, conform as nearly as may be practicable to those which the steam roads, by long use, have found most effective. Believing that the solution lies in this direction the writer has, for some years past, been endeavoring to perfect a system which, while closely patterned after steam railway practice, has greater flexibility and can be simplified to conform to the requirements of the line and service to which applied.

Under the system referred to, a printed timetable, containing the running schedule, meeting points, and all rules necessary to a proper understanding, is provided, a copy being supplied to each motorman, conductor and such other employees as are interested therein.

Trains are of two classes, regulars and extras.

Regular trains are given a number and shown on timetable, and are designated by a corresponding red figure displayed, in a conspicuous place, on front and rear of train by day, and, in addition, a red light at either end of train at night.

*Paper read at the twentieth annual convention of the New York State Street Railway Association, at Caldwell, Sept. 9, 1902.

Extra trains can occupy main track only upon written orders from the dispatcher, and are designated by a green letter "X" by day and green light at night.

Regular trains, having a second section following, carry in addition to their red number or red light signal, a white sign, worded "Car Following" by day and a white light at night.

Trains, running in sections, are required to keep 3000 ft. apart by day or 5000 ft. at night, or during foggy weather when running at speed, distance and speed being correspondingly reduced when approaching meeting points.

Extra trains are required to be in on siding to clear at least five minutes before the regular train is due.

A red flag and a red lantern are carried on front platform at all times, lanterns to be kept lighted at night and during foggy weather, ready for immediate use.

Trains which are disabled in the vicinity of curves, where the vision is obstructed, are required to be immediately protected by the conductor (using red flag by day and red lantern at night), proceeding at least 1000 ft. in the direction from which danger may be expected.

Under ordinary conditions, where no unusual delays are encountered, this timetable is found to be all that is necessary.

A dispatcher is located at a central point, who, by telegraph or telephone, issues the necessary orders under the prescribed form, when, owing to the operation of extra cars or unusual delay, such are found to be necessary.

Operators or receiving agents are maintained at certain stations on the line for the purpose of copying and delivering train orders to passing cars.

When receiving an order the operator or receiving agent makes three copies on manifold paper, the original is retained by him, the duplicate and triplicate being passed to the motorman and conductor to whom addressed. As soon as the operator or receiving agent receives an order, by telephone or telegraph, he at once repeats it back to the dispatcher, who, at that time, copies it into a book of permanent record, the orders being numbered by him consecutively, commencing with No. 1, at 12 a. m. each day. The plan described affords protection to both the front and rear of trains.

The complete timetable herewith, that of the Buffalo, Lockport & Olcott division of the Interurban Traction Company, representing, in a concrete form, the method which has been proved satisfactory after nearly two years upon a single-track line over 30 miles in length, where at times the patronage requires the operation of the largest number of cars possible at a maximum speed of 45 miles per hour.

The timetable submitted with the paper shows the regular running times and in addition the meeting points of cars in heavy type. Each run is numbered, and the timetable indicates for each meeting point the number of the runs which pass at that point. The following rules and whistle signals are also given in the timetable:

RULES

1. A regular train is one shown on timetable and may be run in one or more sections.

All regular trains will display on front and rear dash a red dash sign designating run number by day, and, in addition, a red signal light at night.

When a regular train is run in sections, first train is called first section; following sections being numbered in order.

Every train having another section following must display in addition to its red dash signs and its red signal lights, immediately to the left thereof, a white sign "Car Following" by day and a white signal light at night.

A space at least 3000 feet by day and 5000 feet at night or during foggy weather will be maintained between sections when running at speed, each section to be under full control when rounding curves where vision is obstructed, both distance and speed to be correspondingly reduced when approaching meeting points.

2. An extra train is one not shown on timetable and must not occupy main track except under written order of dispatcher.

Extra train will display on front and rear dash a green dash sign "X" by day, and, in addition, a green signal light at night.

3. Regular trains will meet as shown on timetable, unless written orders to the contrary are received from dispatcher.

When impossible to make meeting point on time motorman will notify dispatcher from first telegraph station.

Motormen whose cars meet at Mill Street, Lockport, or Main Street, Buffalo, will secure a clearance card from operator, unless sure of their own knowledge that the opposing train has arrived.

Red flags and red lanterns will be used for danger signs and for signals at telegraph stations. Motormen must never pass by such signals or semaphores when set against them.

Motormen will invariably compare watches with relief at time of change and must set to agree with dispatcher's clock at Main street or Lockport when passing station on their first trip.

4. When first train arrives at meeting point motorman will run to extreme end of siding (when possible), allowing sufficient room for passing train to clear. Conductor will step off train, examine switch, and, if it is properly set for opposing train will signal motorman on opposing train that track is

clear. Motorman, when approaching meeting point, will bring car to a dead stop before reaching switch, unless he receives a "come ahead" signal from conductor of train on siding, in which case speed will be reduced to four miles per hour while passing over point of switch.

When a train displaying a "Car Following" sign arrives at meeting point motorman will reduce speed to two miles per hour and call the attention of the crew going in opposite direction to the "Car Following" sign by poining thereto and tapping gong.

Motorman, when passing at meeting point, must use extreme care to avoid mistaking an extra for a regular train.

Motorman operating extra train under orders from dispatcher must not attempt to make a siding against a regular unless he can arrive at such siding and get his own train into clear at least five minutes before such regular train is due.

5. Motorman must shut off power and reduce speed when passing over switches and railroad crossings and also observe instructions contained in signs provided and displayed by the company at points on the line.

Motorman when approaching highways and road crossings north of Main Street station must sound his gong 1000 feet therefrom and continue to do so until positive that the road is clear. Instructions contained in "Rules for Trainmen," dated April, 1901, Nos. 27 and 33, will govern when passing over city streets.

6. Main line switches, showing white target by day and white switch light at night, denote that switch is closed and main track O. K. Red target displayed by day and red switch light at night are danger signals and denote that switch is set for siding.

Trainmen must report to dispatcher at once all main line switches found open or unlocked, switch targets defective, switch lights not burning, also any defective rail or obstruction found on the line and liable to cause accident.

7. "Come ahead" signal is given with the right arm in a horizontal position swung forward from the back.

"Stop" signal is given with both arms on a level with shoulder at right angles from the body and dropped to the side. These signs are to be repeated until answered by the motorman tapping the gong twice, signifying that he has seen and understood the signal.

8. The instructions as to the approach and flagging of railroad crossings contained in book "Rules for Trainmen," dated April, 1901, Nos. 23, 29 and 39, will govern, except where semaphores or gates are provided, viz.:

1st. Main Street station.
2nd. South Tonawanda—Eastern Lumber Co. switch.
3rd. South Tonawanda—Buffalo Steel Co.
4th. North Tonawanda—Oliver Street crossing N. Y. C. for north-bound trains only, located at right of track. Right hand side signal governs this company's trains. Derail operating in connection with this semaphore is located 100 feet north therefrom.
5th. North Tonawanda—Oliver Street crossing N. Y. C. for south-bound trains only, located at right of track. Left hand side signal governs this company's trains. Derail operating in connection with this semaphore is located 100 feet south therefrom.
6th. One-quarter mile east of Paynes Avenue, at crossing of N. Y. C., a one-arm semaphore governs our trains. Derail operating in connection with this semaphore is located 100 feet on each side from crossing.
7th. Pendleton Center.
8th. Paynes Avenue telegraph offices.
9th. Mill Street dispatcher's office.
10th. Corwin station telegraph offices.
11th. Charlotteville station telegraph offices.

On all the above semaphores red arm in horizontal position by day and red light at night block our tracks. Arm must be dropped to diagonal position and red light replaced by white before car proceeds.

Flagmen are placed at Goundry, Thompson, Robinson and Oliver Streets, North Tonawanda, to guard crossing. When they display a white flag B. and L. car has right of way; if they display a red flag cars must be brought to a stop. At night, white and red lanterns will be used in a similar manner.

9. A red flag and a red lantern must be carried by motorman on front platform at all times and will be hung in place provided directly over air gauge. Lanterns must be kept lighted at night and during foggy weather ready for immediate use.

The headlight, as well as signal lights, must be lighted at dusk, or when vision is obstructed by fog. Motorman is held responsible for the lights on front end and conductor for those on rear end of train.

10. Extra trains encroaching upon the time of regulars, and regular trains which become disabled in the vicinity of curves or where vision is obstructed, must be immediately protected by conductor (using red flag by day or red lantern at night), proceeding at least 1000 feet in the direction from which danger may be expected.

11. Motorman will run car at reduced speed, with car under full control, expecting to find main track occupied in yard limits, which are as follows:

Buffalo, between International Junction and Main Street.
North Tonawanda, between Goundry Street and Division Street.
Lockport, between west end of long siding and Lockport station.
North Lockport, on Mill Street between Clinton and Mill Street junction, on Gooding Street between Gulf line and Mill Street junction.

12. All trains will be brought to a dead stop before crossing Paynes Avenue junction, Niagara Falls cars having right of way.

13. In case of wreck, or where car is disabled so as to be unable to proceed, motorman will take place of conductor and protect car by flagging as provided in Rule No. 10, the conductor going ahead to next meeting point or nearest telephone from which dispatcher can be notified.

Upon reaching meeting point, should telegraph line be down and telephone not available, conductor will notify crew of waiting car that his run (giving number) is disabled. Car will then move to scene of trouble and push disabled car into first available siding and then proceed, stopping at each meeting point and notifying opposing trains of their action. Crews of cars so notified will then proceed under timetable rights in the same manner as though disabled train had been annulled.

Where telegraph line is known to be down and wreck or derailment occurs requiring service of wrecking crew, conductor and motorman will both proceed in opposite directions to the nearest meeting points, notifying crews of waiting cars, who will then proceed until reaching disabled car, exchange run numbers, transfer passengers around wreck and then return under time table rights, notifying all opposing trains that the wrecked train (giving number) is disabled and should be considered annulled, the meeting point thereafter to be at the point of wreck instead of the nearest meeting point thereto in either direction.

Should the action prescribed in either of the foregoing be taken, notice must be given when passing each station so that information may reach dispatcher at earliest possible moment.

14. Motorman will be permitted to use seat provided except when running within limits of Buffalo, Tonawanda and Lockport.

TRAIN ORDERS

Special orders, directing movement of trains varying from and additional to the timetable, will be issued over the signature of the division superintendent, viz.:

"A" Fixing Meeting Point for Opposing Trains—
"Run 1 and Run 3 will meet at Hinman."
"Run 3 and X car 64 will meet at Paynes Avenue."
"Run 1 will meet 1st, 2d and 3d sections of Run 2 and X car 46 at Pendleton Center."

"B" For Sections of Regular Trains—
"Cars 46-50 and 58 will run as 1st, 2d and 3d sections of Run 1, Lockport to Main Street."

"C" For Extra Trains—
"Car 48 will run X from Lockport to Main Street, keeping out of the way of regular trains."
"Engine 1 will work as an X from 7 A. M. until 2 P. M., March 15, between Lockport and North Tonawanda, keeping out of the way of regular trains."

"D" For Annulling Trains—
"Run 2, due to leave Lockport at 10:20 A. M. March 15, is annulled between Lockport and Main Street."

Dispatchers will endeavor to have train orders copied before the arrival of train at telegraph station. Operators will, where practicable, deliver both copies to motorman on front platform. Motormen will read and understand the order before proceeding. Block must be removed or clearance card secured before train proceeds. Upon approaching block motorman will call conductor to front platform, so as to be prepared to receive train order.

One long blast of the whistle (thus ——) is the signal for approaching stations, railroad crossings and junctions.

Two long, followed by two short blasts of the whistle (thus —— —— — —) is the signal for approaching road crossings.

One long, followed by two short blasts of the whistle (thus — — — —) is the signal to be given by trains when displaying signals for a following train to call the attention of trains of the same or inferior class to the signal displayed. To be answered by two short blasts (thus — —) by opposing trains.

Four long blasts of the whistle (thus —— —— —— ——) is the signal to call in flagman from the north.

Four long, followed by one short blast of the whistle (thus —— —— —— —— —) is the signal to call in flagman from the south.

A succession of short blasts of the whistle is an alarm for persons or cattle on the track.

Whistle must not be used in the cities of Buffalo, Tonawanda, North Tonawanda and Lockport.

SPECIAL RULES

Speed not to exceed 2 miles per hour crossing road at entrance to terminal and going over switches at Olcott Beach.

Speed not to exceed 20 miles per hour over switches and when passing cars must not exceed 15 miles per hour.

Speed must not exceed 2 miles per hour going over switch at junction of Olcott freight track.

Trainmen must not pass any depot on line without looking for signal.

The Most Economical Management of the Repair Shop*

BY CHARLES S. BANGHART

The subject given me for consideration, "The Most Economical Management of the Repair Shop," is one in which I am greatly interested.

The repair work of an electric road, operating twelve or fifteen cars, is, generally speaking, as varied in character as that of a much larger road. But, since it would be impossible for small roads to maintain a repair equipment equal to that of a larger road, much of their repair work must be done outside. I will, therefore, speak of the large road—one which operates from seventy-five to several hundred cars.

In the list of machinery and tools which I have prepared I have aimed to give those which are most generally useful in a repair

*Paper presented at the meeting of the Pennsylvania Street Railway Association, Sept. 10, 1902.

shop. Many small conveniences for the quick and easy handling of the work will suggest themselves and can be added to the equipment.

The machine shop, with its auxiliaries, the blacksmith shop, truck shop and armature and coil room, naturally take first place in repair work. The value of a convenient arrangement of these departments and the proper location of work benches and machinery to give ample working space cannot be overestimated. In a repair shop you never know "what a day may bring forth." A good rule to observe, in this connection, is to take as much room as you think you may need and double it.

A lathe equipment, consisting of one 24-in., one 20-in. and one 10-in. speed lathe, will meet ordinary requirements for that class of work. The large lathe should be provided with crane fitted with chain blocks for the safe handling of heavy work.

One large drill press, 26-in., and one speed-drill press will answer for that class of work.

The other machinery necessary may be listed about as follows:

A good milling machine.

A shaper.

Hydraulic wheel press.

Vertical wheel boring machine.

Power shearing machine.

Power hack saw.

Power thread cutter (right and left).

The grinding work can be done with an emery wheel and ordinary grindstone. There should also be a set of buffing wheels for finishing car and electric fittings. Also a good babbitting outfit. This is essential.

A good arrangement regarding tools is to have a special tool room, in charge of a competent man, and a check system for the purpose of holding workmen responsible for tools drawn.

In the armature room, besides the necessary work benches and armature stands, a binding machine, field winding machine and bake oven are required. At this point I would state that it is an unnecessary precaution to bake armature after rewinding, as in motors of modern type the coils are wound and painted with insulating compound and then dried before being inserted in the core. But the oven is essential for baking armature and field coils.

An overhead trolley with chain blocks is necessary for the proper handling of armatures, also a full outfit for testing work, such as instruments for testing open circuits, and for short circuited coils on completed armatures. Armatures, when completed, should be given an insulation breakdown test of not more than 2000 or less than 1500 volts, alternating current. All armatures should, after being completed, be given the generator test. The system is very simple, and the entire process can be carried on by one man and helper.

The coil department, besides work benches and form holders, should be fitted with taping machine, pair of rollers for flattening leads, a press for pressing completed coils, and tanks for insulating compound for dipping armature and field coils.

The truck shop, besides assembling tools, should have an overhead hand-power crane, with sufficient capacity for the safe handling of motors and truck frames.

The following outfit will do for all ordinary carpenter work: One planer, one resurfacing machine, one jointer, one mortiser, one boring machine, one shaper, one wood turning machine, one band saw, one circular saw, one emery wheel, one grindstone.

In the space devoted to work on car bodies see that there is plenty of room for necessary trestle benches and convenient handling of work. Pit room in this department for half a dozen cars is a necessity.

The paint shop should be constructed so that it will have a good roof light, and the space between the tracks should be such as to allow the work to be done on cars standing parallel and not to crowd the workmen. The floor should be concrete, with smooth surface, so as to be easily kept free from dirt, and graded to be readily drained.

In the maintenance of motor equipments to-day, where almost continuous service is demanded and high mileage made, only those equipments fitted with both oil and grease boxes will safely run over thirty or forty days without a thorough overhauling. With a large road it is necessary to do this work at several different points, but a smaller road can concentrate it.

To overhaul a motor car thoroughly it is advisable to have at each overhauling shop trucks with motors mounted, and in first-class order, ready to run under a car body whose trucks and motors need overhauling. For the purpose of lifting the body from the trucks, four chain hoists, conveniently located, together with two cross-timbers and four stirrup irons, form a good combination, and will do the work with the least possible injury to the car body.

When the car is lifted, the truck to be overhauled is run out, the good truck substituted, car lowered, connected up and turned over to the operating department. The whole operation should take about one hour, and for that length of time only is the use of the car lost. A suitable crane, equipped with a carriage and chain blocks, will be found a great convenience in overhauling.

This department should be fitted with a wheel pit, with necessary jacks, to be able quickly to renew broken and wornout wheels without removing car from the trucks. Motor shells should be thoroughly cleaned out, either by compressed air or kerosene. The grease in grease boxes should be taken out and put in the gear case, and grease box thoroughly cleaned. Brush holders should be taken out, thoroughly inspected and cleaned. At this time you have the best opportunity for truck inspection.

To prolong the life of an equipment and to reduce the number of crippled cars, new fields and newly wound armatures should be put in motors by themselves.

I have found that overhauling done with a car standing over the pits, with the bottom half of motor dropped, does not allow as thorough an overhauling as is necessary to keep the motor equipment in perfect shape, besides tieing up the car body while the work is being done.

In the matter of general inspection a car started out, say, to-day, in perfect order, can run safely for several days without it being necessary to inspect it, with the exception of cars run at high speed on suburban and interurban lines. These should be thoroughly inspected after each day's run.

In this connection, to inspect from twenty-five to thirty cars per day, one man can be responsible for the proper inspection of all trolleys, including the taking out and replacing of any defective poles, wheels or springs and the straightening of all bent poles. Another man should be responsible for the proper inspection of all circuits, together with hood switches, fuse boxes, circuit breakers and lightning arresters. Another should give his whole attention to controllers, while the brakeman and his assistant should be able to keep all brakes in good shape and replace all worn-out shoes. This arrangement of inspection and overhauling should keep the truck and motor equipment in good shape, if the night inspection of carbons, grease and oil boxes be done after an equally thorough system.

At a car house operating seventy-five to one hundred cars three or four men should be able to grease motors, inspect brushes and make small trolley repairs. I recommend doing as little work as possible at night. The night car cleaning should be limited to sweeping and dusting cars and cleaning windows, while all washing should be done during the day. If the cars are of the closed type, with drop sash, the space under the seat should be cleaned once a week.

My experience has been that the "Car Report" system, by which the conductor on housing his car reports it in good shape, or designates some portion of the equipment in bad order, is a great assistance to both day and night inspection and to the shop work in general.

All cars should be taken to the general repair shop once a year and the body thoroughly repaired, and the car varnished or burnt off and painted anew, as the case may demand.

While the car body is in the carpenter's hands the truck should be run out and gone over thoroughly. In case it is a built-up truck all rivets and bolts should be carefully inspected and renewed, where necessary. The brake rigging at this time should be taken apart, and if it is a truck with brake beams working in slides, the beams should have what we call "Dutchmen" jumped into the ends, to bring the wearing parts back to their original thickness, as the beams will probably have worn wedged shaped. If the brake beams are hung by links these should be renewed if they show any sign of wear.

At this shop should be concentrated all classes of repair work. It pays all railway companies operating fifty or more cars to make their own repairs on electrical apparatus, including the making of armature coils and renewing of commutators. Regarding the latter we find that the dropped forged bars make the best commutators. Most roads will find it cheaper to buy the ordinary repair parts to controllers, hood switches, etc., and assemble them themselves.

I would advise that car body repairs—painting, rewinding armatures, making commutators, armature and field coils—be made by piece work. If good inspection is provided and the prices honestly matched, both the company and its employees are gainers by this method.

There are two more things which I think very essential to the economical maintenance of car equipment: First, that all material of any consequence be bought by specification, subjected to a rigid chemical and physical test. Second, that the employee who operates the equipments be properly instructed and schooled in handling them.

The Track Construction of Suburban and Interurban Electric Railways*

We have two systems of suburban and interurban electric railways now in operation—the one constructed upon the public highway, and the other through private property; each has its advantages and disadvantages. The adoption of each depends largely upon local condtions.

In locating and building a railroad, be it steam or electric, it is not only the engineer's province to give the investor the best for the least money, but he must also think of the manager, and consider fully the safety and economy of operation and maintenance.

In the public highway system the engineer starts out to build a railway under the supervision of not only his own employer and the local civic authorities, but also of every resident along its route, and in a short time he runs up against a mass of grievances in number almost as great as the number of residents. If he is not a successful diplomat he finds himself trying to build a sectional railway, differing radically in many parts from his original well-thought-out plans, or else he encounters the broken link in his system with exasperating delays in the courts or in attempts to effect compromise before he secures a completed roadway; but we had better start to build our road and leave these generalities to the manager.

A preliminary survey of the highway is necessary, to get a proper conception of the grades and alignment, and in projecting a location on this information it is frequently advisable to make many minor changes in the original roadway in order to avoid many small "kinks" in surface and line, and by judicious management with the local authorities this can be frequently accomplished. These changes may slightly increase the first cost of construction, but are justifiable.

In the construction of a railway through private property much more judgment is required of an engineer than is necessary in building one upon the fixed line of a public highway, and more time should be accorded him in making a location than is generally given, principally for the reason that after the rights of way have been secured it is very difficult to make such revisions as subsequent developments may require or make desirable.

In securing rights of way care should be taken that a width is adopted which will not only protect your roadbed but also afford sufficient material for future repairs.

In the selection of a general route by the projectors of a road is where the engineer often encounters his greatest drawback to making a good location. The practice of the investor, as a rule, is to seek the poorest land on a farm for his railroad, at the sacrifice of his roadbed, under the impression that it cheapens the cost of the right of way, whereas my experience has been that the land occupied by a railroad is, in the eyes of the average farmer, "the best on the farm," his price being fixed on this basis, and very often where money may be saved on land damages, it entails much additional cost in the construction and future operation and maintenance of the road.

In making a location it is advisable to keep away from bottom lands in the vicinity of long, tortuous water courses and territory of rapid water sheds, as in such localities you find that it is necessary to erect many bridges, that material for embankments is very scarce, and that the roadbed, especially light embankments, will be in constant danger of wash from high water and sudden downpours of rain, forming rapid and uncontrollable floods.

Another thing to be avoided, wherever practicable, is a sharp curve in or at the foot of a heavy descending grade. This combination is the fruitful source of many accidents, as is so frequently attested by newspaper accounts of accidents caused by runaway cars.

Long, straight lines or tangents are with many the great desideratum, and frequently to gain this end sharp curves are resorted to, whereas by the introduction of some additional lighter ones those with very short radii might often be avoided, and when the factor of safety, together with the wear and tear of roadbed and rolling stock are considered, relative economy results. The same rule applies to heavy grades, which should be avoided wherever practicable. It is much better to spend a little more money once to make the cuts a few feet deeper and the banks a few feet higher, than to be constantly spending it for additional power to climb excessive grades. In general, simply because electric cars can be operated around sharper curves and over heavier grades than steam cars does not imply that these are desirable things to have in an electric railway.

In constructing the roadbed, the cuts should be made wide enough, say a minimum of 15 ft., to admit of a ditch along either side of the track, to keep water from the ends of the ties.

The embankments should be of sufficient width to support the ballast under the ties and leave room beyond, on either side, for examining or "jacking up" a car, should the running gear or machinery become disabled while running on the same; a minimum width of 13 ft. should be maintained upon all embankments. The slopes of both cuts and embankments should be made sufficiently flat to resist the erosive effects of the elements.

Should it be necessary to construct an embankment through marshy ground that cannot be drained it will pay to make it of stone, if available, but, if this cannot be had, the next best plan is to cover the ground to the full width of the embankment, including the slopes, with a thick mattress of brush and build the embankment upon it; this will force the water out of the ground and secure a firm foundation.

In bridge work the masonry should be put up in a substantial manner, not necessarily of expensive cut work, but with an eye to solidity. Especial care should be taken to make the foundations broad enough to sustain the load to be carried, and deep enough to resist the action of frost and of abrasion or undermining by the periodical visitations of continuous high water and sudden floods. Should quicksand be encountered in foundations it is best to bridge the same with a cement concrete floor; in fact, I prefer making all foundations of concrete, giving ample time for the cement to set and harden before building upon it. In the point of durability stone or concrete arches, steel or iron superstructure and wooden construction rank in the order named, the use of either depending largely upon local conditions and the amount of available funds.

Cast-iron pipe drains can often be used to advantage and with economy, but when you have decided upon the size of pipe to use at any point, don't fail to put one in of double its capacity, and under no circumstances use any of less than 12-in. diameter.

A thorough system of drainage should be adopted for all roadbeds, not one which will concentrate the water upon your right of way and carry it along for an indefinite distance, as is often done in borrowing material for embankments out of ditches along and against its sides, but such a system as will provide ample openings at frequent intervals to carry across, if necessary, and away from the roadbed, all water wherever intercepted before it accumulates into large destructive volumes. All roadbeds should be so constructed as to admit of placing of 6 ins. of clean gravel or broken stone ballast under the ties for the promotion of sub-drainage and for tamping the ties to a firm and elastic bearing, from the ends to about 10 ins. or 12 ins. inside the rail bearings, the middle of the tie repairing untamped.

The ties should be placed 2 ft. apart between centers; they should have a top and bottom face of 8 ins., a depth or thickness of 6 ins., and be not less than 7 ft., preferably 8 ft., long. They should be made of sound white or rock oak timber, if it is available, on account of its wearing qualities and its tenacity in holding spikes, but other woods, such as white chestnut or spruce pine, if seasoned, must be substituted when the white oak cannot be obtained. The rails should be of a weight corresponding to the rolling stock and service required, but no mistake has ever been made in using a too heavy rail. The weight of new rolling stock, according to present practice, never lessens after a road has been put in operation, and it is very difficult to keep a track in even fair surface or line when the rails begin to depress between the tie bearings.

The joints of rails should be made as strong as possible, splice plates, called "the continuous rail joint," giving the most rigid construction. The joints proper, or the ends of the rails, should come between ties, with good tie bearings under the ends of the splice plates.

The rails should be laid with broken and not even or opposite joints to prevent the double hammer on the joint ties, which the latter method produces, and which, in time, gives a slight downward bend to the end of each rail that can never be removed; hence, rough riding.

I know engineers and managers frequently disagree upon the policy of "even" or "broken" joints, but I am willing to take my own experience with steam road work and that of old track repairsmen to back up my position on this point, whether a T or girder rail is used. "Special work" should be the best obtainable, long radii being always used on the switch ends in preference to the quick, jerky, short leads and points one often sees, and the best efforts should be put forth in securing dry and uniformly firm beds throughout the full length of the frog and switch pieces to eliminate as much as possible the tendency to wear out in spots.

In order to maintain the proper gage in the girder rail construction, the rails should be braced at about every fourth tie with the outside "pressed steel braces;" the reason for my preferring

*Paper presented at the meeting of the Pennsylvania Street Railway Association, Sept. 10, 1902.

this kind being that the weight of the car on the rail assists the brace in doing its work, there is no obstruction in the track to interfere with paving and there are no screw threads to rust out or nuts to become loosened as with the tie-rod.

Concealed joint bonding I consider the best for a track and the least liable to be loosened by vibration or careless interference by trackmen at their ordinary repair work, as well as affording protection against robbery, yet the utmost care should be exercised to secure a clean and full contact in the barrel of the hole in the rail, and such bond should be selected as would best produce this result. Rivetting or bolting against the face of the web will retain contact about as long as it takes to attach the bond, for vibration will very soon cause the harder metal to compress the softer, and thereby destroy the contact. Cross bonding and bonding around special work should be as carefully done as the joint bonding using well-tinned copper for the purpose, and the lines of wire should be carried down and buried in the sub-grade to protect them against the midnight prowler and careless repairsmen; but this work belongs rather to the electrical than the civil engineer, and I'll turn the subject over to him.

At road crossings, excepting those with long skews, I would dispense with the use of wood or plank, substituting a length of rail on the inside of each running rail, to form a groove for the wheel flange, and packing the space inside and outside the track with broken stone, covered with screenings, or, if this cannot be obtained, with gravel and sand.

On all curves of less than 500 ft. radius, I would recommend, for safety, the use in T-rail work of a guard rail along the inner running rail, and bolted to it in like manner to the guard rail of a spring frog; this will give the assistance of the weight of the car on the running rail to hold the guard in place instead of depending entirely on spikes for that purpose. Grooved rails should be used in girder work under similar conditions.

The outer rail of curves should be given sufficient elevation to overcome the centrifugal force generated by the highest rate of speed which the cars are capable of developing, in order to protect the passengers as well as the company against the careless or indifferent motorman, who tries to make up lost time without consideration for possible consequences, yet, there may be unavoidable parts of the roadbed where "slowing up" is essential to good running, and managers should never be lenient with discipline in dealing with a motorman who disregards instructions covering such points.

After the track is laid, tamped and surfaced, the space between the ties, to the top of the same, should be filled with broken stone, gravel or sand, materials which retain the least moisture, to hold the track in rigid position and prevent the shifting about which always results when this space is left open.

For safety, all private rights of way through pasture lands should be fenced, and cattle guards should be placed at all road crossings, even though they are not absolutely effective, in order to reduce to a minimum the danger from roving cattle, particularly on high-speed roads.

The proper section of rail to use where no paving is to be done is unquestionably the T, but in cities and towns where much wagon travel parallel to the track is encountered, and where special work is necessary in a wagon road, it is essential to use the girder, and this should be deep enough to dispense with the use of chairs wherever possible.

All tracks in cities should be paved inside and outside the rails to the limits of the ties, and this paving should consist of a material and be so shaped as to shed water as rapidly as possible, to prevent it seeping through to the ties.

To insure this result it is best to cover the bed and ties with a cement concrete base, tamped in well against the web of the rails, which will not only keep the moisture from the ties but also, by giving a uniform and firm foundation to the paving surface, materially prolong the life of the whole roadway. If good material and workmanship have been put into the track, and it has been properly ballasted, the most improved and lasting pavement is, with time consideration, the most economical to lay.

With the "Right of Eminent Domain" accorded the steam road charter, which should also be extended at least to the interurban electric road, it is possible to build an electric road capable of being operated safely and successfully at any rate of speed to which the electric system of the future may be developed.

It has become necessary for the Northern Ohio Traction Company to announce, through the newspapers, that it will not be responsible for hats blown from the heads of passengers while on its cars. The claim agent of the company has recently received several demands for new hats from people who claim to have lost their headgear while enjoying trolley trips on the company's lines.

Exhibits at the Caldwell Convention

Several supply houses and manufacturers were represented with exhibits at the Caldwell convention, although no organized effort was made to present an elaborate display of railway apparatus. The following is a list of some of the companies exhibiting:

The Consolidated Car Heating Company, of Albany, exhibited a car heater, in charge of F. C. Green and C. S. Hawley.

The General Electric Company's exhibit comprised line material and overhead supplies. It was represented by F. H Gale, J. G. Mahoney and W. R. Darly, of the New York office, and W. G. Carey, of Schenectady.

Heywood Bros. & Wakefield had a car seat on exhibition, in charge of Bertram Berry.

H. K. Doolittle, of Watertown, exhibited his patented car window, which can be taken out and replaced without taking apart the sash.

The Brady Brass Company, represented by Daniel Brady, Fred. C. Cameron and C. P. King, showed a line of motor bearings, car bearings and trolley wheels.

The Continuous Rail Joint of America was represented by William C. Chapman, who showed a joint illustrating the company's product.

The Ohmer Car Register Company, of Dayton, had on exhibition a cash register. William F. Briedenbach was present in the interests of this company,

The Detroit Trolley & Manufacturing Company's exhibit comprised a ball-bearing trolley base, in charge of W. L. McDonald.

Harold P. Brown was represented by J. Maxwell Coots, who exhibited the flexible copper bond.

The Gold Car Heating & Lighting Company displayed heaters and switches. The exhibit was in charge of J. G. Schmidt.

The Hale & Kilburn Company showed sample plush and rattan seats. S. A. Walker represented the company.

The Atlas Railway & Supply Company showed rail joints. J. G. McMichael was in charge of the exhibit.

R. W. Conant, of Cambridge, Mass., had new motor-testing and bond-testing instruments. The motor tester is a very simple device, with which no disconnecting of motors is necessary for use. If any portion of the field is short-circuited the instrument will detect and locate it, so that it is necessary to remove only the damaged spool. The bond tester can be operated by one man, is portable and self-contained, with no delicate moving parts to get out of order.

Merger at Springfield, Ill.

The proposed plan of organization of the Springfield & Central Illinois Railway Company, incorporated in Illinois two weeks ago, is announced. The company was formed with power to acquire and operate the Springfield Consolidated Street Railway and to construct and operate lines of suburban railways radiating from that city. The company is to be capitalized at $1,500,000. The outstanding bonds of the Springfield Company to be assumed amount to $750,000. There is to be a new issue of 5 per cent bonds amounting to $2,250,000. Seven hundred and fifty thousand dollars of the proceeds of the bonds and stock are to be held by the trustee for the purpose of retiring the Springfield Company's bonds. To acquire the Springfield stock, $562,500 will be spent. To build and equip new lines and purchase additional equipment and make improvements, $600,000 will be necessary. In the treasury, $337,500 will be retained.

Reports of Consolidation in Michigan

It is reported in Detroit that plans are being arranged for consolidating all the electric railways in the lower peninsula of Michigan, excepting the Detroit United Railway, the Toledo & Monroe Railway and the road now under construction from Monroe to Detroit by the Black-Mulkey interests. The roads to be taken over, it is said, are the Detroit, Ypsilanti, Ann Arbor & Jackson Railway, the Grand Rapids, Grand Haven & Muskegon Railway, the Holland & Lake Michigan Railway, the Battle Creek & Kalamazoo Railway, the city lines of Grand Rapids, Lansing and Ann Arbor, the city lines in Saginaw and Bay City and the interurban between the two cities. J. D. Hawks and S. F. Angus, of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway, who have in the past so stoutly refused to consider offers for the purchase of this road, are said to be interested in perfecting the consolidation, and a prominent New York banking house is said to be associated with them.

Strike on the Hudson Valley Railroad

The first Hudson Valley trolley car to reach Ballston from the north in seventeen days arrived on the afternoon of Sept. 15. On the same day cars were sent out on several divisions, all well guarded, but there was no trouble, and it is thought that the strike will soon collapse.

More than the usual amount of interest has been taken in this strike owing to the recent convention at Caldwall of the New York State Street Railway Association. Several misleading paragraphs as to the causes which lead to the abandonment of the work by the employees of the company last month have been published in the New York daily papers and elsewhere, and it may not be generally known that the cause of the strike was the discharge of two employees who had occasioned accidents and was not due to a dispute as to wages. Thoroughly to understand the situation it should be said that on May 16, 1902, the company entered into a written agreement with its employees, of which the following is a copy:

MEMORANDA OF AGREEMENT, made this 16th day of May, in the year one thousand nine hundred and two, between the Hudson Valley Railway Company, of Glens Falls, Warren County, New York, party of the first part, and the Amalgamated Association of Street Railway Employees of America, Division 132, located at Fort Edward, New York, party of the second part.

WITNESSETH:—Sec. 1. The party of the first part, through its properly accredited officers will continually treat with the employees of Division 132, of the Amalgamted Association of Street Railway Employees of America, of Fort Edward, N. Y., through their properly accredited officers.

Sec. 2. Any man who may be suspended or discharged shall be entitled to appeal from the General Manager to the Executive Committee of the Company, and to have a hearing by that Committee, and all suspensions or dismissals shall be subject to reversal by the Executive Committee of the Company.

Sec. 3. The party of the first part will pay all employees for lost time when they have been suspended by an officer or appointee of the Company and are reinstated.

Sec. 4. All conductors and motormen shall be members of Division 132, of the Amalgamated Association of Street Railway Employees of America, of Fort Edward, N. Y.

Sec. 5. The party of the first part hereby agrees to pay all conductors and motormen who have not worked consecutively for the Company two years or over 16 cents per hour; all conductors or motormen who have worked for the Company two years or more consecutively, 18½ cents per hour. To this amount conductors and motormen who run interurban passenger cars are to be paid in addition to the above wages 25 cents per day for inspecting their cars before they are taken out on the road to insure their being in proper condition in all respects, except in the case of such conductors and motormen as are paid 18½ cents per hour, and in each instance 15 cents per day shall be added to the wages of such employees. Engineers, pitmen and steam fitters to have 10 cents per day in excess of present wages. Blacksmiths $1.85 per day. Firemen 16 cents per hour. Battery men 16 cents per hour. Machinists 21 cents per hour. Barn men and pitmen's helpers 16 cents per hour. Laborers 15 cents per hour. All time on cars to be paid for whether cars are moving or not.

Sec. 6. All regular or day trips shall be ten hours, as near as possible, said ten hours to be worked within twelve consecutive hours, if practical. Runs 6 and 7 on the Glens Falls Division to be made day runs. The oldest men on all divisions to have the preference of runs. All timetables shall be posted a reasonable length of time before taking effect.

Sec. 7. The party of the second part agrees that in consideration of the several agreements herein contained to be performed by the Company that the members of said Division will discharge their respective duties in an efficient, faithful and skillful manner until July 1, 1903, at the scale of wages above enumerated, said scale of wages to take effect June 1, 1902.

Sec. 8. No employee shall be dismissed upon the unsupported testimony of one inspector.

In witness whereof, the parties hereto have hereunto set their hands and seals the day and year first above written.

Hudson Valley Railway Company,
By Addison B. Colvin, President.

Witness, H. E. Smith.

Amalgamated Association of Street Railway Employees of America, Division 132, of Fort Edward, N. Y.
By D. H. Hall, President.

Witness, W. W. Brown.

It should also be stated that since April 26 of this year the company has had a number of unfortunate accidents on its lines. In these accidents five persons have been killed, some ten or twelve limbs have been broken, about seventy people have suffered various injuries from broken ribs to broken backs in addition to the limbs above mentioned, and twenty cars have been smashed. The company has already paid about $12,000 in damage claims, suits are pending against it for upward of $100,000 and about twice as much as that has been threatened.

With this condition of affairs the board of directors of the company, believing that something should be done to protect the lives of the public traveling upon its cars, as well as its property, after considerable investigation employed F. A. Boutelle as general superintendent. Mr. Boutelle, at the time of his appointment, had been in charge of the train despatching of the Susquehanna division of the Delaware & Hudson Railroad Company for the past sixteen years and trainmaster for two years, and his record for safe and conservative management and avoidance of accidents was his chief recommendation. Mr. Boutelle was employed to have exclusive charge of the operation of cars and the men engaged in their movement.

Various complaints had been made by the men as to dismissals prior to Mr. Boutelle's incumbency. On Aug. 16 Mr. Boutelle and a committee of the motormen and conductors went over the entire list of grievances they had and adjusted the whole matter up to date. Among the things which Mr. Boutelle did at the request of the men was to put back into the service of the company a motorman named Fulton who had been previously discharged for the negligent running of his car. On this date it was stated by the men that all grievances had been satisfactorily adjusted.

On Aug. 21 this same motorman, Harry Fulton, was the cause of a collision which occurred on Lincoln Avenue, near Hamilton Street, in the village of Saratoga Springs, and after a written report had been made to Mr. Boutelle by Motorman Fulton and the inspectors, conductors and passengers on both cars Mr. Boutelle discharged Fulton, sending him the following notice:

Glens Falls, N. Y., Aug. 26, 1902.

Harry Fulton, Esq., Saratoga Springs, N. Y.

Dear Sir:—My conclusions in the matter of the collision at Saratoga, on the 21st of August, are that you were guilty of inexcusable carelessness on that occasion, and are alone at fault for the accident. You are, therefore, advised that your services are no longer required.

F. A. BOUTELLE, Superintendent.

On the same day, Aug. 21, a collision occurred at a place called Smith's Crossing, south of Fort Edward, in which an express car operated by Howard Osgood as motorman, running as second section, ran into the rear end of a passenger car. Mr. Boutelle investigated this accident, taking the written statements of the passengers and employees on the car, as well as personally examining Mr. Osgood and hearing his explanation of the cause of the collision, and believing that his conduct was grossly negligent Mr. Boutelle discharged Motorman Osgood, sending him the following communication:

Glens Falls, N. Y., Aug. 25, 1902.

Howard Osgood, Esq., Stillwater, N. Y.

Dear Sir:—After careful inquiry into the circumstances of the collision at Smith's Crossing, on the 21st inst., I am convinced that you were guilty of gross carelessness in following the regular car too close in approaching the crossing where the first section might be expected to stop without having your car under control. The point at which the accident occurred I consider one where the greatest care should have been observed, and I can find no excuse for exercising clemency in this case. You are, therefore, advised that your services are no longer required.

F. A. BOUTELLE, Superintendent.

On Aug. 28, 1902, a committee of the motormen and conductors called upon Mr. Boutelle and served him with a notice, of which the following is a copy:

Division 132.

Meeting is called to order and the following resolution is adopted:

That we, as a Committee, having heard our brothers state their grievances, and have taken a vote, decide that they were discharged without cause, and, we, as a committee, supported by our brother workmen, demand that our Brothers Osgood and Fulton be reinstated on or before the following Friday, at 6 o'clock p. m. Said reinstatement to be in their old positions and with their former badges, or that we as a body, as one man, shall refuse to operate cars on any division of the Hudson Valley Railway Company.

(Signed) M. Frost, L. Williams, William Burritt, E. Bailey, J. Gorman, D. Sadler, L. Myers, Leroy Vede, C. Murray, J. Malin, S. King, W. Haynes, George Demorest.

To this Mr. Boutelle replied as follows:

August 28, 1902.

M. F. Frost, President Division 132, Amalgamated Association of Street Railway Employees of America, of Fort Edward, Glens Falls, N. Y.:

Dear Sir:—Confirming my statement made to your committee this morning, made verbally at the time, I desire to say that I regret my inability to see just and sufficient cause for reversing my decision in the case of Osgood and Fulton, discharged by me. After investigation of their offenses it is my honest belief that the Hudson Valley Railway Company, who has the lives of the traveling public entrusted to their safe keeping, cannot afford to overlook the serious offenses of these former employees. The argument advanced by your committee that such offenses have been overlooked in the past has no bearing whatever on these cases. It is a matter of public record that serious inexcusable accidents have happened on the lines of this Company in the past few months, resulting in the loss of life and great expense. It is to avert a recurrence of such unfortunate affairs that I have been placed in charge of the operation of the cars of this Company and the employees operating said cars. This decision, as far as I am concerned, is final, but is, as you know, subject to revision by the Executive Committee of this Company by your appeal, as contract with this company provides.

F. A. BOUTELLE, Superintendent.

The employees met at Mechanicsville Friday evening, Aug. 29, and without availing themselves of the privilege given by the contract permitting appeal to the executive committee, which was

called to their attention in Mr. Boutelle's letter, ordered this strike.

The position that the executive officers of the company has taken is that the cars must be operated with safety, that accidents and collisions must be stopped and the rules and regulations of the company providing for the safety and convenience of the public enforced, otherwise it would be much better that cars should not be run. The unfortunate record of the summer is most appalling.

Since the strike was ordered on Saturday morning, Aug. 30, 1902, every possible effort has been made on behalf of the company to reach an amicable adjustment of the differences between the company and its former employees consistent with the question of public safety and convenience. Various attempts have been made by the men to get away from the cause of the strike, as enumerated by them in their notice, and they have undertaken to bring in and make an issue of the strike the question of wages. In this regard the company's position has been that the contract with the men above set forth, which provided in detail the wages to be paid until July 1, 1903, and which provided that the men should work "in an efficient, faithful and skillful manner" until that time, controlled that question and it was not open for discussion or argument. It is true that a disagreement arose as to the payment of wages of firemen under the agreement of May 16. As to this, during the progress of negotiations the company offered to arbitrate the question, leaving it to the committee of its former employees who had adjusted the rate of wages to be paid at the time the contract was entered into, and finally to effect a settlement offered to waive any question there was in the matter and pay the rate of wages to the firemen which they had claimed was due them under the contract. The company, as a last step, offered to arbitrate the question of the dismissal of Mr. Osgood, the Fulton case having been abandoned by the men, but this was refused.

As will be seen, there is no question at issue in the strike as to "union" or "non-union" or as to the wages paid any of the former employees. That was settled by the written agreement of May 16 and was as binding on the men as it was on the company. The only question at issue and upon which the company stands is the right to enforce discipline and operate its cars in such a manner as to avoid accidents and protect the lives of the public riding on its cars. It is needless to say that in this it should have the active support of every citizen along the line.

Test of 300 H. P. Turbine Dynamo

Dean & Main, the well-known mechanical and mill engineers of Boston, at the request of the De Laval Steam Turbine Company, of New York, recently made some tests of a 300-brake tip De Laval steam turbine, at the company's factory in Trenton, N. J. In view of the great interest taken at present in the subject of turbines some results of the test are given below.

The De Laval steam turbine was described in the STREET RAILWAY JOURNAL for Nov. 2, 1901, and, as will be remembered, regulation of speed is accomplished by a throttling valve, operated by a centrifugal governor. The machine tested had twelve nozzles, but seven gave the rated capacity. In connection with economy of steam and the ability to throw nozzles into and out of action, it is at once apparent that each nozzle performs its function as perfectly when operating alone as when any other number of nozzles is in operation. For this reason the turbine does not change its economy of steam per indicated horse-power, if such could be determined, as does a reciprocating engine. The principal cause of diminished economy with lighter leads than the rated load is the fact that friction is constant with all loads. At overloads there is even greater economy than with the rated load for the reasons that the extra nozzles are of maximum economy and the friction losses are constant.

The turbine rotates very rapidly, and the speed is reduced by the employment of a spiral spur pinion on the turbine shaft gearing into one or two spiral gears, as the case may be, depending upon whether the power is desired on one or two shafts. The pinion and gears are both double, with the teeth inclined in opposite directions so that there will be no end thrust to either shaft.

The power, the measurement of which was desired, was the brake-horse power of the turbine, as it might have been measured by some form of friction brake simultaneously applied to each shaft on which the electric generators were secured. For this purpose the generators might have been disconnected by means of a flanged coupling in each shaft, but as the electrical power was needed for operating the shop, the generators were used and their efficiencies determined for each load carried. The friction of generators was determined by driving them as motors by another generator. Other resistances were computed by well known methods and under the actual conditions of temperature, speed and output. Into these features of the tests this report does not enter, as the steam consumption per brake-horse power only is desired. The computations for powers, efficiencies and brake-horse powers were made by Messrs. Stone & Webster, of Boston, and by the De Laval electrical engineer.

No tests were made to ascertain the instantaneous effect in speed of change of load or to see how quickly the normal speed was regained after a change. In regard to the permanent effect of change of load on speed, this can best be observed from the data given in the tables or results forther on. The speeds and loads are here tabulated for convenience with percentages of variation of load and speed referred to these with eight nozzles in operation.

TABLE OF DIFFERENT LOADS AND SPEEDS
(When using superheated steam except with three nozzles.)

Nozzles open	Loads	Relative Loads	Speeds	Differences in Speed
	H. P.	%	R. P. M.	
8 Nozzles	352	100	750	....
7 "	298	85	756	+ 8/10 of 1%
5 "	196	56	745	+ 7/10 of 1%
3 "	119	34	751	+ 1/10 of 1%

TABLE OF RELATIVE STEAM CONSUMPTIONS FOR DIFFERENT LOADS, PER BRAKE HORSE POWER

Nozzles Open	Loads B. H. P.	Relative Loads	Steam per Brake Horse Power	Increase for Diminishing Loads, Referred to Maximum Load
Superheated Steam	H. P.	%	Lbs.	%
8	352	100	13.94	....
7	298	85	14.35	2.9
5	196	56	15.53	11.4
Saturated Steam				
8	333	100	15.17	....
7	285	86	15.56	2.6
5	196	59	16.54	9.0
3	119	36	16.40	8.1

By comparing the results of the tests with superheated and saturated steam, the saving by the use of the former can be determined for the particular amount of superheating existing. As the tables show, the superheat steadily diminished as the load became lighter. This was caused by the fire and draft being very light with the lighter loads. The superheat for the eight-nozzle load averaged 84 degs. F., while that for the five-nozzle load only averaged 16 degs. F. There is, therefore, scarcely any propriety in making a comparison for the effect of superheat, except with eight and seven-nozzle loads.

TABLE SHOWING THE SAVING BY THE USE OF SUPERHEATED STEAM FOR EIGHT AND SEVEN-NOZZLE LOADS

No of Nozzles in Use	Amount of Superheat	Load with Superheated Steam	Load with Saturated Steam	Steam Used per Brake H. P. with Superheated Steam	Dry Steam Used per Brake H. P. with Saturated Steam	Saving by Use of Superheated Steam
	F.	H. P.	H. P.	Lbs.	Lbs.	%
Eight	84°	352	333	13.94	15.17	8.8
Seven	64°	298	285	14.35	15.56	8.4

In all of the statements made in this report of the consumption of superheated steam, the actual consumption without reduction to dry saturated steam as a standard is given. This is customary, while with the results by saturated steam the moisture is deducted.

THE RESULTS WITH SUPERHEATED STEAM

Nozzles Open	Hour	Steam Used Per Hour	Pressure Above Governor Valve	Pressure Below Governor Valve	Vacuum	Superheat Above Governor Valve	Revolutions per Minute of Generator	Brake Horse Power	Steam Used per Brake Horse Power per Hour
		Lbs.	Lbs.	Lbs.	In.	F.			Lbs.
8	8—2	4,906	207.0	198.5	27.2	84°	750	352.0	13.94
7	2.10—4.10	4,282	207.4	197.0	27.4	64°	756	298.4	14.35
5	8.45—11.45	3,033	200.7	196.6	27.5	16°	743	196.5	15.44
5	1.45—4.45	3,062	202.4	197.7	27.4	16°	747	196.0	15.62

THE RESULTS WITH SATURATED STEAM

Nozzles Open	Hour	Feed Water Weighed per Hour	Condensation from Separator	Moisture in Steam at Throttle by Calorimeter	Dry Steam Entering Turbine	Pressure Above Governor Valve	Pressure Below Governor Valve	Vacuum	Revs. per Minute of Generator	Brake Horse Power	Dry Steam Used per Brake Horse Power per Hour
		Lbs.	Lbs.	%	Lbs.	Lbs.	Lbs.	In.			Lbs.
8......	8.15-12.15	5,288	70	2.15	5,052	206.4	196.9	26.6	747	333.0	15.17
7......	12.45-2.45	4,567	60	2.15	4,430	207.3	196.5	26.6	746	284.8	15.56
5......	3-5	3,351	51	2.15	3,229	207.6	195.8	27.35	751	195.2	16.54
3......	6.35-9.35	2,026	38	2.15	1,950	201.5	197.9	28.1	751	118.9	16.40

All barometer readings are reduced to 32 degs. F.

The Annual Convention of the Pennsylvania Street Railway Association

The annual convention of this association was held at York on Sept. 10 and 11 and there was a large attendance. Among the street railway systems represented were those of Harrisburg, Lebanon, Reading, Wilkesbarre, Williamsport, York, Chester, Holmesburg, Wilmington and Trenton. There was also a good-sized attendance of supply men.

The convention was called to order at the York Country Club at 1:30 p. m., and in the absence of the president, John A. Rigg, Henry C. Moore was elected chairman of the meeting. Hon. M. B. Gibson, Mayor of York, was then introduced and delivered an address of welcome, which was responded to by Mr. Moore. Two papers were then read, as follows: "The Most Economical Management of the Repair Shop," by Charles S. Banghart, superintendent of repair shops of the United Traction Company, of Reading, and "The Track Construction of Suburban and Interurban Electric Railways," by S. S. Hoff, civil engineer, of Reading. These papers are published elsewhere in this issue.

After the reading of the papers the association proceeded to the election of officers, and the following were elected: President, E. H. Davis, of Williamsport Passenger Street Railway Company; first vice-president, Edward Bailey, of Harrisburg Traction Company; second vice-president, W. W. Greist, of Conestoga Traction Company; secretary, Charles H. Smith, of Lebanon Valley Street Railway Company; treasurer, W. H. Lanius, of York Street Railway Company; executive committee, E. H. Davis, C. H. Smith, B. F. Meyers and John A. Rigg.

At the close of the convention, about 4 p. m., the attendants were invited to take a trolley ride to Windsor, a distance of about 10 miles, after which the return to the hotel was made. In the evening a banquet was given at the York Country Club, at which Mr. Bragg, of the Westinghouse Company, presided as toastmaster, and a number of speeches were made.

On Thursday morning, at the invitation of the York County Traction Company, a very pleasant trip was made over the Western Maryland Railroad to Gettysburg. The delegates left the hotel at 9 o'clock in the morning and arrived at Gettysburg about 10:30 a. m., where carriages met the party and the members were driven over the first day's battlefield, and all points of interest were pointed out by well-informed guides. After luncheon at the hotel carriages were again taken and the party was driven over the second day's battlefield and then over that of the third day. Altogether the trip was most enjoyable, and President W. H. Lanius, of the York County Traction Company, who was the host of the occasion, and the other gentlemen connected with the company in attendance—Messrs. Hearsh, Schmidt, Mayer and Mellinger—were tireless in their efforts to make the meeting a successful and pleasant one to all. The York meeting will long remain a most pleasant memory in the minds of those who attended it.

Brooklyn Tunnel Contract Signed

At the meeting of the Rapid Transit Commission last week the contract for the building of the subway between this city and Brooklyn was signed. Under its terms the Belmont-McDonald Company agreed to build the tunnel for $2,000,000, with an additional $1,000,000 for terminal facilities. The contract provided for the giving of $1,000,000 security for the proper construction of the tunnel and $1,000,000 for security for the operation period of the contract. Mr. Belmont discovered that the surety companies, apparently as the result of an understanding between themselves, demanded a very high premium, so he deposited city stock with the Comptroller as security for the satisfactory carrying out of the operating part of the contract. For the construction security a certified check for $1,000,000 was deposited. Chief Engineer William Barclay Parsons is at work on plans for the building of an extension from Forty-Second Street up the east side of the city and for a short line up Broadway from Fourteenth Street to Forty-Second Street. The commission received petitions from people living in the Fordham and Williamsbridge districts asking that the subway should be extended from the present limit north through Jerome Avenue. Chief Engineer Parsons was instructed to prepare the necessary plans for this line. In making the motion Mr. Grout said that the city would have a substantial sum to spend on subways next year and he desired all the preliminary work to be pushed forward so that the contracts could be awarded promptly.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED SEPT. 9, 1902

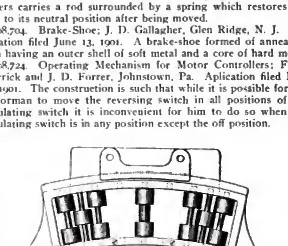
708,523. Swivel Truck for Vehicles; F. Burger, Fort Wayne, Ind. Application filed Feb. 20, 1901.

708,559. Trolley Pole; C. D. Jenney, Indianapolis, Ind. Application filed Dec. 8, 1900. The lower end of the pole is formed by a coil spring which enters a bowl-like socket, affording it support in all directions.

708,601. Roller Side Bearings; J. C. Wands, St. Louis, Mo. Application filed Nov. 8, 1901. The box carrying the anti-friction rollers carries a rod surrounded by a spring which restores the box to its neutral position after being moved.

708,704. Brake-Shoe; J. D. Gallagher, Glen Ridge, N. J. Application filed June 13, 1901. A brake-shoe formed of annealing iron having an outer shell of soft metal and a core of hard metal.

708,724. Operating Mechanism for Motor Controllers; F. A. Merrick and J. D. Forrer, Johnstown, Pa. Aplication filed Feb. 12, 1901. The construction is such that while it is possible for the motorman to move the reversing switch in all positions of the regulating switch it is inconvenient for him to do so when the regulating switch is in any position except the off position.



PATENT NO. 708,601

708,734. Emergency Brake for Tramway Cars; C. Real, Schwyz, Switzerland. Application filed May 29, 1902. One or more brake beams are lowered from the vehicle, which beams are provided with grippers which anchor themselves in the roadway and thus bring the vehicle to a stop within a very short distance.

708,800. Railway Switch Operating Mechanism; E. Crapper. Jr., Akron, Ohio. Application filed Oct. 22, 1901. Lever mechanism in the roadway actuated by a projection from the car.

708,885. Emergency Brake; W. W. Hopkins, St. Louis, Mo Application filed Nov. 27, 1901. Tread-plates are connected with the brake mechanism so that when the wheels move on to any of them the brakes will be applied.

708,899. Car Fender; E. C. Moulton, San Jose, Cal. Application filed Sept. 9, 1902. Details.

708,901. Tramway Rail; F. E. Musgrave, Bolton, Eng. Application filed July 16, 1902. A construction by which the tread of the rail can be renewed without disturbing the body portion or the roadway.

708,927. Device for Connecting the Electrical Gear of Electric Cars; A. Siemens, Westover, Milford-on-Sea, Eng. Application filed March 24, 1902. Controllers on adjoining cars are placed in flexibly suspended boxes below the car coupling and their shafts rigidly connected together so that one will partake of the motion of the other without interference from the difference in motion of the cars.

708,929. Sander; S. T. Simmons and W. T. Moore, Columbus, Ohio. Application filed June 10, 1902. Conveyors operated by bevel gear by the motorman extend to the distribution points.

708,960. Method of Controlling Electric Motors; J. C. Henry, Denver, Col. Application filed June 3, 1899. A method of starting a pair of motors consisting of first placing them in parallel in opposite relation to each other, each armature being in series with the corresponding field and cross-connecting them so that each armature is in shunt with the field of the other motor.

708,961. Method of Controlling Electric Motors; J. C. Henry, Denver, Col. Application filed April 1, 1901. The method of controlling a plurality of electric motors whose fields are excited by a circuit independent of the armature, which consists in starting with the armatures in series and the fields in parallel and speeding up by changing the fields to series without breaking their circuit.

708,962. Electric Vehicle; J. C. Henry, Denver, Col. Application filed June 3, 1899. The motors are employed to operate and stop a vehicle to regenerate to the battery in the form of electricity the energy ordinarily destroyed by the application of frictional brakes where they are used to overcome the force of momentum of gravity.

708,971. Switch Operating Device; F. E. Quest, Knoxville, Pa. Application filed Jan. 25, 1902. A section of the rail is given a forward movement when a car wheel to which the brakes are applied runs on to it; a spring returns the section, and in so doing sets the switch to the desired position.

ENGINEERING SOCIETY

THE ENGINEERS' CLUB, OF PHILADELPHIA.—A business meeting of the club—the first fall meeting—will be held on Saturday, Sept. 20, 1902. There will be a discussion of the paper "Depreciation as Affecting Engineered Structures," presented by Horatio A. Foster.

NEW YORK RAILROAD CLUB.—A regular meeting of this club will be held on Thursday, Sept 18, at 349 Madison Avenue, New York. J. C. Brackenridge, chief engineer of the Brooklyn Heights Railroad, will present a paper entitled "The Construction of Perfect Track." Both girder and T-rail work will be considered.

PERSONAL MENTION

MR. E. K. TURNER, consulting engineer of the Massachusetts Railroad Commission, returned to Boston on Sept. 11 after a vacation trip in Europe of several weeks' duration.

MR. CHARLES RODGERS has been appointed superintendent of the Uxbridge & Blackstone Street Railway, which has just been put in operation from Uxbridge to Melville, Mass.

MR. THOMAS A. LEACH, who has been acting as superintendent of Division 1 of the Worcester Consolidated Street Railway Company, of Worcester, Mass., since the resignation of Mr. H. E. Bradford in May, has been appointed to the position permanently.

MR. J. L. GREATSINGER, president of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., has left for Duluth, Minn., where he will spend the greater part of the coming month in shooting and other pastimes, his recent vacation having been marred by illness.

MR. WILLIAM H. TUCKER, for several years superintendent of the Fourth division of the Old Colony Street Railway Company, with headquarters at Fall River, Mass., has been appointed manager of the Jacksonville Electric Company, of Jacksonville, Fla., and has entered upon the duties of this position.

MR. GEORGE R. FOLDS, for nine years prominently connected with the Twin City Rapid Transit Company, of Minneapolis and St. Paul, and for the last three years claim agent of the company in the latter city, has severed his connection with the company to become connected with the legal department of the Brooklyn Rapid Transit Company.

MR C. D. PORTERFIELD, manager and salesman for the Atlas Railway Supply Company, has just returned from a very successful business trip in Europe. Mr. Porterfield had charge of the exhibit of his company at the Street Railways and Tramways Exhibition, in London, during the first two weeks in July. Since then he has been traveling over England and the Continent.

MR. B. S. JOSSELYN, who has just assumed his duties as general manager of the Hudson Valley Railway Company, of Glens Falls, N. Y., was presented with a handsome diamond stud a few days ago by the employees of the Kentucky & Indiana Railway, Bridge & Railroad Company, from which company he resigned as manager to become connected with the Hudson Valley Railway.

MR. GEORGE C. MURRAY has just resigned the position of superintendent of equipment of the Brooklyn Rapid Transit Company to accept that of superintendent of the repair department of Rossiter, McGovern & Company. Mr. Murray has been connected with the Brooklyn street railway system for ten years, and upon leaving that company the employees of the repair shops presented him with a gold watch and chain and a diamond locket.

MR. EDWARD B. GRIMES has resigned his position as managing editor of the *Herald*, of Dayton, Ohio, to accept the position of superintendent of the plant of the Ohmer Fare Register Company, of Dayton, Ohio. Mr. Grimes has been connected with the *Herald* for eighteen years, having succeeded to the editorship of the paper in 1885. Sincere regret is expressed at his retirement from the newspaper field, but his associates extend to him their best wishes for his continued success.

MR. RANDOLPH PEYTON, who for several months has been assistant superintendent of the Berkley division of the Norfolk, Portsmouth & Newport News Company, with headquarters in Berkley, has been transferred to Norfolk for duties in connection with the Norfolk railway and light division of the Norfolk, Portsmouth & Newport News Company. Mr. Allen Mackenzie, now with the Norfolk Railway & Light Company, will succeed to the position made vacant by the transferring of Mr. Peyton.

MR. H. P. O'DOUGHERTY has resigned as superintendent of the San Jose & Santa Clara Railway Company, of San Jose, Cal., to become master mechanic of the Los Angeles Traction Company, of Los Angeles. Mr. O'Dougherty was connected with the San Jose & Santa Clara Railway for six years, and while in the service of the company earned for himself an enviable reputation. As a token of their appreciation of their superintendent the employees of the San Jose & Santa Clara Railway Company presented Mr. O'Dougherty, when he retired from the company, with a handsome gold chain and a beautiful Masonic emblem, in the shape of a watch charm, studded with diamonds.

MR. WINFIELD SCOTT STRATTON, president of the Colorado Springs Rapid Transit Company, of Colorado Springs, Col., and a millionaire miner, died on Sept. 14 at Colorado Springs. Mr. Stratton was born in Jeffersonville, Clark County, Ind., opposite Louisville, July 27, 1848. He was the only son in a family of nine children and was educated in the public schools of his native town. When 17 years old he was apprenticed to a carpenter and draftsman. When he was 20 years old he went to Eddyville, Ind., and was a clerk in a drug store for six months. He then returned to his trade and worked in Sioux City, Omaha and Lincoln, Neb. In 1872 he went from Lincoln to Colorado Springs, Col. His life until 1891, when the tide of fortune changed, was such as befalls the average prospector. In the year mentioned he located a claim which netted him sufficient means to carry on work on his famous Independence mine, and from that time wealth accumulated so rapidly that he is said to have been worth $20,000,000 at the time of his death.

MR. E. F. FOOTE, of the British Electric Traction Company, is making a short visit to this country on business connected with his company and also to secure several employees, including a superintendent of repair shops, a line man and a track superintendent. Before taking up his residence in Great Britain Mr. Foote was connected with the New Jersey & Hudson River Railway & Ferry Company, and previous to that time had been general manager for the Union Traction Company, of Rutherford, N. J. Mr. Foote entered the employ of the British Electric Traction Company last March, at the time Mr. P. W. Davies, secretary of the company, made a trip to this country to secure American managers for a number of small electric railway systems owned by that company throughout Great Britain. Mr. Foote's first assignment was to Gateshead, which, although a small road, soon showed the results of the introduction of American methods, and within three weeks the traffic had been increased 75 per cent, which increase has been maintained continuously since. Mr. Foote was then sent to manage the road owned by the company in Middleton, and after that to a larger system at Greenock, in Scotland. The history at Gateshead was repeated in both of these cities, the traffic being largely increased and a better system of discipline being introduced, and the schedule and in some cases the fares being entirely changed. As a result of his success, Mr. Foote has recently been appointed general traffic manager of the British Electric Traction Company, in which position his duties call him to visit all the various properties of the company, of which there are between forty and fifty, and to suggest and introduce improved transportation methods.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Sept. 17, 1902.

The tight money market of a week ago has developed, as there had been plenty of reason to anticipate, into a well-defined money stringency. Of the causes which are responsible for this condition, and which have already been freely discussed in this column, the government collections of the excessive customs revenue continue to be the most important. So urgent is the need for even a temporary offset to these Treasury withdrawals that the Secretary of the Treasury has authorized the increase of government bank deposits in the sum of $4,000,000, and in addition has anticipated the payment of the $5,000,000 interest on the public debt, due the first of October. By these means it is calculated that about $8,000,000 will be rendered immediately available for the New York market. Every one realizes, of course, that this is a mere drop in the bucket. The Treasury revenue operations alone have drawn from the New York money supply no less than $13,000,000 during the past fortnight. If this rate of depletion continues it will therefore take less than two weeks for the additional resources involved in the Secretary's emergency measures to be exhausted. The hope is that in the meantime gold will have begun to flow in from abroad; consequently that the anticipated interest payments and the extra deposits of public moneys will serve to bridge over the interval before this more substantial form of relief can arrive. To present appearances, this expectation is well-founded. Sterling exchange, after a sharp decline since the outset of the month, has now reached a point where gold imports from Paris and Berlin are likely to be made at any moment. Already $2,500,000 gold on its way from South Africa to London has been intercepted and will be transferred to this country. Several millions of gold have also been announced as on their way from Australia, to arrive some time next month. The foreign markets, Paris especially, are well-equipped to spare a considerable quantity of the precious metal, and financial circles abroad are fully prepared for the movement to begin at any time. These indications of outside assistance do not entirely allay the uneasiness over the main problems in the home money situation. It is difficult to draw any very optimistic inferences concerning the future demands either from the Treasury or the Western harvest regions. But the immediate crisis has doubtless been averted. Money rates must continue very high in order to attract foreign capital, but the market is by this time used to the high level. Time loans are quoted generally at 6 per cent, and call loans average from 10 to 12 per cent, with extreme quotations of 20 per cent reported.

The Stock Market

The situation described in the money market has been the absorbing influence on the Stock Exchange during the week. The greater part of the Clearing House banks, having fallen below the legal reserve requirements, have been forced to reduce their loans. Where the trust companies and other outside lenders have been unable to supply an adequate substitute, securities carried on credit have been liquidated. The excessive money rates of themselves, moreover, have induced considerable voluntary selling by the smaller speculative holders. Consequently there has been greater pressure upon the stock market than there was in the previous weeks, and the pools and syndicates of large interests have taken their cue from this change and have ceased their efforts to bid up prices. The natural tendency of the market under these circumstances has been toward reaction, and with few exceptions quotations are substantially lower than they were a week ago. It is hardly necessary to allude to any other outside features of the situation, inasmuch as their influence has been comparatively slight. Reports of damage to the crops by frosts excited some momentary concern, but it was demonstrated satisfactorily that the larger part of the corn harvest, which is the only one of the cereals that has not reached maturity, is far enough along to be out of danger. Railway earnings and trade reports continue pretty uniformly encouraging. The stock market apparently has settled down for a term of quiet until the money outlook becomes more assured. No decided movement for the general list seems impending in either direction.

The local traction shares as a group have moved with a good deal of irregularity. All of them joined in the general decline at the beginning of the week, but Manhattan showed considerably more resistance in the subsequent dealings than the rest. Undoubtedly the buying in this issue is relatively stronger than in the others. Metropolitan, on the other hand, has displayed rather conspicuous weakness. No definite reason for this is given, except that insiders are evidently determined that the stock shall stand on its merits, and are offering no concerted support. Brooklyn Rapid Transit has merely followed the course of the general speculation.

Philadelphia

Following the tendency of the general speculation, the traction stocks on the Philadelphia Exchange have been inclined toward reaction during the past week. American Railway, which was one of the features last week, advancing to 53, has dropped back 1½ points, to 51½. Philadelphia Rapid Transit is off from 15½ to 15 and Union Traction from 48¼ to 47¼. It is a noticeable fact, however, that dealings on the decline have been considerably smaller than they were on the previous advance, indicating that liquidation has not been commensurate with the recent buying. There is no news, either actual or speculators' gossip, concerning any of these properties. Fairmount Park Transportation has been an exception to the general movement, holding steady at 32½. Huntington & Broad Top has also been strong, with sales at 30. Odd lots of Pittsburg Traction preferred sold at 52¼ and of Consolidated, of New Jersey, at 69¾. Reading Traction certificates were strong at an advance to 37⅝, reacting later to 36⅞. Railways General was not particularly affected by the poor earnings statement for the year, the stock selling down to 5¾, but later rallying to 6. American Railway 5s, after establishing a new high record at 108, broke sharply to 106 without any special reason given for the fall. Other bond sales comprised Consolidated of New Jersey 5s at 110¼, People's Passenger 4s at 105, United Railways 4s at 87 and Electric People's Traction 4s at 98½.

Chicago

Toward the end of last week Chicago securities developed considerable strength, many of the traction issues reaching the highest they have sold at for some time. Since the opening of the current week, however, the movement has been partially reversed, owing to the uncertainty of general market conditions. City Railway rose to 224 on active buying inspired by the idea that the vigorous prosecution of the plans for extending the system meant that the company was no longer afraid of the ultimate franchise tax decision. Union Traction was sympathetically strong, the preferred selling up to 54. Lake Street Elevated, on operations supposedly by the old-time pool in the stock, rose from 10¾ to 11¾, but later on lost most of the gain. Metropolitan common advanced to 40¾, but dropped back to 39½, and the preferred, after reaching 90½, declined to 90. Northwestern common sold up to 37¼ and then down to 36⅛, while South Side held its full advance to 114. All of the elevated lines are maintaining their excellent traffic returns. Labor troubles among the surface roads seem to have been settled, for the time being at least.

Other Traction Securities

Boston Elevated, after its recovery to 157 a week ago, fell again under profit-taking sales to 155. The "rights," on heavy dealings, sold down from 50 cents to 25 cents a share. Massachusetts Electric issues have been rather more active but heavy, the common, after touching 39, dropping to 38 and the preferred changing hands around 97. In Baltimore the week has been duller than for some time past. The United Railway securities have been depressed for no particular reason, except the lack of any special speculation stimulus. The common stock sold down from 15½ to 15, the income bonds from 70¼ to 69¾, while the general 4s have merely remained stationary at 95½. Nashville common stock has been active and exceptionally strong at an advance from 6⅛ to 6½. The 5 per cent certificates, however, did not share in this rise, continuing merely steady around 75¼. Other Baltimore transactions include Lexington Railway 5s at 104¾, United Traction of Pittsburgh 5s at 116⅞ and Anacostia & Potomac 5s at 102½. The week's sales of traction securities on the New York curb comprise Brooklyn City Railroad (100 shares) at 247¼. New Orleans Railway common at 18⅜ to 17¾, the preferred at 56½ to 56¼ and San Francisco preferred at 60 to 60½.

This has been a very active week on the Cleveland Stock Exchange. Traction sales numbered 9770 shares, as compared with 12,762 shares for the week before. Cincinnati, Dayton & Toledo was again the leading issue, 2870 shares selling on an advance from

31 to 36½. The closing was 35¼, a gain of nearly 7 points in two weeks. The new Springfield & Xenia sold to the extent of about 2000 shares, advancing during the week from 20 to 26½. Aurora, Elgin & Chicago preferred was also active, 1126 shares selling from 83½ to 98, the latter the closing figure. The common sold between 36 and 38 for 641 shares. Northern Ohio Traction common, whose high mark the week before was 57½, experienced a boom and advanced to 64, but declined at the close to 61½; sales, 806 shares. Elgin, Aurora & Southern ranged from 45½ to 49½ on sales of 290 shares. Syracuse Rapid Transit preferred was in demand at several points advance, selling at 75 and 75½ for 220 shares. Lake Shore Electric common advanced during the week from 20½ to 23; sales, 342 shares. One lot of Cleveland Electric sold at 90¾, a drop of 2 points from the previous ruling price. Eastern Ohio Traction, a new stock which succeeds the Cleveland & Eastern and the Chagrin Falls lines, made its first appearance, and a small lot sold at 30.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Sept. 9	Closing Bid Sept. 16
American Railways Company	52½	51½
Aurora, Elgin & Chicago	36	36
Boston Elevated	156	154
Brooklyn R. T.	71	68½
Chicago City	220	220
Chicago Union Tr. (common)	18⅜	17½
Chicago Union Tr. (preferred)	51	48
Cleveland Electric	91	90
Columbus (common)	57	60
Columbus (preferred)	108	108
Consolidated Traction of N. J.	69⅝	69⅝
Consolidated Traction of N. J. 5s	111	110¼
Detroit United	a96	a94
Electric People's Traction (Philadelphia) 4s	*98¼	98¼
Elgin, Aurora & Southern	44⅝	46¼
Indianapolis Street Railway 4s	87⅝	87
Lake Street Elevated	10⅝	10½
Manhattan Railway	137¼	136
Massachusetts Elec. Cos. (common)	38½	38
Massachusetts Elec. Cos. (preferred)	97	97
Metropolitan Elevated, Chicago (common)	39¼	40
Metropolitan Elevated, Chicago	89¼	89½
Metropolitan Street	147⅝	145
New Orleans Railways (common)	18	17⅝
New Orleans Railways (preferred)	57	56⅝
North American	128	124
Northern Ohio Traction (common)	61⅛	62¼
Northern Ohio Traction (preferred)	93⅝	93½
North Jersey	37	34½
Northwestern Elevated, Chicago (common)	36½	36⅜
Philadelphia Rapid Transit	15⅛	14⅞
Philadelphia Traction	100	*98
St. Louis Transit Co. (common)	30½	30½
South Side Elevated (Chicago)	110	112
Syracuse Rapid Transit	28½	27
Syracuse Rapid Transit (preferred)	71⅝	75
Third Avenue	131	130
Toledo Railway & Light	36½	35
Twin City Minneapolis (common)	126½	125¼
United Railways, St. Louis (preferred)	84	84
United Railways, St. Louis, 4s	87	87
Union Traction (Philadelphia)	48	47⅛
Western Ohio Railway	27⅝	27½

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

Decline in the domestic output and increase in importations from abroad continue to be the chief characteristics of the market for basic iron. The *Iron Age* estimates that the home production last month was 100,000 tons less than it would be were there no scarcity of the fuel supply. This domestic shortage is being made up by steady imports of foreign-made iron, the most important development in this connection being the announcement by a well-known New York commission firm that they had engaged the entire foundry iron product of the Dominion Iron & Steel Company, of Canada, for six months. The situation is also tending toward increasing imports of rails, as the impossibility of getting any immediate fulfilment of home orders is forcing American roads to pay higher in order to bring in the foreign product. Quotations are unchanged for the week, as follows: Bessemer pig, $21.75; steel billets, $31.50; steel rails, $28.

Metals

Quotations for the leading metals are as follows: Copper, 11.80 cents; tin, 26½ cents; lead, 4⅛ cents; spelter, 5½ cents.

CHICAGO, ILL.—The directors of the South Side Elevated Railroad have declared the regular quarterly divideod of 1 per cent, payable Sept. 30.

CHICAGO, ILL.—President Clarence Knight, of the Lake Street Elevated Railway, who returned to Chicago a few days ago, after heing in conference with J. B. Dennis, of Blair & Company, of New York, declines to make any statement regarding the proposed reorganization of the company.

MOLINE, ILL.—There has been filed for record in the circuit clerk's office a trust deed or mortgage from the Tri City Railway Company to the German Trust Company, of Davenport, for $800,000 to guarantee 5 per cent gold bonds to that amount, issued in accordance with a resolution adopted at the last annual stockholders' meeting. Of the $800,000 issued under authority of this resolution, $587,000 is to be used to meet maturing bonds of the Davenport & Rock Island Railway Company, payment of which was assumed when its property passed to the Tri-City Railway Company, $33,000 of bonds of the same company which matured July 1, 1901, and which amount was paid with money borrowed for that purpose, and also to meet $11,000 bonds of the Moline Central Railway Company, which were outstanding when the company's property was purchased by the Tri-City Railway Company. The balance of the funds accruing from the bond issue is to be used in the extension and improvement of its lines. The mortgage covers all the property of the company except twenty-five acres at different points along the lines, which are specifically excepted. The bonds issued are in denominations of $1,000, and mature Sept. 1, 1922.

LOUISVILLE, KY.—The Wall Street Journal says: "The Louisville Railway directors will declare a dividend on the common stock Jan. 1 and will place it on a 5 per cent basis. The company will also issue $500,000 of new common stock at $50 a share, similar distributions to be made the next two years."

WORCESTER, MASS.—The Worcester & Southbridge Street Railway Company has asked approval of an issue of bonds by the Railroad Commissioners.

BOSTON, MASS.—The Railroad Commissioners gave a hearing, Sept. 11, on the petition of the West End Street Railway Company for approval of an issue of bonds to the amount of $569,000 to pay indebtedness to the Boston Elevated Railway Company for expenditures on the system from October, 1900, to March, 1901; for authority to use $7,496.34 and $12,221 received in excess of proceeds of former bond sales for the same purpose; and an issue of $3,000,000 in bonds to take up bonds falling due Nov. 1.

PITTSFIELD, MASS.—The petition of the Berkshire Street Railway Company for issue of additional stock will be continued on Oct. 2.

DETROIT, MICH.—The directors of Detroit United Railway have declared the regular quarterly dividend of 1 per cent, payable Oct. 1.

ST. LOUIS, MO.—The total earnings of the St. Louis Transit Company for August, as shown in a statement issued last week, were greater than for any previous month in the history of the company. They were $579,575 against $509,048 for the same month last year, showing a gain of $70,527. Up to September the total earnings of the company aggregate $4,169,346, as against $3,795,675 for the first eight months of 1901. This is a total gain of $363,671. It is said that the percentage of operating expenses to the gross earnings is being steadily reduced so that the proportion of net earnings will be greater than the percentage of the total gain. The gross earnings of the company for 1901 were $5,777,599, and the deficit at the end of that year $526,630. Business this year has far exceeded that done by the company in 1901. Every month has shown an increase over the same month of the previous year, and the operating expenses having been materially reduced, there is every indication that a surplus will be recorded at the end of the year.

JERSEY CITY, N. J.—The directors of the United Traction & Electric Company, of New Jersey, have declared a quarterly dividend of 1¼ per cent, payable Oct. 1.

CLEVELAND, OHIO.—The plan for refinancing the Northern Ohio Traction Company which is receiving most serious consideration contemplates the organization of the Northern Ohio Railway & Light Company, with a bond issue of $7,000,000 and capital stock of like amount, the bonds to be used as follows: $3,000,000 to retire the present outstanding bonds, $1,000,000 to retire the preferred stock, $500,000 for improvements, $1,500,000 or 60 per cent of the total common stock now outstanding to retire the present common stock, and $1,000,000 for treasury purposes. The new common stock to be divided between the present common and preferred stockholders, the preferred holders receiving in addition to 100 per cent of their holdings, one-half or perhaps 100 per cent of their entire holdings in common stock. The common stockholders would likely receive, in addition to 60 per cent of their holdings in bonds, 200 per cent in new common stock.

CLEVELAND, OHIO.—It is announced that within a very short time the bankers' committee which has been in charge of the Everett-Moore properties since the embarrassment of this syndicate will shortly surrender whatever control it has exercised over the properties. The sale of the Detroit & Toledo Shore Line is about to be completed, and the financing plan for the Lake Shore Electric Railway has practically been consummated. Five leading trust companies of Cleveland—the Cleveland Trust Company, the Prudential Trust Company, the Savings & Trust Company, the Federal Trust Company and the American Trust Company—have agreed to take $1,500,000 of the bonds of the Lake Shore Electric Company. With these two obstacles out of the way all that remains for the syndicate to adjust are the affairs of the Federal Telephone Company, and the various properties of this company are fast being disposed of.

PHILADELPHIA, PA.—A dividend of 2½ per cent will be paid on the preferred stock of Union Traction of Indiana Oct. 1.

PHILADELPHIA, PA.—The Philadelphia Traction Company has declared the regular semi-annual dividend of $2 a share, payable Oct. 1.

SHERBROOKE, QUE.—The syndicate that recently made an offer to purchase the stock of the Sherbrooke Gas & Electric Company is understood to have begun negotiations for purchasing the Sherbrooke Street Railway and the People's Telephone Company. A consolidation of these companies is planned, so it is said.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., Aug. '02	84,301	42,191	42,110	12,737	29,412
	1 " " '01	65,094	31,089	33,005	11,058	22,016
	6 " June '02	318,162	185,392	133,577	77,560	56,018
	6 " " '01	258,907	161,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	518,728	*411,475	106,240	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., Aug. '02	141,830	80,796	61,064	23,806	37,218
	2 " " '02	292,029	169,740	122,291	47,772	64,519
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., Aug. '02	23,547	12,321	11,221	......	......
	1 " " '01	21,490	10,806	10,684	......	......
	2 " " '02	46,816	23,592	23,294	......	......
	2 " " '01	43,270	21,168	22,102	......	......
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,969,106	7,393,597	3,575,909	2,906,850	636,339
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos.	12 m., Sept. '01	5,778,143	3,915,494	1,862,648	937,206	925,442
	12 " " '00	5,518,855	3,659,357	1,860,500	994,294	866,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., July '02	1,256,000	*728,135	528,264	......	......
	1 " " '01	1,263,701	*778,466	485,206	......	......
	12 " June '02	12,780,716	*8,822,310	3,957,400	......	......
	12 " " '01	12,101,196	*7,970,633	4,130,563	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., June '02	251,246	147,614	123,632	56,043	69,589
	1 " " '01	412,300	192,295	210,041	94,098	128,842
	1 " " '00	218,728	106,174	112,563	65,348	47,217
	3 " " '02	790,290	439,917	349,306	250,003	90,303
	3 " " '01	852,102	445,800	406,801	272,964	134,140
	3 " " '00	631,371	363,927	297,444	221,944	75,601
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., Aug. '02	45,217	31,191	14,025	13,357	668
	1 " " '01	47,474	29,290	17,178	13,697	3,481
	8 " " '02	378,984	200,240	155,784	81,064	74,720
	8 " " '01	346,478	262,145	84,253	82,618	674
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Aug. '02	25,591	7,221	18,300	......	......
	1 " " '01	24,042	7,470	16,563	......	......
	8 " " '02	125,091	52,839	72,201	......	......
	8 " " '01	112,092	49,271	68,801	......	......
CLEVELAND, O. Cleveland & Eastern Ohio Traction Co.	1 m., July '02	19,629	10,554	9,080	5,416	4,254
	1 " " '01	17,095	8,301	8,793	5,320	3,461
	[illegible] '02	111,889	60,231	41,291	30,674	4,907
Cleveland, Elyria & Western	1 m., July '02	28,240	16,577	11,667	......	......
	1 " " '01	21,278	11,870	12,110	......	......
	7 " " '02	156,084	91,093	65,391	......	......
	7 " " '01	131,356	76,069	55,187	......	......
	12 " Dec. '01	240,260	138,387	112,094	57,123	55,571
	12 " " '00	179,036	102,391	77,344	34,562	42,712
Cleveland, Painesville & Eastern	1 m., July '02	22,640	10,132	12,218	......	......
	1 " " '01	19,144	7,763	11,381	......	......
	7 " " '02	105,408	57,148	48,261	......	......
	7 " " '01	84,592	44,078	40,514	......	......
	12 " Dec. '01	164,871	*87,012	77,860	72,560	5,300
	12 " " '00	141,112	*69,562	71,520	72,500	†980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.	1 m., July '02	77,888	*42,884	35,104	15,958	19,096
	1 " " '01	71,121	*40,082	31,039	15,811	15,181
	7 " " '02	400,126	*204,157	206,957	106,602	100,314
	7 " " '01	401,235	*251,871	130,387	109,822	19,864
DENVER, COL. Denver City Tramway Co.	1 m., Aug. '02	124,516	[illegible]	55,181	32,065	26,119
	1 " " '01	[illegible]	[illegible]	53,106	31,304	22,186
	8 " " '02	[illegible]	[illegible]	[illegible]	131,250	88,972
	8 " " '01	[illegible]	[illegible]	[illegible]	125,622	72,379
	12 " Dec. '01	[illegible]	[illegible]	[illegible]	383,161	305,783
	12 " " '00	[illegible]	[illegible]	[illegible]	374,201	255,518
DETROIT, MICH. Detroit United Ry.	1 m., [illegible] '02	[illegible]	[illegible]	[illegible]	......	......
	1 " " '01	[illegible]	[illegible]	[illegible]	......	......
	6 " June '02	[illegible]	[illegible]	[illegible]	305,[illegible]	[illegible]
	6 " " '01	[illegible]	[illegible]	[illegible]	317,[illegible]	[illegible]
	12 " [illegible] '01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12 " " '00	[illegible]	*[illegible]	[illegible]	613,466	[illegible]
Detroit and Port Huron Shore Line	1 m., [illegible] '02	41,[illegible]	[illegible]	19,012	......	......
	1 " " '01	[illegible]	[illegible]	21,[illegible]	......	......
	7 " " '02	230,[illegible]	[illegible]	[illegible]	......	......
	7 " " '01	211,[illegible]	120,1[illegible]	97,[illegible]	......	......

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
DULUTH, MINN. Duluth-Superior Tr.	1 m., July '02	52,688	24,966	27,647	9,685	17,962
	1 " " '01	45,983	22,117	23,866	9,218	14,647
	7 " " '02	296,034	157,396	140,640	67,529	73,111
	7 " " '01	254,322	141,720	112,602	63,984	48,418
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., Aug. '02	43,507	22,129	21,378	8,333	13,045
	1 " " '01	37,395	17,094	20,301	8,393	11,908
	8 " " '02	270,436	158,851	111,584	66,667	44,917
	8 " " '01	241,397	136,236	105,161	66,667	38,495
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., Aug. '02	24,340	12,033	12,307	......	......
	1 " " '01	16,849	9,025	7,824	......	......
	6 " June '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O. The Cincinnati, Dayton & Toledo Traction Co.	1 m., Aug. '02	49,301	24,498	24,819	15,830	8,989
	3 " " '02	140,412	68,156	72,256	47,659	24,597
LONDON, ONT. London St. Ry. Co.	1 m., July '02	16,337	9,297	7,040	2,311	4,730
	1 " " '01	15,303	8,767	6,537	2,144	4,393
	7 " " '02	91,401	52,464	38,937	15,984	13,093
	7 " " '01	75,416	48,718	26,698	14,076	12,622
MILWAUKEE, WIS. Milwaukee El. Ry & Lt. Co.	1 m., Aug. '02	243,845	113,340	130,505	64,677	62,128
	1 " " '01	211,808	96,196	115,614	64,068	51,548
	8 " " '02	1,735,350	835,772	919,578	536,219	383,359
	8 " " '01	1,574,615	794,732	790,884	497,004	292,880
	12 " Dec. '01	2,442,342	1,185,584	1,256,808	755,189	501,669
	12 " " '00	2,280,628	1,189,727	1,090,911	834,665	255,947
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., July '02	337,452	142,369	195,083	58,793	136,340
	1 " " '01	299,648	133,340	155,298	57,880	97,478
	7 " " '02	2,034,892	952,740	1,081,152	410,856	670,265
	7 " " '01	1,745,198	853,690	894,001	357,048	536,953
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., July '02	198,656	93,966	104,690	19,920	84,700
	1 " " '01	178,180	90,464	87,716	14,142	73,573
	10 " " '02	1,643,587	940,960	702,977	164,228	538,748
	10 " " '01	1,533,206	931,933	601,272	104,413	496,858
NEW YORK CITY. Manhattan Ry. Co.	12 m., June '02	11,291,711	5,518,583	5,773,128	2,699,670	3,073,458
	12 " " '01	10,483,271	5,358,229	5,000,042	2,677,706	2,322,336
Metropolitan St. Ry.	3 m., Dec. '01	3,897,986	1,738,972	2,148,964	1,151,140	992,324
	3 " " '00	3,786,080	1,690,649	2,096,381	1,138,467	947,914
	12 " June '02	15,866,641	7,385,888	8,480,758	6,815,491	1,665,257
	12 " " '01	14,720,767	6,755,181	7,965,586	4,534,064	3,431,547
OLEAN, N. Y. Olean St. Ry. Co.	1 m., July '02	6,569	3,216	3,353	1,771	1,582
	1 " " '01	5,954	2,207	3,747	1,768	1,979
	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co.	1 m., July '02	9,387	5,300	4,087	2,098	2,012
	12 " June '02	86,796	*56,394	30,402	23,125	7,277
PHILADELPHIA, PA. American Railways	1 m., Aug. '02	125,150	......	......	......	......
	1 " " '01	91,158	......	......	......	......
	2 " " '02	245,455	......	......	......	......
	2 " " '01	180,811	......	......	......	......
	12 " June '02	1,009,509	......	......	......	......
	12 " " '01	811,396	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., June '02	89,226	46,800	42,426	24,734	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	527,742	258,016	269,727	148,606	91,130
	6 " " '01	495,286	306,966	188,320	147,137	41,182
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., July '02	62,571	34,365	28,206	19,085	9,131
	1 " " '01	59,483	31,620	27,813	18,971	8,842
	12 " " '02	603,254	384,235	319,019	229,246	80,773
	12 " " '01	621,259	340,830	280,409	233,918	56,550
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., July '02	131,492	62,316	69,176	27,904	41,388
	1 " " '01	121,013	53,613	67,399	24,479	42,920
	7 " " '02	802,776	414,697	388,079	224,998	133,191
	7 " " '01	719,941	357,016	362,925	170,104	192,821
	12 " Dec. '01	1,321,084	*636,407	674,677	415,128	259,549
	12 " " '00	1,182,517	*616,945	565,572	409,051	156,521
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,270	133,283	53,987	......	......
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	3 m., June '02	56,636	35,622	21,013	25,000	†3,986
	3 " " '01	56,986	35,600	22,385	25,000	†2,665

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Danger on Running Board

The Board of Aldermen of Waterbury have under consideration a proposed ordinance prohibiting passengers from riding on the running board or steps of trolley cars, and providing for the infliction of a fine upon both passenger and company whenever violation is proven. No doubt there is great danger in the practice aimed at, especially in crowded thoroughfares and on streets where cars pass in close proximity to shade trees or a pole line, and in going through tunnels. In New York passengers are strictly prohibited from standing in exposed places of this kind, and in other cities a similar rule is enforced by the local companies, but in many places it has been the practice for years to permit passengers during the rush hours to crowd onto the cars wherever they could secure a foothold. Of course there are occasional accidents, and some of them are serious; and when, as a consequence, the operating companies are mulcted for damages, they lose more than they could possibly make up in extra fares collected on the running board in many months. But the fault does not rest entirely with the company. During the discussion at Waterbury one Alderman suggested that the proposed rule be suspended during the noon hour, when the workmen patronized the cars; otherwise, he explained, many of them would be unable to go home to their midday meal, as the company hadn't enough cars to carry them without crowding. Of course such an exception as that proposed would defeat the object of the measure, and it is hardly to be expected that it will be admitted, but the proposal reveals the true condition of affairs. The frantic haste of the people to reach their destination is the cause of the trouble.

The Promoter in Politics

Yankee ingenuity is manifested in many ways, in politics as well as in business, and occasionally it is exercised in securing an advantageous mixture of these elements; but we know of no better example of this characteristic than appears in a plausible and convincing argument addressed to the people of New Hampshire on the subject of electric railway development, coupled with an appeal to the pride and jealousy of the community. It is worthy of Sam Slick, but aside from this it has real merit. The promoter and constructor of several electric railways in the southern part of New Hampshire published full-page advertisements in influential newspapers, in which he called attention to the work which his syndicate was doing toward the development of the Granite State, and asked that the citizens consider the question of electric roads in selecting candidates for the Legislature, nominating and electing only such men as favored the granting of charters for proposed lines wherever there might be a good field for their construction.

The issue thus raised is worthy of serious consideration, and the method employed in urging the claims of the trolley upon the community might well be adopted in other localities where the people are equally desirous of improvements. The cities of southern New Hampshire have enjoyed many advantages because of the progress that has been made there in building trolley lines, and in this respect they have been very much ahead of other parts of the State. It is expected that before the end of the year all of the cities as far north as Concord will be connected by trolley lines, and that they will also enjoy direct communication with beach resorts and the larger cities of Massachusetts. This particular locality, it should be remembered, depends largely upon the summer visitors, and, therefore, the establishment of a comprehensive system of electric roads cannot fail to be of great advantage to the natives. There are no large cities in that section to make railroading profitable the entire year, and, therefore, it will be necessary to depend largely upon visitors for support. Other parts of the State are equally interested in securing improved transportation facilities, particularly in the lake and mountain regions, which also depend almost entirely upon the summer business. Of course anything that makes these charming resorts accessible will add to the value of property and the earning capacity of the residents; therefore, the proposition to build an

extensive system of trolley lines appeals directly to the people, and, as the projects depend upon the action of the Legislature, the wisdom of the course pursued by the promoters in the plan we have outlined is at once apparent.

The people of New Hampshire and elsewhere are not particularly interested in the personnel of the promoters of electric railway projects. The question with them is how can they best secure improved transportation facilities, which is a matter of vital importance to them, and one that will have to be recognized. The steam railroad lines have persistently refused to extend their lines unless they were assured of profitable business from the start. They were not willing to build lines and develop traffic by encouraging these smaller resorts. The electric railway companies, on the other hand, have shown that it is possible to create a profitable business in this neglected territory, and they are taking advantage of the shortsightedness of the steam railway companies in this respect. But if the steam railway companies fail to recognize the possibilities in this line for themselves, they have been quick to recognize and obstruct every movement having for its object the extension of the electric railway. The newspapers throughout New England, and particularly New Hampshire, have taken up this subject, and they have encouraged the idea, so that in all probability the electric railway managers will find a much more favorable Legislature in New Hampshire this winter than formerly.

The Street Railway Situation in Chicago

This subject seems to be attracting a great deal of attention just at present from political economists as well as street railway men in general, and an extended article on the subject by H. A. Millis appears in the current number of the Annals of the American Academy of Political and Social Science. This of itself is a very healthful sign, as the more attention given to street railways by professors and students of political economy the better. It will help the public to appreciate that the street railway systems in our large cities are not only most important factors in the public welfare, but also that politicians cannot play fast and loose with large companies, as they often have in the past, and threaten their investment in all sorts of ways without fear of the consequences. We do not mean to say that we agree with all of the theories held or advanced in regard to street railway operation by some of the economical writers who have within recent years taken up this subject with great elaboration, particularly the systems of New York, Philadelphia and Chicago, but, as a rule, these gentlemen are not ardent advocates of municipal operation, or certainly not of municipal ownership, nor the imposition of impossible conditions which is usually part of the propaganda of the average politician. They recognize the fact that in most cities the limit of municipal indebtedness is so near the constitutional limit which has been most wisely provided that the cities could not take over the railways if they would, and are generally unanimous that the political conditions in most cities are not such as to guarantee even a fair amount of efficiency in the service, or such as to make it desirable to add to the existing municipal problems the care of an immense transportation system.

Mr. Millis confines himself principally to a short history of the present controversy over franchises in Chicago, quotes from Dr. Maltbie's extended report on the financial history of the companies, describes the formation of the committee on local transportation, and outlines the problem which the City Council and expert engineer are now investigating. In conclusion, he states that if the demands made by the city government are too urgent the companies will undoubtedly make the most of any rights which they may be found to have under the ninety-nine-year act of Feb. 6, 1865. If, however, the situation is not complicated by rights under this act, he believes that franchise extensions will be awarded to the corporations now in possession of the streets; but that period for which they will be run will be shorter than before; that the right of purchase after a comparatively short term of years will be reserved, and that the municipality will secure a right of control greater than that ever before exercised in Chicago over private corporations. He also believes that with expenditures involved in improving the service, and the short period for which franchises can be granted, larger payments of gross receipts as compensation or a considerable reduction of fares cannot be effected.

It is unfortunate for Chicago that under the present conditions long-term franchises cannot be granted. The maximum period for which a franchise can now be given is twenty years, which is certainly too short to warrant any very large investment in permanent construction or reconstruction without some satisfactory guarantee that the investment made will be protected when the franchise expires. We do not mean by this that there is any possiibility of confiscation or practical confiscation of the street railway properties either in Chicago or elsewhere when their franchises expire. The courts in every State, we believe, will uphold the company in demanding a fair price from its successor to its franchise for material in the street which cannot be removed, whether there is any provision in the franchise for such purchase or not. But an appraisement can be made on so many bases that it is useless to expect a company to sink any considerable amount of money in irremovable property unless it either has an opportunity to recover the value of this investment by use through a long term of years or else that it shall be properly compensated if it has to abandon its plant within a shorter time. We are confident, however, that so far as Chicago is concerned a fair course will be taken. The most urgent need in that city is for a subway, which all evidence goes to show can be built. The companies have indicated a willingness to meet the city authorities on any reasonable basis, and they, on their part, have given every indication of a purpose to treat the subject in a broad way.

It might be said in this connection that much evil often results from a thoughtless comparison of what is done in the direction of franchise payments and in other ways between street railway companies in one city and in another. It is often assumed by city authorities that the railway company which uses the streets in that city should be willing to do anything, or almost anything, in this direction which any company in any other city happens to do; and as New York is the metropolis of the country it is often assumed that what is good enough for New York is not too good for any other city of the country. This is unfair, however, because there is probably no other city in the country with which, for many reasons, a comparison is less suitable than with New York. In the first place, the earnings on the system of the Metropolitan Street Railway Company, of New York, per mile of track, owing to the topography of the city and other local conditions, is vastly in excess of that in any city at home or abroad with which we are acquainted. In actual figures they amount, including the horse car lines, to about $73,000 per mile of track, and not including the horse car lines to about $90,000 per mile of track, as compared with $26,600 in Boston, practically the same in Chicago and $23,200 in Brooklyn. These figures by themselves indicate immediately the immense difference in traffic conditions, but do not tell the whole story. The reason for this is that the New York surface system is relieved of a large amount of its long haul, or unprofitable traffic, which goes to the elevated, so that in addition to having a large income per mile of track this sum is derived from what is almost entirely a short-haul business, so that the transportation expenses for doing the same business are considerably less than on a road which has to care for both a long and a short haul traffic. If we carry the comparison of gross receipts per mile of track to the cases of railways in cities of the second class we will find an even greater difference than that cited above. There are many other practical operating points which differentiate the New York situation from that of any other city in the country and which make it useless as a criterion in many respects for comparison. We have not space here to point out all of these points, but direct attention to the item of gross receipts per

mile of track as one which often escapes the theorist on the subject of political and municipal economy, and which, if unconsidered, deprive the results derived from his theories of any practical value.

Package Freight Business

Many interurban and suburban lines have found the carrying of packages a profitable branch to cultivate, especially where the road extends from a large city to numerous nearby towns which depend upon it for the bulk of its supplies. In the case of the Ohio road, which forms the subject of the leading article in this issue, it is pointed out that the electric line has not only secured the greater part of the passenger traffic in the territory covered, but that it is also gradually gaining control of the freight business. In the handling of light freight packages, which is in reality express matter, the electric company has been particularly favored, as it has been able to give much better service than the old steam lines. The latter have been hampered by the conservative class of management that disapproves of all departures from long-established methods, and refuses to admit that the changed conditions of to-day may materially affect the efficiency of an organization that was formed for meeting the requirements of the last generation. With the constant diminution of business, however, a realization of the necessity for reorganization has dawned upon some of the old roads—not all of them, however—and those that have seen the light are now preparing to furnish frequent service along the lines followed by modern electric railways. The electric lines have greatly simplified the methods of handling this class of business, and while their plan may be considered crude by those familiar with the organization of the steam railroads, it seems to lend itself readily to the limited requirements of this class of business, the chief requisite of which is prompt and frequent delivery. It is in this very important feature that the steam lines have failed, and, consequently, it behooves the management of such enterprises as may be threatened with electric competition, as well as those who are already enjoying that distinction, to make a careful study of the situation and consider whether, after all, a modification of their entire system for package and light freight business is not desirable.

Municipal Socialism

We earnestly hope that every one of our readers will study carefully the paper concluded in our issue of Sept. 6 on the failure of municipal undertakings in England. It is a most interesting examination of a very pertinent topic. We do not in the least usually class England as a socialistic country, yet when an Industrial Freedom League has to be formed to combat municipal interference with private business it would seem that our British cousins were really in the clutches of a socialistic "octopus" at least as ferocious as the far-famed American species. Every municipality, as a matter of course, has to undertake certain work of construction and supply, which might in whole or in part be relegated to private enterprise. For years economists have been struggling to work out the logical theory of municipal ownership, but on the whole their struggles have only served to involve them in deeper uncertainty. Without desiring to plunge ourselves into the intricacies of what has been wittily called "the dismal science," we desire, apropos of Mr. Porter's paper, to record our conviction that the failure to evolve a consistent theory arises from the very simple fact that there is none. It is a case of dealing with conditions, not theories; of practical compromises and shrewd restraint. Only in a few cases can any general rules be laid down, and even these are mostly of local applicability. For instance, we recently pointed out the practical distinction between municipal waterworks and municipal tramways, under existing American conditions, and showed how, with the present state of practical politics, any enterprise requiring a large amount of skilled labor must suffer when conducted by the municipality. Obviously this is a question of degree, not of kind, and while we can conceive of a civic government so constituted that it could safely undertake even a tramway, we can lay our finger without difficulty on cities in which even street cleaning and construction could be better and more cheaply done by private enterprise.

Now, our British friends have gone into all sorts of municipal trading, and instead of contenting themselves with doing merely work of general necessity have tried to wring a profit from undertakings which are in direct competition with the natural course of private industry. That such socialistic enterprise has often met with disaster is not to be wondered at, for human nature is about the same the world over, and the political factors, notoriously operative here, are not confined to this side of the Atlantic. There is current here a somewhat exaggerated idea of the purity of English politics, and we do not fully realize that municipal enterprise abroad may be tainted with the same venal element with which we are all too familiar. It may not be manifested by exactly the same symptoms, but the results are similar. The fact that English municipal ownership has led to conspicuously bad results implies a record of at least mismanagement and probably corruption to boot. The fundamental difference between private and public management is that in the former the active managers have a permanent and acute personal pecuniary interest in the success of the enterprise, while in the latter the moving power is a temporary and often perfunctory sense of partisan responsibility. This difference cannot be disposed of by resorting to high-sounding platitudes. The president of an American street railway, for instance, is usually a very heavy stockholder, with a long and varied business training—a man of affairs, with large personal interests at stake. His superintendent is a trained tramway manager, held directly responsible for results, who stands or falls with the enterprise he is conducting. The Mayor of an American city is generally a lawyer, whose practice has run to politics, very likely an able man of high personal integrity, but with an eye for Congress, and no private interests at stake in the success of particular branches of municipal enterprise. If one such branch were a tramway its manager, however able, would keep his place only by the most adroit trimming, and would be kicked out without ceremony if his course crossed the path of party supremacy.

Analogous conditions hold abroad, and Mr. Porter has very clearly shown that the taxpayers suffer from the necessary results. We think that if the public could clearly comprehend the real sources of failure in municipal ownership there would be very little danger of our following England's bad example. It is a very difficult thing to compare with precision the details of public and private management. We customarily judge the two only by their general results. The very searching basis of comparison of costs laid down in Mr. Porter's last article is very difficult to apply, but would disclose some very unpleasant conditions if it were rigorously enforced. Truth to tell, it would damn plenty of private enterprises. The most efficient comparison which could be made, we think, would involve the investigation of two plants in neighboring and similar communities—the one under municipal ownership, the other under private ownership. If such a pair could be found the next step would be to tabulate the detailed expenses of each, so as to show plainly just what prices were paid by each for the separate items of material and labor, management and general expense. We have seen comparisons without number, but they have rarely been searching enough to show the full weakness of the municipal case. This lies, we think, not so much in the treatment of depreciation and sinking fund, which are seldom adequately provided for, as in the suppressed items of general expense and in the details which generally escape comparison entirely. We have not yet in this country to deal with the stagnation produced by municipal competition, which has shown itself so seriously in England. It is a logical result of the conditions there existing, and we earnestly hope that such an example will preserve us from entering upon a policy so short-sighted. England is in the main a wonderfully free country, but in freedom of enterprise and labor it has little to be proud of. And singularly enough this failure is not one which can be charged up against the English form of government so much as against misguided popular sentiment.

Interurban Road Through Ohio Oil Field

One of the most promising of the interurban lines of Ohio is the Toledo, Fostoria & Findlay Railway, connecting the prosperous cities of Fostoria and Findlay. Right of way has been secured to extend the road to Toledo, and it was the original intention to build the line this year, but the great scarcity of material, together with the general depression of traction matters in Ohio, resulting from the Everett-Moore embarrassment, prevented the completion of these plans for the time being.

The accompanying map (Fig. 1) shows the route traversed by the road, and the proposed extension from Fostoria to Toledo. Broken lines on this map show the Tiffin, Fostoria & Eastern Railway, an independent line operating between Fostoria and Tiffin. The population of the towns in this section is indicated on the map. It will be noticed that there are a number of small settlements along the line in addition to the towns from which the road takes its name.

Fostoria has a population of 8000 and Findlay about 18,000. The tributary population of the present road is about 40,000. The country traversed is the heart of the great oil fields of Northwestern Ohio, so that for its country traffic the road not only draws from the thriving farms but from the hundreds of oil wells and numerous pumping stations along the line. Oil men are desirable patrons; they make frequent trips to the cities, and supplies for the wells form a very important item in the package freight business of the road. So numerous are the oil wells in this district and so fierce is the competition for available ground that the company has accepted two or three propositions for the lease of unoccupied land along its right of way. Wells have been drilled and derricks erected, and in places the cars almost graze the latter in passing. Oil leases form a considerable item in the earnings of the road. A trip over this road at night is an interesting sight for one who is unfamiliar with the oil districts. The country for miles around is illuminated by hundreds of small flames from escaping oil and gas, and the clank of the pumping machines, mingled with the steady hammer of the drills, makes a fitting accompaniment to a scene which is weird in the extreme.

Between Fostoria and Findlay the road is built on 35-ft. private right of way adjoining the highway, and separated from it by a ditch. The country traversed is extremely level, there is only one grade on the line, and that is something less than 1 per cent. There is one 12-ft. fill, and there are three curves requiring guard rails, but all of them can be taken at full speed. The extension to Toledo will be even better adapted for high speed, as there will be no grades over 1 per cent; only one railroad crossing outside the cities, and but two curves requiring guard rails.

The track is laid with 60-lb. T rails, 30-ft. lengths with Atlas joints. Ties are white oak and cedar, 6 ins. x 8 ins. x 8 ft. on 2-ft. centers. Eight inches of crushed stone is used for ballast, and the road bed is drained by a ditch at each side, with crock piping where necessary. The poles are 30-ft. and 35-ft. cedar, 100 ft. apart. Direct current distribution is used, and there are two 250,000 cm aluminum feeders. Double trolley wires of the No. 00 figure-8 type are used. Hangers and insulators were supplied by

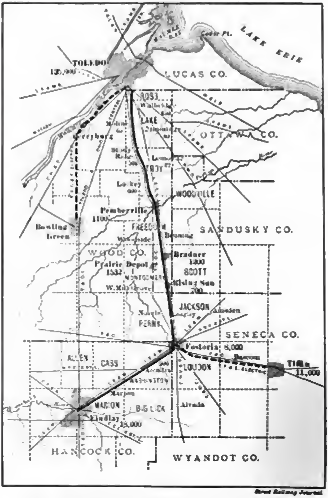


FIG. 1.—ROUTE OF THE TOLEDO, FOSTORIA & FINDLAY RAILWAY

the Ohio Brass Company. Stops and fare limits are designated by signs, the former being about half a mile apart. Cattle guards are placed at all crossings.

FIG. 2.—CAR SHED, POWER HOUSE AND PASSENGER STATION OF TOLEDO, FOSTORIA & FINDLAY RAILWAY

The headquarters, power house and car houses are at Fostoria. The buildings, which are shown in Fig. 2, are of brick and structural steel and very substantial. The car houses have space for the storage of double the present equipment. The building also includes a small repair shop, equipped with lathes, drill presses, emery wheels, blacksmith's forge, etc. There are facilities for rewinding armatures, but although the road has been in operation for more than a year, there has been no demand whatever for this class of work, as the management has yet to experience the burning out of an armature.

The power house (Fig. 3) is designed with a view to extensions when the Fostoria-Toledo line is built. The power equipment consists of two 250-kw 650-volt Westinghouse railway generators (Fig. 4), direct-connected to two 300-hp 4-valve tandem compound Russel engines; two 400-hp Sterling boilers, and a 75-kw motor-driven booster, used for extra service.

A general view of the engine room, showing the switchboard, is presented in Fig. 5. The auxiliary equipment consists of Dean feed-water pumps, and Stilwell-Bierce water heaters. Rain water, taken from an artificial pond, and city water are mixed for the water supply. At present the engines are operated non-condensing, but they will shortly be changed to condensing, when the power generated will be increased to 375 hp each. The electrical equipment was installed by the Westinghouse Electric & Manufacturing Company; the engines and boilers by Arbuckle-Ryan Company, of Toledo; the piping by the Best Manufacturing Company, of Pittsbugh; the line work by the Star Electric Company, of Toledo; while the general construction work was done by the Dover Construction Company, which is composed of men interested in the road. The consulting engineers were E. P. Roberts & Company, of Cleveland, from whom the plans of the piping and general layout of the power house, presented in Figs. 6 and 7, were secured.

The rolling stock of the road consists of eight 45-ft. Jewett cars and two 15-bench Brill open cars. Two of the former are combination cars, with baggage compartments, and five are standard coaches with smoking compartments, water coolers, closets and other improvements. The other car of this lot is a magnificently

FIG. 3.—POWER HOUSE AT FOSTORIA

FIG. 5.—ENGINE ROOM IN POWER STATION, SHOWING SWITCHBOARD

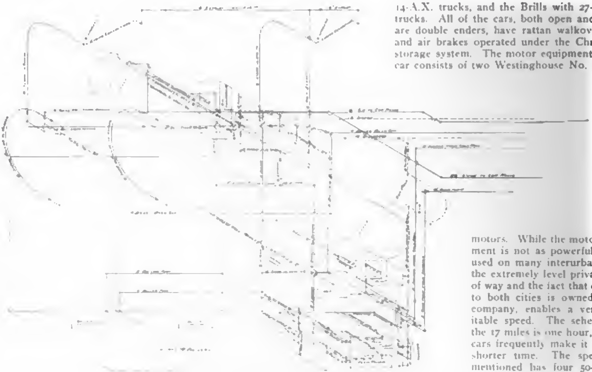


FIG. 6.—ISOMETRIC DRAWING OF PIPING, TOLEDO, FOSTORIA & FINDLAY RAILWAY

14-A.X. trucks, and the Brills with 27-G. Brill trucks. All of the cars, both open and closed, are double enders, have rattan walkover seats, and air brakes operated under the Christensen storage system. The motor equipment of each car consists of two Westinghouse No. 56 50-hp motors. While the motor equipment is not as powerful as that used on many interurban roads, the extremely level private right of way and the fact that entrance to both cities is owned by the company, enables a very creditable speed. The schedule for the 17 miles is one hour, but late cars frequently make it in much shorter time. The special car mentioned has four 50-hp motors, and is geared to 60 miles an hour. On several occasions this car has made the run between the two cities in 30 minutes, and on one occasion Manager Wentz, of the company, took a party from

equipped private chair car, which is used for special trips and trolley parties. The Jewett cars are equipped with Peckham

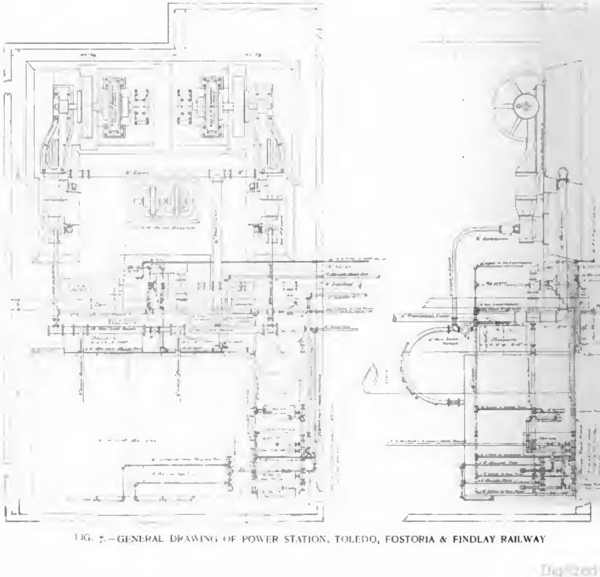


FIG. 7.—GENERAL DRAWING OF POWER STATION, TOLEDO, FOSTORIA & FINDLAY RAILWAY

Fostoria to attend a baseball game in Findlay, in 25 minutes. An hourly service is maintained between the cities, but on Sundays, holidays and on numerous summer evenings, a half-hour

FIG. 4.—ONE OF THE 250 KW UNITS IN THE POWER HOUSE AT FOSTORIA

headway is maintained. The through fare is 25 cents, the road being divided into 5-cent limits. Sam Reeves' Park lies about half-way between the tw towns, and only to this point are tickets sold. Ohmer car registers are used, and these indicate the fare paid, so that no cash receipts are given.

The company derives a very considerable income from package freight, and, as before intimated, much of this comes from supplies for the numerous oil wells. Considerable farm produce is handled, and the through business is also very heavy. The company has the mail contract between the two towns, having wrested it from the steam road which it parallels. It is also claimed that the steam road has lost practically all its passenger business, and much of the freight between the two points. Indication of the fact that the competition is a serious matter, is shown by a recent report that the Lake Erie & Western will entirely rebuild its lines between Fostoria and Findlay. More trains are to be operated and a strenuous effort will be made to regain the lost ground.

In handling the package freight business the standard railway classification is used, and packages are carried at either 7 cents or 8 cents per cwt. At present no agents are maintained, and all goods are handled in combination cars. The business is growing so rapidly, however, that a special freight car will be installed in the near future. The conductors and motormen handle all the freight. Instead of voluminous blanks, the conductors are provided with tickets similar to transfer slips, and in receiving freight the kind and amount, whether collected or not, is punched in duplicate, one slip being handed to the consignor as a receipt. Coal cars are frequently received from the steam roads at Findlay and Fostoria and delivered to the gas and pumping stations on the line. Thirty cents per ton is charged for the 6 miles which it is usually hauled.

Probably the heaviest earnings of this road come from the excursion business to and from Sam Reeves' Park. It might be truthfully said that without this business, which it handles exclusively, the present road could not make a living in competition with the steam road. The park, consisting of 55 acres, is owned and was laid out by the company at a very reasonable figure, in view of its earning powers. It draws from both cities, as well as the entire surrounding country, being one of the most attractive little resorts in that section of the State, and the only one of its kind in the immediate vicinity. It lacks somewhat from the fact that it has no body of water, but the other appointments seem to make up for this deficiency. Unlike numerous similar resorts, the park draws good crowds all the year around. The theater and pavilion, shown in Fig. 8, is designed so that it can be thrown open during the summer months and closed tight during the cold weather. Two large furnaces supply ample heat

FIG. 9.—DESPATCHER'S STATION AND CAR AT ENTRANCE TO SAM REEVES' PARK

in the coldest weather, and, if desired, during moderately severe weather, the heat can be regulated by operating only one furnace at a time. The round-trip ticket from either city admits the

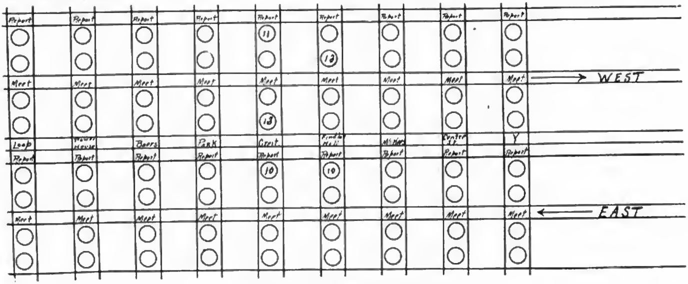


FIG. 10.—PLAN OF DESPATCHER'S BOARD

holder to the grounds and theater. Reserved seats are 5 cents and 10 cents extra, according to location. There is a balcony, and, with the auditorium, there is a seating capacity of about 1200 in the house. High-class vaudeville is given each evening, and on certain nights the floor is cleared for dancing. On the ground floor of the pavilion there are a shooting gallery, billiard and pool tables, bowling alleys, and toilet and dressing rooms. No liquors are sold on the grounds, and George C. Richards, who manages the park for the company, has been entirely successful in his efforts to cater to the very best class of people in both cities. One portion of the pavilion is leased to a popular caterer, and refreshments of all kinds are served. Frequently the dancing privileges are let to private parties, and this includes the board, plan of which is presented in Fig. 10. The board was planned by Manager Wentz and improved by George Fink, the train despatcher. It is about 6 ft. in length, divided into spaces representing the switches or passing points. The board is divided transversely for east-bound and west-bound trains, and at each passing point represented are eight holes, into which are inserted pegs numbered on the heads to correspond with the numbers of the cars. In each section two holes are provided for the order "report" and two for "passing." For example, car No. 10, east-bound, reports from Findlay Hill; No. 11, west-bound, has orders to report at Creightons, but has not arrived; No. 13 has just left the Park, after No. 10 had reported from Findlay Hill, with orders to pass No. 10 at Creightons, and report at

FIG. 8.—PAVILION AT SAM REEVES' PARK

use of the private car already mentioned. Among other attractions are a merry-go-round and a small but promising Zoo. Other features are to be added. One section of the enclosure is divided off for a baseball ground. During the season there are games between well known teams on regular dates, and on these dates admission to the grand-stand seats is 10 cents and 15 cents. On account of the park business, the travel on the road is heaviest in the evenings and on holidays. July 4 of this year was the heaviest ever known.

The despatching system of the road is handled from an office at the park entrance, which is shown in Fig. 9. The line is covered by a telephone system, which is connected with the exchanges of the Bell Telephone Company in both Findlay and Fostoria. Each car is provided with a standard Bell telephone, and connection with the telephone wire can be made at any point. In despatching the operator uses, in connection with the ordinary train sheet showing schedule and passing points, a despatching Findlay Hill. For this order, the operator inserts plug No. 13 in "meeting" hole at Creightons, and "report" hole at Findlay Hill. When No. 10 reports at Findlay he gives her orders to report at Creightons, and inserts plug in "report" hole at Creightons for east-bound car. No. 10 arrives and reports, and the operator looks at the board and finds she is to pass No. 11 and No. 13, and so advises the conductor. About the same time a car reports from the Y, after the orders have been given to No. 13, and the operator looks at the board and finds he can not send a car east of Findlay Hill, and gives orders accordingly. The board is found to be very useful, and at times eight cars are operated with very little delay at switches.

The Toledo, Fostoria & Findlay Railway Company is incorporated for $1,500,000 authorized capital stock, but this has in view the extension of the road to Toledo. The bonded indebtedness at present is $450,000. The stock and bonds are held almost wholly by the men who built the road, consequently they

are well satisfied to have it pay all fixed charges, leaving the surplus for improvements and extensions. The extension of the road to Toledo will bring it into active competition for Findlay-Toledo business with the Toledo, Bowling Green & Southern Traction Company, operating to Findlay over the shorter route by way of Bowling Green. The Toledo, Findlay & Fostoria officials, however, claim they will be well able to compete with the other road, because of their advantages in possessing the private right of way, and the absence of seven grades and curves. This discussion hinges on something even more important than the Findlay-Toledo business, since it is an open question in the minds of the general public of that section as to which road will form an alliance with the powerful Pomeroy-Mandelbaum syndicate in the through line from Cincinnati to Toledo. This syndicate is completing its system into Findlay from Lima, and it is generally accepted as a foregone conclusion that it will not attempt to build a third line from the latter point to Toledo. There is, therefore, much speculation as to which of the present roads will be chosen.

The officers of the company are S. W. Croxton, Cleveland, president; E. C. Deardorff, Toledo, vice-president; Theodore Wentz, secretary-treasurer and manager.

The Strike on the Hudson Valley Railway

The strike of the employees of the Hudson Valley Railway Company assumed such a serious aspect on Sept. 17 that the sheriff of Warren County, deeming his force insufficient to guard the company's property, had the militia called out. On the day mentioned a car, guarded by several deputy sheriffs, took a number of non-union motormen and conductors from Fort Edward to Glens Falls. This seemed to be a signal for a demonstration by the strikers and their sympathizers, for they lined the track and so hampered the work of replacing the car that several hours were consumed in completing the job.

However, it was not until Sept. 18, when the company made strenuous efforts to resume passenger traffic, and was to a limited extent successful, that the strike assumed a very serious aspect. Extra companies of militia were then called out, and details were sent to protect the company's power house near Saratoga. Troops were also sent to Whitehall and Mechanicsville, where there had been riotous demonstrations. A boy was shot by a deputy sheriff in Waterford late on the afternoon of Sept. 18, but the injury was slight.

The most severe riot since the strike was begun occurred on Sept. 20 at Waterford. A freight train of the Delaware & Hudson was wrecked at the crossing where the trolley tracks intersect. The locomotive was overturned and the engineer and fireman were injured. A mob of strike sympathizers had gathered at that point and it is thought that the cross-over was tampered with to wreck a trolley car.

Since Sept. 18 the company has each day succeeded in operating more cars, and the strikers are less demonstrative. Armed guards are sent out with each car that leaves the car house, however, and those who would interfere keep at a distance when the cars are operated through the towns where most of the violence was displayed last week. The lawless element, it would seem, has come to realize that the company proposes to maintain its determined stand. The company's property is still being tampered with at isolated points, and many obstacles are found at different points along the line.

The old practice of declaring a boycott has been resorted to, and committees from the unions have threatened business men who have any dealings with the railway, its officers or present employees, or with the National Guard. An instance of the extreme to which this boycott practice is carried is furnished at Glens Falls, where one of the operatives in a shirt and waist factory who rode to work on a car was jeered and hooted at by her fellow employees. A committee, representing the employees of the factory in which the girl worked, waited on the local manager of the company owning the plant, and demanded the girl's discharge under a threat of striking. The company owning the plant, which has had considerable trouble with its employees, declares that the plant will be removed before it will submit to such tyranny.

Later, when the men found that their original demand would not be granted, they modified it somewhat, asking an explanation and apology and a promise that the operatives would not patronize the cars. The company refused positively to exact any such conditions and the committee did not press the demand.

Annual Report of the Union Traction Company, of Philadelphia

Twelve directors were elected to the directorate of the Union Traction Company, at the annual meeting of the stockholders of the company held last week. The receipts of the company from operation for the year just ended were $14,118,158, cost of operation, licenses, taxes and fixed charges, $13,040,120, showing a profit of $1,078,039. The operating expenses were 52.30 per cent, as against 51.74 per cent last year, an increase of .56 per cent.

The board of directors elected for the ensuing year, 497,764 shares being voted, was: William L. Elkins, Alexander M. Fox, John B. Parsons, William H. Shelmerdine, J. J. Sullivan, P. A. B. Widener, George D. Widener, George W. Elkins, Alexander Balfour, Charles O. Kruger, John M. Mack, George H. Earle, Jr. The personnel of the board is the same as that of last year, with the exception of Mr. Earle, who was elected to the place vacated by the death of Alfred Smith, and Mr. Mack, who recently succeeded Mr. Dolan.

P. A. B. Widener and William L. Elkins were the only stockholders of prominence absent when President Parsons made his report. He said:

"As this is the last operating report which will be issued by your company, I thought it might be of interest to give the subjoined information. On June 30 the trackage of your company was 475.45 miles, divided as follows: Operated track on street, 453.25 miles; track in car houses, 22.20 miles." The car equipment included 1698 closed cars and 1234 open cars.

The annual report of the company for the year ended June 30, presented at the annual meeting, shows:

	1902	1901
Gross receipts	$13,969,232	$13,269,465
Operating expenses	6,402,338	5,836,186
Earnings from operation	$7,566,894	$7,433,279
Receipts from other sources	148,925	162,215
Gross income	$7,715,819	$7,595,494
Taxes, licenses and fixed charges	6,637,781	6,734,228
Net earnings	$1,078,038	$861,266
Number of passengers carried	325,801,963	302,225,286

The balance sheet as of June 30 compares as follows:

ASSETS

	1902	1901
Cash		$194,697
Cash in agent's hands	$230,463	20,000
Fire insurance fund	242,996	242,965
Advertised leased lines	6,659,555	5,880,572
Supplies	250,938	190,709
Construction and equipment	4,728,885	3,847,867
Real estate	617,837	432,274
Accounts received	30,426	27,273
Stocks and bonds	5,225,703	5,584,091
Franchise account	90,248	90,248
Total	$18,086,065	$16,510,940

LIABILITIES

	1902	1901
Capital stock	$10,500,000	$10,499,912
Income fire insurance fund	31,418	12,490
Accounts payable	204,191	111,465
Accrued maintenance account	218,819	382,265
Fixed charges and taxes not due	1,332,496	1,450,208
Open accounts	1,560,000	800,000
Operating account due company's 999 years	902,568	1,004,101
Deposits underlying companies	239,012	215,790
Trustees' accounts	120	120
Profit and loss	3,097,429	2,034,381
Total	$18,086,066	$16,510,640

Third Annual Report of the American Railways Company

The third annual report of the American Railways Company, being that for the fiscal year ending June 30, 1902, was submitted at the annual meeting of the company, held last week.

The net income for the year is, in round figures, 8 per cent upon the capital stock of the company. The gross earnings of the subsidiary companies for the year 1902 were $1,009,496, as compared with those for the year 1901 of $844,297, an increase of $165,199.

During the year there were issued $2,500,000 of the American Railways Company 5 per cent collateral trust convertible gold

bonds, dated Dec. 2, 1901, and payable Dec. 1, 1911. These bonds are redeemable at the option of the company at any time after Nov. 1, 1904, at 105, together with accrued interest on the principal of the bond to the date of redemption; they are also convertible, at the option of the holder at any time prior to Nov. 1, 1904, but not thereafter, into the capital stock of the American Railways Company at par; the holder receiving at time of conversion the accrued interest upon the bond. Of these bonds there have been sold at this date $1,500,000, and the accrued interest on said sales has been included in the statement of fixed charges.

The collateral deposited with the trustee, the Provident Life & Trust Company, of Philadelphia, as security for said convertible bonds, consists of $1,600,000 of the first consolidated mortgage 5 per cent bonds of the Chicago & Juliet Electric Railway Company, being the whole issue thereof except $400,000 reserved to pay a like amount of bonds secured upon parts of the company's system; $500,000 of the first mortgage 6 per cent bonds of the Springfield Railway Company, of Springfield, Ohio, being the whole issue thereof; and 10,500 shares of the capital stock of the People's Railway Company, of Dayton, Ohio, out of a total issue of 11,000 shares now outstanding.

There have been acquired by purchase during the year the following securities: twenty shares of the Springfield Railway Company, thirty-nine shares of the People's Railway Company, nine shares of the Altoona & Logan Valley Electric Railway Company, 583 shares of the City Passenger Railway Company, of Altoona, Pa.

No new properties were purchased during the year, but extensions and improvements to properties already owned have been made, and satisfactory returns for the expenditures incurred are being received.

The treasurer's report for fiscal year ended June 30, 1902, shows:

INCOME

Interest on bonds owned by the company	$75,009.16	
Dividends on stocks owned by the company	172,500.00	
*Miscellaneous income	162,776.11	
Gross income		$410,284.27

DEDUCTIONS FROM INCOME

General expenses	$31,146.08	
Printing and registration of stocks and bonds, stamp tax, etc	5,731.30	
Legal expense	1,765.76	
Taxes	3,386.75	
Interest on funded debt	25,427.06	
Depreciation of office furniture and fixtures, and of engineering department instruments	383.00	
Total deductions from income		$67,552.95
Net income		$302,731.32
Dividends paid		178,178.52
Surplus		$124,552.80
Profit and loss account, balance June 30, 1901		206,313.03
Surplus June 30, 1902		$330,865.83

* Principally interest on advances made to sub-companies and deducted from their earnings before dividends were declared.

The general balance sheet, dated June 30, shows:

Total cost of stocks and bonds	$4,168,196.19
Bills receivable, accounts receivable, etc.	2,830,100.91
Tax on capital stock paid from July 1 to December 31, 1902	1,687.25
Office furniture and fixtures	2,792.77
Engineering department instruments	711.30
Discounts on loans, paid but not due	3,192.70
Interest on bonds owned, due July 1, 1902	15,000.00
Port Norris extension, Bridgeton and Millville Traction Company	†211,586.78
Collateral trust gold five per cent bonds in treasury	900,000.00
Cash on hand	67,993.34
	$7,531,264.22

LIABILITIES

Capital stock	$3,751,000.00
Collateral trust convertible gold 5 per cent bonds	2,500,000.00
Bills payable	875,000.00
Bills audited but not paid	11,066.55
Accident insurance fund	20,412.12
Interest accrued but not due on funded debt	6,062.00
Interest accrued but not due on floating debt	3,730.21
Balances due sub-companies	26,561.91
Profit and loss, surplus as per operating report	330,865.83
	$7,531,264.22

†$150,000 Bridgeton and Millville Traction Company first mortgage 5 per cent gold bonds will be issued in part settlement of this amount.

American Car Company's Works at St. Louis Purchased by the J. G. Brill Company

The J. G. Brill Company, of Philadelphia, which has recently received so many orders for new work that there were indications of the inability of its plant at Philadelphia to cope successfully with the sudden demand, has purchased the plant of the American Car Company, of St. Louis, which company has been endeavoring, since March, 1901, to make sale of its property to the Brill Company. The plant of the American Car Company is, of course, very much smaller than that of the J. G. Brill Company, but as its capacity is about one-half that of the Brill plant, the facilities for providing for the additional amount of work that the Brill Company has on hand, are provided at once, while these facilities could not have been made ready at the Brill works in less than six months' time. The property of the American Car Company was held by trustees for a St. Louis Bank, which represented the creditors. The sale was negotiated on Sept. 12.

Topics of the Week

Of the many articles that have appeared in the magazines and newspapers tending to show the growing importance of the electric railway the article by Albert Bigelow Paine in the current issue of *World's Work*, describing a June journey from New York to Chicago, is one of the most interesting on the subject. The entire trip consumed nine days of leisurely going and involved fifty-seven changes of cars, costing about $50. "Without views, interviews and fishing," Mr. Paine remarks, "it could have been done in a week" and also for less money. "Steam for speed; trolley for a good time," is his general conclusion.

A curious condition of affairs exists near Rochester, N. Y., where an electric railway is making an effort to condemn the land of a farmer. The electric railway wants to run its line between the barn and the house of the farmer, and to this the farmer objects. It would seem that instead of stepping from his stoop out beneath the gracious shade of the ewe trees, the farmer would, as the Rochester Post-Express puts it, butt into the firm end of a trolley car. "He does not," says the Post-Express, "wish to oppose the advance of civilization and is willing for the new road to muss up the rear end of his farm to almost any extent, but he does object to hunting eggs with a basket in one hand and his life in the other." There are others who would object to doing this, too.

Commenting upon the general denunciation of trolley lines that has characterized the daily newspaper accounts of the accident at Pittsfield the Buffalo "Commercial" declares that these criticisms do not apply to the company which serves Buffalo and its vicinity. "We only note the exception," says the "Commercial," "to show that a trolley line may be managed safely and successfully on railroad, not horse-car, principles. With the appliances and safeguards used on the big electrics in Buffalo, supplemented by a system of bonuses to employees who are responsible for no accidents in a given time, and by good discipline, an electric railway can be run in a large city, on 'railroad principles,' with fewer accidents than the horse-car system. Local experience proves it." As a matter of fact, the experience of most communities proves it, but the habit of denouncing public-service corporations has taken possession of many newspapers, and their desire to create a sensation is too strong to resist temptation.

The Interurban Street Railway Company has been sued for $10,000 damages, alleged to have been sustained by Simon Kurtz, as a result of an accident. On Sept. 8 he was stepping on a car on Clinton Street when, as he alleged, having only one foot on the steps of car No. 80, it started up, threw him down, and dragged him for some distance. His body was bruised, but the injury of which he complains principally he described as follows: "The plaintiff, by profession a cantor in a synagogue, avers that, by reason of the injuries aforesaid, deponent was compelled to have his beard shaved off, in consequence whereof he has been refused employment in the capacity as cantor, and sustained damage thereby." It appears that to sew up the wound in Kurtz's chin it became necessary to shave off the beard in spots. That ruined it, and made it appear scraggy. The scriptural injunction, "neither shalt thou mar the corners of thy beard," was violated, and now Cantor Kurtz swears "by my beard I'll have the law on the railway company."

Proceedings of the New York State Street Railway Convention—II

In the last issue of the STREET RAILWAY JOURNAL a full report was given of the proceedings of the New York State Street Railway Association at Caldwell on Sept. 9. The convention closed Sept. 10, and the proceedings of that day were as follows:

The convention convened Wednesday morning pursuant to adjournment.

The President: We will open with the discussion of the rules and the suggested amendments. In the temporary absence of Mr. Connette, the chairman of the committee, I will ask Mr. Fassett to proceed with that subject.

Mr. Fassett then read rules Nos. 1 and 2. These rules in full are published elsewhere in this paper.

A Member: I find it necessary in carrying out the provisions of Rule 2 that the notice sent by the trainmen to the station should be a written notice, and should reach the station ten minutes before the man is due to report, the reason for that being that if it is a verbal communication it may have been given to some of the man's fellows and neglected to have been turned in; and then I have known at times a man to be under the influence of liquor and get somebody else to telephone for him. I would suggest a change that that notice be made a written one

The President: Any objection to that?

Mr. Fassett: I have no objection to it

Mr. Clark: Does not the rule as it now stands leave it either written or verbal?

Mr. Fassett: I think, perhaps, under some conditions, it is just as well to leave the rule as it is. Let there be a special rule for such companies as desire a written communication. Take for instance this Hudson Valley road, where a man may live 10 or 15 miles away from where he is to report, and it might be impossible for him to get his written notice in, and yet he could get his ten minutes' notice in before the time arrived to take his car out. If the rule is left as it is it can be made written notice for such companies as desire. I think, as a basic rule, it is all right as it is.

Mr. Fassett then read Rules Nos. 3, 4 and 5.

A Member: Rule 5 might be interpreted in such a way as to mean that an employee should not take a drink at any time. It would seem the way the rule stands it would prohibit a man from taking a drink at all. I think we will all agree that a man should not go into a saloon or drink while in uniform. I suggest that the rule be reconstructed in such a way as to make a misunderstanding of it impossible.

Mr. Fassett: That rule is pretty well covered by the State law The superintendent is responsible for any man whom he employs whom he knows uses intoxicants.

Mr. Lord: The rules can only be held to apply to men while they are on duty.

Mr. Fassett: I would suggest then that Rule 5 be changed so as to start with "during hours of duty," then continue right down to where the words "during hours of duty" are now in italics, and then there will be a period, and the next paragraph can start "when off duty."

The President: If there are no other suggestions we will pass on to the next.

Mr. Fassett then read Rules Nos. 6 and 7

Mr. Fassett: I do not agree with Rule No. 7, and I never have I know it is the recommendation of the State Board of Railroad Commissioners, and, as a general thing, I look upon their recommendations as law, but I think if the rule is observed, that the motorman comes to a full stop and looks and listens before going over railroad crossings, there will never be an accident. The fact that the conductor goes ahead and signals simply means that the car for a certain time is in charge of the motorman alone, and I think more accidents are apt to happen from passengers being thrown in getting on or getting out of a car in places of that kind, than by having the motorman stop and the conductor listen from the proper place on the rear end.

A Member: I note that the rule says "at a safe distance." It should be a distance sufficient that if the motorman starts and finds anything is about to happen he will have room enough to stop his car.

Mr. Barnes: I hope that that rule will not be modified It might be added to and made stronger. It is certain, and the experience of the Railroad Commission has proved, that it is necessary that every precaution should be taken at steam road crossings that is possible, and Mr. Cooper's suggestion that an arbitrary distance should be fixed is impracticable, for the reason that the cars and other conditions vary the safe distance at which a car can be stopped from the crossing. The local conditions govern. It is necessary that the car be stopped far enough from the crossing so that it can get headway enough to drift over in case the power is not on.

Mr. Robinson: I should be glad to see that rule broadened in some way so there will be a distinct enunciation of the principle of the method of procedure as to what should be done in cities where there are right-angle crossings of electric roads. It should be laid down as a rule, or else the operating men should agree that it should not be enforced, that cars must absolutely come to a stop before crossing at right angles, or it may be said to be sufficient if they slow down. I think these rules should be broadened so that they should do either one of those two things and not leave it to the motorman.

Mr. Barnes: This rule applies only to steam railroad crossings.

Mr. Fassett: I think if any electric railroad has a crossing which is dangerous enough to require the conductor to go ahead the company should protect it by flagmen. More accidents happen from the car being started by the motorman after he is signaled by the conductor than any other cause. The worst accidents that ever happened on the United Traction Company's road happened when this rule was supposed to be in force. The conductor went ahead in a perfunctory sort of way, and the car started and was struck by a train which the conductor failed to see. The fact was that the electric car never stopped at all; the car simply slowed down and the conductor ran ahead. The car continued slowly, and when the conductor started the car the train was on him and the accident happened. It seems to me that where there is any crossing that is so dangerous that it requires a man to inspect the crossing there should be a man placed there all the time. This is also one of the positions you can fill with the older men of the road who have outgrown their usefulness; put them at crossings of that kind and let them protect the crossings in that way and not have the conductor leave his position on the car.

Mr. Barnes: The accident to which Mr. Fassett refers was at a crossing which was protected by a flagman who had a lantern in his hand. The fact that the accident occurred through the failure of the conductor to go ahead simply emphasizes the necessity of the rule. If the rule had been lived up to the accident would not have occurred.

Mr. Connette: I suppose for the size of the place Syracuse has more steam railroad crossings at grade than any other city in the State, and I would not assume the responsibility of operating cars over those crossings without taking every possible precaution to avoid accidents. So far we have been fortunate in not having any accidents at the steam railroad crossings, but we pursue every possible recourse of safety. We require the conductors to go ahead and go to the center of the steam railroad track and then flag the car ahead I do not believe that we can place too many safeguards around places of danger. One accident will cost a great deal more than the expense of providing for the different means of safeguarding the dangerous places.

Mr. Lord: Why should it not be well to have something in the rule which would guide the conductor. It may be that trolley cars cannot be stopped at any given distance; but this places the whole responsibility on the conductor of judging whether there is sufficient room and time for the car to pass, and he is merely doing then exactly what every motorman does under all circumstances of vehicles or cars proceeding in an opposite direction. Why could not there be some provision requiring the conductor to have the car wait the passing of any train that was then an approximate distance away or within sight, because a train proceeding at any fast rate of speed will soon pass the spot, even if it is in sight when the conductor first observes it.

Mr. Cooper: Notwithstanding what Mr. Barnes says in regard to that distance from the track, I think that you will find it will be absolutely necessary to provide that the car shall stop a minimum distance from the track. I have had some little experience in that in Schenectady, where we cross the tracks of the New York Central and Delaware & Hudson. We finally put a mark virtually thirty feet away from the track, for the reasons that if the motorman had started the car and then found he had to stop he had space to do it.

Mr. Clark: In the orders we have issued in relation to the motorman bringing cars to a stop at steam railroad crossings it is required that motormen should bring the car to a full stop not nearer than ten feet nor farther than thirty feet from the nearest rail, placing a maximum and minimum distance. That covers the conditions and gives definite instructions.

Mr. Root: I think the statements made by Mr. Cooper and Mr. Clark are all right; but you cannot embody in any one rule any statement which will relate to all. I think every individual company should make a special rule covering its particular case.

The President: The Railroad Commissioners have adopted a rule, haven't they?

Mr. Barnes: Yes, or generally by agreement between the

roads that are crossed; but on this subject I would like to say this, which, of course, everybody knows, that the law requires the Railroad Commission to examine into the condition of each crossing in the State of New York and to recommend such protection at that crossing as in their judgment is necessary. This rule, if left as it is, in my opinion would cover the case, and as Mr. Cooper suggests and as Mr. Root has said, each individual crossing must be treated by a sub-division of this rule or addition to it, marked A, B or C, covering the distance at which each car shall come to a stop at that particular point.

Mr. Fassett: Every crossing we have is protected by our own flagmen, so that the conductor can stay on the back of the car; and I think that any street railway can well afford to pay the amount of $1,200 a year for the expense of a flagman to protect the crossings and let the conductor stay where be belongs and take care of his passengers that are on his car.

Mr. Byrne: One great danger that I do not think has been mentioned is that the trolley pole has often slipped while the car is in the middle of the railroad track, and had the conductor been in his position at the time he might have adjusted it and thereby averted a very great calamity.

Mr. Clark: In small villages and towns where steam railroad crossings are frequent and only a few cars are operated I do not think that the expense of flagging crossings would be practicable. I know we have several outlying crossings which are in a measure dangerous and should be carefully protected and guarded, but which would not warrant, from the standpoint of the infrequency of the service and the expense of operation, the stationing of a flagman at those points. Neither do I think it necessary upon those remote crossings where the conductor has ample time to go ahead, and we have been operating ten or twelve years. I think the placing of a flagman on those street crossings would be an objection to Mr. Fassett's suggestion.

Mr. Seixas: We have a crossing at grade where our line takes a curve and the steam line takes a curve. It has always been protected by flagmen, but a Michigan Central train almost caught us while our flagman was there. We used to leave the conductor on the platform for the purpose of looking after the trolley and for the purpose of looking after the people who get off before they get to the crossing. Passengers get on and off on either side of that crossing, because we come to a full stop on either side. We decided, however, that the only further safeguard we could have was to have the conductor go forward and flag. We have never had any trouble since then. We have further arranged our trolley framework so that it is almost impossible for the trolley to come off. At the same time we are up against that situation of having two places where passengers get on and off of a 50-ft. car, so it is impossible for the motorman to see whether passengers are getting on or off. We cannot use a distance clause. The only thing we can do is the best we can do, and that is to have a flagman there all the time and have our own conductor go ahead and the motorman do the best he can in starting, whether the passengers are getting on or off. If the motorman turns around to see whether passengers are getting on or off the train might come up after he had the signal to cross the crossing.

Mr. Mitten: We have very many dangerous crossings. We are endeavoring to protect them by the use of towers. There is no doubt that the practice of having the conductor get off the car and flag brings about many accidents. The modification of this rule exempting in some way such crossings as are protected by tower devices is the only suggestion I have to make.

Mr. Fassett: I think if we should use the words "unprotected crossings" they would cover the case.

Mr. Connette: The word "unprotected" means a great deal in connection with this rule. As I said before, the worst accident that ever occurred in this State at a railroad crossing, where fifteen people were killed outright and sixteen injured, happened at a protected crossing. If the exception is going to be made it should be made as to crossings which are protected by derailing devices operated from a tower.

Mr. Ely: In that connection it seems to me that the best form the matter can take is to leave the rule standing as it is now and adding at the bottom thereof, parenthetically, a provision something of this kind: The provisions of this rule (excepting requirements for a full stop) shall not apply to grade crossings which are provided with derailing devices operated from towers or from a tower.

Mr. Barnes: I hope you will excuse me for taking up so much time, but I consider that this is a very important matter. This convention puts itself on record as intimating to the managers of all railroads throughout this State that a crossing that is protected by a flagman is sufficient protection. Gentlemen, I want to say that that is a dangerous procedure. A crossing cannot be too well protected. The most dangerous point in the operation of any street railway is the point where you cross a steam road, and you cannot put too much protection at that point; and the best protection that can be had is a derailing switch interlocked with home and distance signals on the steam railroad, to be operated from the tower. My experience and the experience of all managers, perhaps not on their own railroads, is to the effect that a flagman is not sufficient protection at a crossing, and the fact that he is employed by the electric road or the steam road does not add to his efficiency. It enables you to discharge him after the accident has occurred, but I do not think it leads to efficiency before the accident occurs. I do not think the idea will be enforced by this convention that a flagman is sufficient protection at a crossing of a steam and electric road if you insert there the words "crossings protected by flagmen."

Mr. Connette: I do not believe that this convention can afford to make any exception to this rule. If there are any companies that have crossings to which they do not wish to have this rule apply they can make an exception to it and make it specific that this rule does not apply to crossings at certain points; that is, if they want to assume the responsibility.

Mr. Allen: I agree with Mr. Barnes. Speaking of our own road, we are equipping every steam railroad crossing with derailing switches, to be operated by the conductor. We are equipping our cars with an extra arrangement to enable the trolley to stay on under all conditions. It seems to me that his convention should not take action in any way except to put the strictest rules on steam railroad crossings. As I understand this book of rules, the rules are general to a great extent, each road taking these rules and applying them as they fit the conditions under their operation. It may be that some steam railroad crossings that are operated by means of derailing switches are operated by men in the towers. The rule as it now stands would certainly not fit those conditions, but every one of those crossings that are operated by derailing switches by a man in the tower has been installed under the direction of the Railroad Commissioners. It seems to me that every precaution that can be taken this convention ought to provide for.

The President: I think this one rule has taken up all the time we can devote to it and that the committee now understands the wishes or ideas of the convention. I think we ought to proceed. Mr. Ely's suggestion has been added. Mr. Robinson states he would like to hear from somebody on his point, that there is no other rule relating to crossings of street railroads.

Mr. Mitten: Our practice has been to issue special rules covering each timetable as regards the crossing of electric lines, for the reason that conditions govern. We do not in our practice require cars going in both directions to stop. We give one the right of way, requiring the other to stop. Conditions will govern in this case as there may be a grade or something of that kind. That I do not think would be proper to insert in our general book of rules. I would suggest that this rule be passed, offering as a suggestion to the committee on rules that they amend it in such a way as to exempt the crossings protected by tower and derailing devices from the general conditions governing other crossings.

Mr. Lord: I want to say a word with reference to Mr. Robinson's suggestion. The question is constantly arising in the courts where cars slow down or stop before the crossing of an intersecting street railway and passengers attempt to alight. The question is constantly arising whether the passenger is entitled to assume that that stopping is an invitation. It seems to me that if the street railway companies could point to a rule which requires them to stop for a specific purpose then any presumption that that stopping was an invitation to passengers would be overcome. In the city of New York large verdicts have been obtained in some cases of this kind. The company's witnesses say the car stopped to let another car go by; the witnesses for the plaintiff say it stopped to let a passenger off. If there is a rule we can point to we can overcome that presumption. We can say "We are complying with the rule." It seems to me, for that reason, it is just as necessary to make this rule apply to street railways as it is to steam railroad crossings.

Mr. Fassett: Our practice is that the cars shall be brought to a full stop before passing any intersecting track, and cars going in any direction should be brought to a full stop, and then the car which has the right of way proceed. If we do not do that then a man is not liable to stop his car if be has the right of way, and some green motorman on the other car, or a man who has lost control of his car, is liable to go on. I think we might add to the rule that cars should be brought to a full stop at all electric railway crossings.

Mr. Mitten: In congested districts that would retard moving

the cars too much. We found it was not practicable, and as to whether the men would obey rules or not, it is a matter of discipline.

The President: I think we had better leave this to the committee and proceed.

Mr. Fassett then read Rules Nos. 8 and 9.

Mr. Robinson: In reference to Rule No. 8, I think the paragraph on page 6 is more a matter of argument than a matter of rules, and I suggest that it be stricken out. It is only a statement of the reasons for the rule; it is not the rule itself.

Mr. Fassett: I don't think it is objectionable.

Mr. Mitten: I like the rule.

Mr. Fassett then read Rules 10 and 11.

Mr. Ely: What does the word "awaits" mean in Rule 10? If it means an agreement to give a hearing, why not say so. "A hearing will be given" is a plain statement of a fact. The word "awaits" might mean a long time.

Mr. Clark: I think the phraseology should be changed to conform to the idea that Mr. Ely has suggested—"A hearing will be given by the superintendent to every employee who has any grievance to state."

Mr. Allen: I would like to ask how many roads belonging to this convention propose to adopt this code of rules as a standard?

Mr. Connette: The idea, as I understand it, is that when this convention is satisfied that a code of rules has been compiled which is satisfactory it will be adopted by all of the roads of our members of this association, and where local conditions are such as to require some changes or some of the rules to be supplemented that can be done by adding a sub-section, for instance designated as Section A of Rule No. 13 or Section B of Rule No. 13, but not to change the fundamental principles of the rule; only add such things as are necessary to provide for the local conditions. I cannot speak for the State Railroad Commission, but from what I learned during the discussion of Mr. Barnes' paper yesterday it seems that the Railroad Commission is very anxious for this association to adopt a standard code, and it is quite likely, when we have reached that point where the rules are ready to be applied to the different lines, the State Railroad Commission may possibly approve them, the same as they have the standard accounts of the Street Railway Accountants' Association of America. It took the steam railroads several years to compile a standard code of rules. Perhaps the committee was at work over five or six years before it reached a conclusion. Now all steam railroads operate under the same system of rules for the government of employees as well as for the movement of trains, and that is the object to which we are aspiring. There is no use of our wasting our time in discussing these rules unless the members of the association propose to adopt them when it has finished with the work.

The President: Is that so understood by the convention?

Mr. Fassett: I think as Mr. Connette does, that we are not going to adopt at this meeting a set of rules, but that the discussion that is going on here is indicating to the committee what it shall suggest in making a set of rules which will be brought before the next convention.

Mr. Lord: I make a formal motion that the committee on rules be continued for the following year, and that the suggestions made by the members to-day be taken under consideration by such committee and the rules altered or amended as they see fit and the report handed in at the next convention.

The President: Mr. Mitten is on the committee on rules in the national convention, and I would like to have him added as one of that committee here.

Motion seconded.

Mr. Barnes: Mr. Chairman, I do not want to suggest anything that will interfere with the order of business of the convention, but I want to say this, that there are a number of roads in this State that are operating to-day without any rules; they are waiting for this convention to adopt a set of rules. Such managers as Mr. Fassett, Mr. Mitten and others, and the gentlemen on this committee, have no idea of the manner in which some of the roads are operating. Mr. Fassett, with his perfect discipline in his methods of operation, can get along without any rules. There are roads in this State that are operated with practically no head to them, without any rules governing the employees or without any perfect system of operation. Those managers with whom we have talked say they are waiting for this convention to take action on a set of rules which they can enforce on their roads, modified to suit their requirements. This committee reported at this convention a set of rules; in fact, it was reported at Rochester last year. I do not see what stands in the way of the adoption of these rules, continuing the committee during the year and suggesting during the year such changes as may be deemed necessary.

The President: If we adopt this as an association all over the State of course a great many legal complications will arise which I am unable to explain; but I make this suggestion, that this committee, after taking the suggestions of the convention, meet as soon as possible or practicable and have another book of rules printed, with the suggested changes, and send them to all of the roads, and then those roads which have no rules may adopt them or not, as they see fit; then next year they will come here better prepared to work out a solution.

Mr. O'Connor: It seems to me that the suggestion made by Mr. Barnes covers the need of the railroad people much more than further delay. If we went ahead and adopted those rules as far as we can, and put them in operation it would be better for the association and better for the railroads to come here next year with such amendments as would be suggested.

Mr. Ely: Gentlemen, the State board is very anxious that we should act in some manner. It seems to be up to us to act, because the frequent occurrence of those horrifying accidents is the worst criticism and the most dangerous thing that we have to face to-day. It condemns alike in public opinion all those who make mistakes and those who do not. We all suffer in the public estimation, and the danger is that if we do not act in some way some drastic measures may be taken by some public authorities which might affect us all. It would therefore seem to me to be a fair way to dispose of the question in some way like this. I will put it in the form of a motion, in order that it may come properly before you: "Resolved, that the committee on rules be continued; that the report of the committee on rules be referred back to the committee; that each company be given thirty days to file any objections, suggestions or amendments to the rules with the committee; that within thirty days after the expiration of such time the committee formulate and make its final report, in printed form, to the executive committee, and the executive committee be, and the same hereby is, thereupon authorized to promulgate and make effective these rules." To show you what may be the great danger of hasty action here, and I know Mr. Barnes would not suggest any ill-advised action or think of suggesting any, I call your attention to Rule 11 for just a moment. If you should leave it as it is it would be most dangerous to us all. It says, when not collecting fares, conductors must remain on the rear platform to keep a vigilant lookout for passengers on both sides of the street. They must also keep careful watch of passengers in the car to note requests to stop for those desiring to leave car, and must be careful to remember requests of passengers to stop at points ahead. Now, you come back again to mandatory language. When you use the word "stopping" it relates back to the mandatory part of the clause, and it reads the same as if he must stop, "stopping car and notifying such passengers when the point is reached." That is impossible for a man to do in every case, and we all know it. It would open the door to a great flood of lawsuits and claims against us on the part of people who were carried past their point of destination, they having announced their point of destination to the conductor. That would rid us of the class of cases of the woman who, having told the conductor that she wished to stop at A Street, when the car ran past that street simply rushed right out and jumped off. They cannot recover now, but they could recover then. The language should be very carefully scrutinized before the rules are adopted.

The President: Mr. Lord's motion is now in order. It is that one member be added to this committee—Mr. Mitten.

Motion seconded and carried.

Mr. Ely's resolution was then put and carried.

Mr. Clark: Inasmuch as opportunity has been afforded to all the roads to make written suggestions, I move that we proceed with the next order of business.

Mr. Connette: I would like to call the attention of the convention to two suggestions in the report of the committee. They ask for a discussion on two subjects on which they have not acted, and it seems to me that the association ought to at least discuss those two propositions; they ought to be settled. The first is a rule restricting the carrying of large packages or bundles on the cars. What should a passenger be allowed to carry on a car as personal baggage? Second, the advisability of a rule prohibiting conductors from changing bills of a higher denomination than two dollars and defining their duties when bills of a higher denomination are presented. The committee would like the association to give them some light on those two subjects.

Mr. Robinson: One of the companies connected with the Metropolitan system was sued by a young man who went out in evening dress and had nothing less than a five-dollar bill, which he presented to the conductor of a horse car, which the conductor refused to accept and put him off the car. I believe he subsequently borrowed 5 cents and proceeded to his destination, where he arrived on time; but he sued the company. His complaint

was dismissed below, and the case was carried all the way up to the Court of Appeals, which court wrote an opinion. It was in the case of Benjamin Barker against the Central Park, North and East River Railroad Company. The court wrote a general opinion, in which it said that it was a harassing thing to require the conductor to change a five-dollar bill. As I recollect the testimony in that case, the court was led to make that statement from the circumstances surrounding the particular situation. It seems to me to be a situation to be governed by the surrounding circumstances in each particular case and impossible to fix the amount by a fixed rule.

Mr. Connette: Isn't there a rule of that kind among the rules of the Metropolitan Street Railway Company in New York?

Mr. Root: We instruct the conductors that they are not required to change anything over a two-dollar bill. They do it in many instances, but in our experience it is very unwise. It takes a conductor anywhere from half a minute to three minutes' time to make the change. He should be attending to matters which are much more important, and whatever the legal proposition is I think it would be very unwise to allow a conductor, with the congestion of traffic on the larger roads, such as we have in New York, to change a bill of more than the denomination of two dollars. I would like to say in connection with this discussion that the committee would like very much to have some suggestions as to Rules 63 and 64 as to ejectments. I consider that one of the most important, if not the most important, rule in any standard code of rules. That rule is subject to a difference of opinion in the committee itself. We do not agree upon the present wording, and there is so much that may grow out of the action taken under ejectment that I think it deserves special thought and consideration of all the members of this convention. The committee would like very much to have full suggestion upon this subject, because the action of this committee is to be final upon these rules. We would like the opinion of all roads stated to the committee so their action may not be unwise on this point.

Mr. Connette: We can leave it out entirely.

The President: That is in the committee's hands. Now as to bundles.

Mr. Connette: The next proposition is restricting the carrying of large packages or bundles on cars. What should a passenger be allowed to carry on a car as personal baggage?

Mr. Byrnes: That reminds me of a case tried in Kings County of a man who came into a car with a couple of cases, and the court seemed inclined to hold that a package that could not be conveniently carried on the lap of the passenger should not be permitted and that the conductor of the car must exercise discretion as to what size package should be carried.

Mr. Lord: It seems to me that the main difficulty might be overcome as well as possible by providing that no packages shall be carried in a car which shall in any way obstruct the aisle of the car. Any rule that attempts to define what can be carried must be either so indefinite as to mean nothing or must be so specific that it will not cover all cases that will arise. If it should say anything that can be carried in the lap it opens the door to a great many things being carried which might be extremely obnoxious, and it is extremely indefinite. A man might carry a bundle six feet high, he might carry glass; he might carry a great many things in his lap; and if the rule was simply that a man might carry what he could in his lap it would open the door to such articles being carried. It seems to me the only thing that can be done is to pass some rule which would provide for free egress and ingress of the passengers or freedom from obstructions in the aisle.

Mr. Cooper: It is not so much the obstruction as that it occupies the place of a passenger, and anything that takes more space than the place occupied by a standing passenger should not be permitted.

Mr. Seixas: As I understand it, all of the rules are to be general rules, such as can be adopted by large city roads and by small village roads and by the interurban roads, and let each road add to those rules special rules made necessary by the locality. As to this question of bundles, I do not see how any general rule can be made that will apply to all roads, because I can very easily see how a rule of that kind on some roads would be quite necessary, whereas on a small road in the country, or an interurban road, the rules adopted by steam roads applies more nearly, and larger packages are allowed. In fact, the manager of an interurban road permits passengers to carry almost every kind of thing that is not obnoxious, and it would seem to me that this is a rule which should be adopted by each road separately, and that no rule could be formed that would apply to interurban, small roads and city roads alike.

Mr. Lord: It seems to me that a rule which merely refers to obstructions would do that very thing. What would be an obstruction under some circumstances would not be under others. If a car is empty a man might have a large dress suit case; it might be on the floor of the car and it would not obstruct the aisle. On the other hand, if that car was crowded and people were standing up and he had a large valise in the center of the aisle it would not only be inconvenient, but dangerous. It is a rule that should be capable of very liberal construction. If the car is crowded something very much smaller than a valise might be an obstruction.

Mr. Clark: It seems to me that anything that applies purely to a local condition or local situation ought not to be embodied in the code, for the reason that I assume that it is proposed by most of the different roads to supply their respective motormen and conductors with copies of these rules, and why burden them with a number of rules that are in no way applicable and which tend to confuse them? I would suggest that, in submitting suggestions, anything that is thought to be purely of a local character which is adopted as the standard be made as brief and as concise as possible and as generally applicable as possible. I quite agree with one speaker in relation to the matter of bundles and parcels being a matter of local consideration. There are roads where the travel is very sparse where you would not object to a passenger carrying in the car a parcel which would be objectionable upon a large city road. It seems to me that rules of that character are matters which should be left to the discretion of the managers of the respective roads.

Mr. Byrne: I entirely agree with the suggestion made by Mr. Clark, and I think that, in view of the fact that there is a motion before the house, we should discontinue further discussion on this subject.

Mr. Lord: Mr. Root suggested discussion of Rules Nos. 63 and 64. They are very important rules.

Mr. Clark: I am perfectly willing to give way.

Mr. Root: I meant that the committee would like to have written suggestions on the question of ejectments when the suggestions are submitted, but not now.

Mr. Clark's motion was then put and carried.

Mr. Connette: Mr. President, will you impress upon the members the importance of sending in their suggestions within the next ten days?

The President: I think it is our duty to do that. I know that the various members of the Railroad Commission, as well as Mr. Barnes, are very anxious that we should establish a code of rules. I hope you will all take an interest in this matter and attend to it promptly.

The President: Certainly. We will now proceed with the reading of papers. The next paper is on the subject of "Car Despatching," by Mr. Mitten.

This was published last week.

Mr. Seixas: I would like to ask Mr. Mitten if our rule in running extras could not apply to this road, and if not, why not? We have almost an absolute rule against sending out an extra car or extra cars except as second and third sections of a regular car. We did start by sending extra cars between regulars, but found by placing them fifteen or twenty minutes ahead or fifteen or twenty minutes behind we could run them as second and third sections of regular cars and therefore eliminated the danger of having a car in between the regular scheduled cars.

Mr. Mitten: It is better that the trains be all run as sections, but in our practice we do a very heavy freight business and have sometimes quite a number of trains on the line. Our fruit business is very heavy, and in stopping at different stations to load fruit and shunt cars it would be impossible to run our train as a section in that you could not follow a regular train over a few miles of track before it would come against another regular train; so we give it written orders, passing it from station to station, not knowing what time it will be able to make, because we cannot be advised as to the work that it will be required to perform.

Mr. Seixas: I referred more particularly to extra cars on the passenger service. We also have freight under ordinary conditions, and the car is in charge of a steam railroad conductor of long experience, who operates strictly according to his written orders, which he gets at different points along the line, as he would on a steam railroad, with the exception of a few points where he must get telephone orders. That is the exception to our rule of running extras except as second or third sections. We run those trains as extra sections, but entirely on written orders. We have our own telegraph line along the entire length of the road and our own telephone line. Our telegraph is used from the main office and the telephone line from each branch. We have a telephone at each branch at every section, and the minute a car gets to that branch, whether it is an extra or not, the conductor must call up the despatcher, whether he is exactly on time

or whether he is not on time, as long as the car he is to keep is standing on the branch. No matter if he is exactly on time, if the car is not on the branch he must call up for orders for the purpose of making the other branch if the other car might be delayed.

Mr. Cooper: I would like to ask Mr. Mitten why he makes his interval between his sections a space interval instead of a time interval. We are operating a high-speed road, and we found where we made a space interval we were liable to have a rear-end collision and had to make it a time interval.

Mr. Mitten: I do not see how a time interval could be any better observed than a space interval; in fact, not as well, in that the space interval can be maintained by the use of the motorman's eye, placing the tail signal lights on the train going in advance, while the time distance would depend entirely upon the speed at which the cars might be runnig at that moment. Our rule requires the motormen to approach all curves under full control, and we have a rule which requires, in case a car becomes disabled in the vicinity of a curve where the view is obstructed, to be immediately protected by the conductor. It provides against accidents sufficiently so that running in the way which I have described at exceptionally high speed, and running the line to its capacity at times, we have never had an accident, which is perhaps the best proof that the system is effective.

Mr. Cooper: I spoke especially with regard to fogs, when you cannot see fifteen feet ahead of your car. Our trouble was caused by fogs. We had a bad rear-end collision on that account, and we had to make it a time interval.

Mr. Danforth: On our small interurban line our trouble is very light. We cannot afford to maintain operators at our points. Our line is 40 miles in length. We have not as yet completed our telephone system, but are following the standard steam railroad rules as closely as possible. We use the telephone in place of the telegraph and we run entirely on written orders, the despatcher issuing an order on leaving the city to every train. The crew registers in the register book at the despatcher's office and again at the small points on the line and terminal, reporting at the terminal to the despatcher. The register book at the intermediate points are at the sub-stations and are looked after by the operators. These operators report to the despatcher by telephone the passage of all trains. If orders are to be delivered to a train from one of the sub-stations the conductor of the train receives the order. The operator also receives the order, and the conductor makes a record of his order in the register book, so that, while he does not follow the written order down beyond the despatcher's office, by the use of the registration book we have on file the passage of all cars and the signatures of the crew, showing that they understand any order that they receive at the registration point.

Mr. Mitten: Have you a timetable?

Mr. Danforth: We have a timetable following the steam railroad form. The only thing omitted is the matter of printing the special rules in the table. That is a matter which will probably be taken up later. The form now is following single-division steam railroads. I believe the members of the association will appreciate the very compact form in which the International Traction Company is printing its tables and special rules. I believe that the printing of the rules on the tables is of almost as much importance as printing the table and that we will not go far astray in following that practice.

Mr. Barnes: Mr. Seixas brought out a point which I think is an important one and which I think all railroad managers should seriously consider, and that is the running of special cars. Where it is possible they should be run as sections of a regular run. We have had two serious accidents on interurban roads in the last two months which would have been avoided had the special cars which were in the accident been run as sections. Another point which appears in Mr. Mitten's paper is that all of the rules provide for the protection of cars when at a standstill. A second section of a regular run is entitled to the same running time as the first section. Mr. Cooper's idea of a time limit is a good one. The spacing plan has resulted in accidents, and the most serious accident that we have had in the last couple of months would not have occurred if there had been a spacing rule which could have been complied with. In this case the special train was following a regular, the regular losing time and the special making schedule time, the special coming up to the regular at a curve near the station. The regular came to a stop and was not at a standstill more than a minute before the extra smashed into the rear end. There was no time for the conductor of the regular train to protect his rear end. The road on which the accident occurred is full of curves, so that the view was limited, and it is a question whether the motorman on the extra car which was following the regular one got sight of the regular train three or four minutes before the collision occurred. It is rather difficult to establish a time limit between trains which would be of any value on account of the lack of station agents or operators along the road; but if such a limit could be enforced it would add to the safety of the operation of that character of road.

The President: Our time is limited, and although we would like to discuss the paper further, I will ask Mr. Reed to read his paper on "Removal of Snow and Ice."

This was published last week.

A Member: I would like to ask Mr. Reed under which department the removal of snow comes.

Mr. Reed: The snowplows and all snow machines are furnished by the master mechanic. They are operated by the transportation department, except that the mechanical department operates the rotaries. We have two special men on each sweeper.

Mr. R. E. Danforth then read his paper on the same subject, "Removal of Snow and Ice."

This was published last week. There was no discussion.

Mr. Robinson: Mr. Vreeland's topics to be taken up at the next meeting are as follows. First, interurban service, divided into three heads: (A) standard equipment, (B) car despatching, (C) standard methods of fare collection and ticket taking; second, extra freight and baggage service on interurban lines; this subject has been divided into three heads: (A) traffic arrangement with steam roads and boats, (B) traffic arrangements with other interurban lines, (C) development of freight and express service.

The President: The next order of business is the nomination of officers.

Mr. Allen: Mr. President and Gentlemen of the Convention: The nominating committee would respectfully submit the following report:

For president, G. Tracy Rogers, of Binghamton.

For first vice-president, E. G. Connette, of Syracuse.

For second vice-president, Addison B. Colvin.

For secretary and treasurer, Henry A. Robinson, of New York.

For executive committee, Messrs. G. Tracy Rogers, H. H. Vreeland, W. Caryl Ely, T. J. Nicholl and J. L. Greatsinger.

These officers were elected unanimously.

Mr. Connette then extended an invitation for the association to meet next year at Syracuse. It was accepted by unanimous vote.

Mr. Ely: I want to say that since my membership in the association I have never seen so largely attended, so earnest and enthusiastic a convention. The banquet was the greatest success of anything which we have ever had. We are progressing forward instead of backward. It is well, and I want to say that I do not believe that General Manager Mitten and myself will incur during this fiscal year any expenditure of money which we feel is more beneficial to us and to our system than the voucher that we will audit for payment of the expenses of our delegation present here at this convention; and I wish to assure you that from now on you may always expect from us a delegation of substantial size and at least two papers, if you desire them, to be read at the convention. And I wish to say something further—and I feel my inability to convey the thoughts, which are too many to find utterance—as to the benefits of this convention and association. Many of them are of such a nature that it is quite impossible accurately or correctly to describe them. I feel that if it were not for this association and the united and co-operative efforts and endeavors that we are enabled to make by reason of this, the position of the street railways in the State of New York and the operating officers, would not be nearly so strong as it is to-day. I believe that all of us, that every president and every general manager, the executive committees of the different roads and different corporations owning and operating street railways or properties in this State, if they fully realized the benefits accruing to the personnel of their respective organizations, they would see to it that they had representation from each individual company, and they would gladly spend the money necessary to send them here in a proper, dignified way. I am not going to talk about the benefits of co-operation, combination and all that sort of thing, because those things you know just as well as I do; if you do not, you ought to. This is the age of combined effort, and individuals to-day are simply straws floating along the current, absolutely lost except in rare instances and ineffective. Combined co-operative effort and endeavor is what is storming all the lines of progress and business and every avenue where man's intellect and his energies and his powers are employed. Everybody knows it. No man can fail to see but that the only way to protect ourselves, the only way to protect our rights, is to get proper laws; the only way to keep track of the laws is to stand and fight shoulder to shoulder. This association is much more important to us than the National Association. The National Association is in-

structive in that you meet men from the large cities all over the country and compare thoughts and ideas, and so is very beneficial. But we are governed by one set of State laws; we have a single line of thought; we have a channel that we are all working in, and if we come together intelligently, exchange ideas and suggestions, it is almost impossible to measure the influence and the result if taken in comparison with the doing of nothing at all. Where would we be if we were left to take care of ourselves? Only those can begin to answer who for the last twenty years have looked after these things and given freely of their time and of their endeavors for the association. And I can only say, as I said before, that if the importance of this association was correctly understood no manager or officer of any corporation in this State would begrudge the money and time that is necessary to be expended to keep it together, to increase its memebrship and make it more and more effective. (Applause).

Mr. Vreeland: I cannot add anything to what Mr. Ely has said. We both have frequently spoken on the same lines before this convention. We have both given our views as to what we consider the value of this association to the combined interests of the State, and if the gentlemen who are on the executive committee of the association are thoroughly conversant with what is going on in connection with the problem of street railways in the State, understand and appreciate the value of the association, certainly those connected with the smaller roads should appreciate the value of this association and its worth to the general interests which we all represent. I do not know of any one interest connected with the street railways in New York which has been more valuable in my work than the association work of the executive committee, and I agree entirely with Mr. Ely that while I am president this year of the American Association and consider its work valuable I do not consider it half as valuable to any particular State interest as this State Association. We have had, so far as business is concerned, a better convention here than any session of the American Association that I have attended since I have been a member of that association and been in business. (Applause).

Mr. Connette: I would like to make a motion to this effect: that the committee on rules would be greatly pleased to receive suggestions from the Board of Railroad Commissioners, and especially from Mr. Charles R. Barnes, the electrical expert of that commission.

Motion seconded and carried.

Mr. Allen: It seems to me that we owe a vote of thanks, and sincere thanks, to our host, the Hudson Valley Railway Company. They certainly have given us a very fine entertainment, and I would move that a vote of thanks of this association be extended to the Hudson Valley Railway Company and its officers

Motion seconded and carried.

The convention then adjourned

The Terre Haute Boycott Declared Off

The boycott declared against the Terre Haute Electric Company, operating the street railway lines in Terre Haute, Ind., and the interurban railway between Terre Haute and Brazil, has been declared off by the Central Labor Union after having been in force for eight months. The boycott grew out of the strike of the employees of the company, and while first declared against the company, was extended from time to time so that merchants, manufacturers, shopkeepers and even clergymen were brought under its ban, the labor organizations carrying on their high-handed practices without regard for anybody or anything. The STREET RAILWAY JOURNAL has already told some of the curious results that followed the declaration of the strike. As previously stated, the boycotts were first declared against the company. Next they were extended to persons patronizing the cars. They were soon extended to the business men, and dry goods stores, mills and factories were one after another placed on the boycott list. Clergymen and school teachers next were assailed, and then a traveling salesman who patronized the cars was prevented from making a sale. One man took his children out of school because one of them was seated next to the daughter of a merchant against whom a boycott had been declared The teacher was requested to change the seats of the children, but this she refused to do. A boycott was proposed against the school, but it was voted down. A clergyman, who frankly declared that the conditions existing in Terre Haute were a disgrace to the city, and that the law should be enforced, was threatened with bodily harm, and a boycott was declared against his church. Finally, a halt was called to the high-handed practice of the labor organization, and the citizens organized a protective league for self protection, with the result described.

Report of Committee on Standard Code of Rules for the Government of Conductors and Motormen*

The committee on standard code of rules respectfully submit the following rules merely suggestive toward reaching a code that will be applicable to all of the street railroads in the State, realizing, however, that the conditions existing in connection with the operation of the large and small roads are such as to make a solution of the problem a difficult one, but we believe that there can be a uniformity in the fundamental rules governing the operation of both large and small roads, and while the committee realize that the rules, which they submit herewith, are perhaps imperfect, they come nearer toward meeting the required standard than the report submitted at the last meeting.

The committee would suggest the following subjects for discussion in connection with these rules, with a view of incorporating the judgment of the convention relative to these subjects, as a part of the standard code of rules:

1. A rule restricting the carrying of large packages or bundles upon a car. What should a passenger be allowed to carry on a car as personal baggage?

2. The advisability of a rule prohibiting conductors from changing bills of a higher denomination than $2, and defining their duties when bills of a higher denomination are presented.

The committee not only recommends the above subjects for discussion, but also recommends that each member of the convention should carefully consider each rule embodied in this report and make such suggestions to the convention or to the committee as they may deem advisable.

For interurban service, and especially for high-speed roads we recommend that they conform as far as practicable to standards of steam railroad practice, not only in the construction of track and equipment, but in the rules and regulations for the government of employees and the movement of trains.

Respectfully submitted, E. G. Connette, Oren Root, Jr., J. C. Brackenridge, Edgar S. Fassett, J. P. E. Clark, committee.

GENERAL RULES

1. Conductors and motormen are required to be familiar with the rules, and with every special order issued. The bulletin board must be examined daily for special orders. Entrance into the service of the company implies acceptance of its rules and regulations, and ignorance of rules will not be accepted as an excuse for neglect or remission of duty. If in doubt as to the exact meaning of any rule or special order, application must be made to the proper authority for information.

2. Regular conductors and motormen must report for duty ten minutes before leaving time for their first trip, or, if for any good reason unable to so report, must give notice ten minutes before such leaving time.

Extra men must report at such time as ordered, or must give notice ten minutes before such time. They must not absent themselves after answering roll call without permission.

3. Motormen and conductors must report for duty clothed in full regulation uniform, and must be clean and neat in appearance.

4. Treat all passengers with politeness; avoid difficulty, and exercise patience, forbearance and self-control under all conditions. Do not use uncivil, indecent, or profane language even under the greatest provocation.

5. Drinking intoxicating beverages of any kind, or entering any place where the same is sold as a beverage; carrying of any intoxicating drink about the person, or the bringing of same on to the premises of the company; or smoking tobacco during hours of duty, or, the constant frequenting of drinking places or entering such places wearing uniform, or the indulgence to excess in intoxicating liquors, when off duty, is positively prohibited.

Smoking is not permitted in any part of the company's buildings, except in the rooms set apart for use of motormen and conductors.

All forms of gambling, including bets and raffles, are forbidden upon the premises of the company.

6. Cars must never be run ahead of schedule time, but must pass time points, and leave terminals promptly on time unless unavoidably delayed.

7. Cars must be brought to a full stop, at a safe distance, at all steam railroad crossings at grade, and motormen must not proceed until conductor has gone ahead to the center of crossing, looked both ways, and given the "Come ahead" signal—but before starting the motorman will look back to see that no passengers are getting on or off; and in no case proceed, even after conductor's signal, until you also have examined the crossing.

When there is more than one track, the conductor must be in advance of the car until the last track is reached.

8. In the event of a blockade of cars from any cause, the cars

*Submitted at the annual meeting of Street Railway Association of the State of New York at Caldwell (Lake George), Sept. 9 and 10, 1902.

in such blockade must not be started at one time, but at such intervals as will not burden the feeder line. The starting of a number of cars at the same time at one point is injurious to the electrical apparatus, hence the necessity of a careful observance of this order.

9. Never run against a switch point when meeting a car, but slacken the speed of your car and allow the car moving in the opposite direction to pass before striking switch point. This rule refers particularly to all crossovers and curves having switch points facing opposite to that in which your car is going.

10. A hearing by the superintendent awaits every employee who has any grievance to make, and reports or suggestions for the betterment of the service will always receive consideration.

11. Employees riding on cars, and especially conductors on duty, are forbidden to converse with motormen while car is in motion.

RULES FOR CONDUCTORS

12. When not collecting fares, conductors must remain on the rear platform to keep a lookout for passengers. They must also keep careful watch of passengers in car to note requests to stop for those desiring to leave car, and must be careful to remember requests of passengers to stop at points ahead, stopping car and notifying such passengers when the point is reached.

When stops are made at principal streets, places of amusement, churches, or at any point where a considerable number of passengers enter or leave the car, conductors must be on rear platform until such point is passed.

13. Conductor and motorman will report to foreman or inspector any defect in car, track or wire which needs immediate attention, and make written report of same to superintendent at end of run.

14. Conductors will not remove trolley from wire at end of run or elsewhere, at night, until passengers have alighted from car.

15. Conductors will announce the names of streets, public places, and transfer points when approaching the same.

16. Conductors must see that route signs are properly displayed on each half trip.

17. Passengers must not be allowed to bring bulky packages aboard cars.

Conductors must not, in any way, assume responsibility for any package which a passenger may bring onto a car.

18. Conductors must be on the rear end of their cars when passing over switches, crossings, on going around curves, with hand upon the trolley rope. Should the trolley leave the wire, the conductor must at once pull down the trolley and signal the motorman to stop. After the car has stopped replace the trolley on the wire, ring two bells for the motorman to start, first looking carefully around and through the car to see if any persons are boarding or leaving same. They must see that passengers keep their hands off of trolley cord.

19. Front and rear gates on closed cars on the side between the tracks must always be kept closed and securely fastened when running on the road. On open cars the guard chains and guard rails must be kept fastened on the side between the tracks. When gates or chains, or their fastenings are broken or out of order, conductor or motorman must report it to foreman, inspector or starter.

20. When necessary for conductor to leave car he must notify the motorman to insure safety of passengers and care of car.

21. When car is run in the house in the day or night, always shut off lights, remove trolley from the wire, and turn up seats of closed cars before leaving car.

22. On closed cars, when standing passengers crowd the rear door, you will request them to please step forward in car.

23. Standing passengers should be directed to vacant seats, if any.

24. Elderly and feeble persons and women and children should be given assistance in getting on and off car, when possible.

25. No dogs will be allowed on a car except small dogs which are carried in the laps of passengers.

RULES FOR MOTORMEN

26. Motorman must keep a careful lookout on both sides of the street and bring the car to a full stop for every person who signals, except that when a car has considerable headway, is overcrowded, and another car with more room follows within the same block (or 200 ft.), the motorman may request passengers to take the following car.

Cars will stop on signal at corners only, on further crossing, at car stations, transfer points, and in front of places of amusement and churches, and at points as provided in special orders.

Do not stop cars so as to block cross streets or crosswalks.

27. When passing a church during the hours of service, and at all times when passing a hospital, do not use the current or ring the gong when it can be avoided.

28. Never use the reversing lever to stop car, except to avoid a collision or running over a person or animal, or when the brake rigging is disabled.

Do not reverse the power when brake is set, but first release the brake (if it is set) and reverse the power simultaneously, and when the reverse lever is thrown to position, apply the current one point at a time, otherwise the fuse will melt or the breaker will release. Sand should be used when making an emergency stop.

29. Motormen must never leave platform of car without taking controller handle with them, throwing off the overhead switch, and applying brakes. They must be careful to see that the hands point to the "off" mark before taking off controller handle.

30. In order to effect an economical use of the electric current, it is necessary that the continuous movements of starting and changing speed should be made gradually.

When starting car let it run until the maximum speed of each notch has been attained before moving handle to the next notch.

Do not apply brakes when the current is on.

Do not apply current when brakes are applied.

Do not allow the current to remain on when car is going down grade. Endeavor to run car with the least amount of current, allowing the car to roll without the use of the current when it can be done and maintain schedule time.

Motormen can save a great amount of power by using some judgment and discretion in approaching stopping places and switches by shutting off the power so as to allow the car to roll to the stopping place or switch without a too vigorous use of the brake.

31. An overhead switch must never be thrown unless power handle is turned entirely off, and must be thrown by hand only, except in case controller cylinder fails to turn when power is on.

32. When the power leaves the line the controller must be shut off and the overhead switch thrown, the light switch turned on, and the car started only when the lamps burn brightly.

33. When brakes are set to make a stop they should always be released, or nearly so, just before the car comes to a standstill.

34. When there is water on the track run the car very slowly, as there is danger of burning out the motors.

35. Never run on freshly sanded rail with brakes full on, except to prevent an accident, as the wheels are liable to be flattened when this is done. On cars provided with sand-boxes, in case of slippery rail, always sand the track for a short distance before applying the brakes.

36. During snowstorms much damage is done by "spinning" of the wheels with no forward or backward movement of the car.

37. On a slick rail motormen must not allow wheels to slide; as soon as the wheel commence to slide the brake must be released and reset.

38. Motormen must not oil or grease any part of a car.

SIGNALS AND THEIR APPLICATION

The following code of bell signals will be used in the operation of cars:

39. From conductor to motorman.

1 Bell—"Stop at next crossing or station."

2 Bells—"Go ahead."

3 Bells—"Set rear brake."

4 Bells—"Signal to conductor that motorman desires to back the car."

From motorman to conductor.

1 Bell—"Come ahead."

2 Bells—"Watch the trolley and danger signal to conductor."

3 Bells—"Throw cut-out switch on rear end of car.

4 Bells—"Set brake."

5 Bells—Warning—"Pull trolley down to roof."

All of the above signals are to be given on the conductor's signal bell.

When the car is standing and motorman desires to back for any reason, he will give the conductor four bells, but must not move the car until the conductor has answered with four bells to signify—"All is clear behind."

Whenever a car in service is stopped the motorman will, as soon as he is ready to go forward, give two taps of the gong; after which, if the conductor is ready to proceed, he will give the regular "go ahead" signal—two bells.

40. Red lights or flags indicate danger, and when they are placed alongside the track cars must be run slowly and with caution. When placed on the track, cars must come to a full stop until such signal is removed.

41. Before passing any vehicle or obstruction close to the track, where passengers or conductor are liable to be injured while standing on the step of an open car, motorman must give two taps of signal bell as warning.

42. Motormen must never move car (whether stopped on signal or for any other reason) without signal from conductor, and then only when assured that no one is getting on or off front platform.

Conductor must never give signal to start when passengers are getting on or off.

Conductor must never give signal to back car unless he is on rear platform and knows track is clear behind the car.

Conductor must see that the steps or running board are clear before giving the "Go ahead" signal.

43. Passengers have a right to ring the bell to stop a car, and conductors should bear this in mind. They must, however, try in a polite way to discourage passengers from doing so.

PRECAUTIONARY RULES; ACCIDENTS

44. The safety of passengers is the first consideration. All employees are required to exercise constant care to prevent injury to persons or property, and in all cases of doubt take the safe side.

45. In case there are persons between tracks, cars moving in opposide directions must not pass. One car must stop until such persons have crossed the tracks.

46. When any fire department vehicle or company patrol is observed approaching in any direction, cars must be stopped until such vehicle has passed.

47. Ambulances must be allowed right of way, and when approaching or passing, cars must be kept under control to avoid collision.

48. Conductors and motormen must, in a polite way, endeavor to keep people from jumping on and off cars while in motion. If they attempt to get on or off the car while it is in motion, call out to them, "Please wait until the car stops." When passengers are alighting from your car and you see a car approaching in an opposite direction, notify them politely to look out for car on other track. In approaching curves always give the warning to standing passengers, "Hold fast."

49. Do not permit anyone to stand on the steps, and never, under any circumstances, permit a woman or child to ride on the steps. They should be fully inside of the car before the signal is given to start.

50. Motormen are cautioned to exercise great care when a vehicle is passing alongside of track ahead of car. Ring the gong vigorously to attract the attention of the person driving, as a warning not to pull in ahead of car; and run guardedly until the vehicle is passed in safety.

51. Whenever persons or vehicles ahead of the car are in a dangerous position, do not rely upon them to get out safely, but get the car under control or stop at once.

52. Under no circumstances must the arrest of any passenger, truck driver, or any other person be caused by a conductor or motorman without an order from starter, inspector or official of the company.

53. When passing standing cars gong must be rung and car brought to slow speed.

54. When it becomes apparent that there is liable to be an accident, such as a collision with a vehicle or person; or when in the judgment of the motorman an accident cannot be avoided, always drop the fender before reversing power, or making any effort to stop the car.

55. In case of accident, however slight, to persons or property, in connection with or near any car, the motorman and conductor in charge of the same will render all assistance necessary and practicable, and make the best of the situation. In no case will they go away, leaving injured persons, without first having seen that they are cared for.

56. Motormen or conductors will not authorize medical attendance, except for the first visit in severe cases of personal injury, nor will they visit injured persons at any time afterward, unless specially instructed so to do by an officer of the company.

57. In the event of a fatal accident, it will not be necessary to blockade the line awaiting the arrival of the coroner or any other official. If any accident occurs where it is impossible to carry the body to a place of shelter and security, motorman and conductor will put the body on the car and carry it to some suitable place.

58. A full and complete report of every accident, no matter how trivial apparently, and whether on or near the car, will be made by the conductor; as accidents, which the conductor may not consider worth reporting, are often the most serious, troublesome, and expensive.

In all cases full data must be obtained and stated in the report as follows:

The date, exact time, exact place, run and car number and the direction in which the car was moving, the nature of the accident.

The full name and address of the party injured or whose vehicle was in collision (giving the name of both the driver and the owner of the vehicle).

Ascertain the extent of injuries or damages, if any, before leaving the spot.

In case there has been an accident on the car and the conductors change ahead, the conductor taking the car on which the accident happened, must secure the name of witnesses as above.

In case a person is struck by a car after passing around the rear of a standing car, the numbers of both cars must be obtained.

If accident is caused by any defect or damaged condition of car, conductor must report same.

Accidents to employees will be reported the same as accidents to passengers.

The conductor will obtain the name and residence in full of all witnesses on or near the car.

The motorman will assist the conductor in securing the names of witnesses whenever practicable, and he will be held jointly responsible for the observance of this rule.

Any trouble or disturbance of a boisterous or quarrelsome character which occurs on a car, or the ejectment of a person from a car, will be reported as an accident.

59. Conductors and motormen will make a verbal report to the first inspector or official of the company they meet of any accident, blockade, or mishap of any kind.

60. No employe shall, under any circumstances, give any information whatever concerning any accident, delay, blockade, or mishap of any kind to any person except to a properly authorized representative of the company.

61. In case of a serious blockade, where assistance is required to get cars moving, conductor of car first in block must, in absence of any inspector or official, telephone at once to nearest depot and give notice and particulars of block. Expense of telephone message will be refunded upon application at office.

62. Employes will be held strictly accountable for any damages caused by their neglect or carelessness or by disobedience of rules. The company reserves the right to charge employees for such damages.

63. The motorman or conductor of any disabled car, withdrawn from the track, must remain with the car until relieved by proper authority or until car reaches depot.

EJECTMENTS

64. No passenger shall be forcibly ejected from a car for any cause whatever, without order of an inspector, starter, or official of the company, unless the conduct of the passenger is dangerous or grossly offensive to the other passengers. In such case the ejectment must be made by the conductor, with the assistance of the motorman, after the car has been brought to a stop, and with as little force as possible.

65. When a passenger refuses to pay fare or presents a defective transfer upon which, in the judgment of the conductor, the passenger is not entitled to ride, the car must be stopped and the passenger requested to leave. If the passenger fails to comply with such request, the facts of the case must be brought to the attention of the first inspector, starter, or official of the company who is met, and the conductor must act according to instructions received from such inspector, starter, or official. In all cases the passenger must be given the benefit of the doubt.

When a person who refuses to pay fare requests that he may be allowed to leave the car, the car must be stopped and the person permitted to alight.

66. No person will be ejected from a car for mere intoxication unless he becomes dangerous or offensive to the other passengers; then he must be ejected with great care and must be guided until free from probable injury from the car.

67. Any person caught stealing a ride on a car must never be pushed from the car while car is in motion.

68. No passenger will be ejected from a car for spitting on the floor. If a passenger violates the rule or law prohibiting spitting the conductor will call the attention of the passenger to the law prohibiting such conduct and endeavor to persuade passenger to desist.

69. In case of ejectment always get names of witnesses, the same as in case of accident.

70. Any person ejected from a car must be put off at a regular stopping place.

No passenger should be put off at a point where he will be exposed to danger.

Particular attention must be paid to this rule during bad and inclement weather, late at night or when a passenger is intoxicated.

FARES AND TRANSFERS

71. As soon as a passenger is seated conductor must collect fare. When more than one passenger or party enters at a time the fare must be rung up on the register in the presence of the party who paid it before any more fares are collected. Conductor must ring each fare from the place where he collected it. Thus a fare paid inside of car or on platform must be rung up inside of car or front platform, as the case may be.

72. When necessary to give change, conductors must first register fare and immediately thereafter give change.

73. Conductors must be careful to see that register rings each fare and that dial shows it.

In case the register gets out of order the conductor must stop using it, make memorandum of fares on back of trip report and report the fact to the first inspector or starter met on the road and give written report to superintendent.

74. In case any line is blocked it is the desire of the company to carry passengers to their destination on other lines. Under such circumstances conductors of parallel or intersecting lines will accept transfer tickets accordingly and will issue a transfer on a transfer if necessary. They will also accept transfer passengers without tickets on orders from any inspector or authorized representative of the company.

75. Motormen and conductors will be held equally responsible for leaving a transfer point when a car of the connecting line is approaching so as to prevent proper transferring of passengers.

The Philadelphia, Bristol & Trenton Passenger Railway

The Philadelphia, Bristol & Trenton Passenger Railway Company has received the rails for its extension from Bristol to Morrisville, opposite Trenton, and work will be commenced at once. It is expected that 10 miles of track will be completed and that cars will be running between Philadelphia and Morrisville (33 miles) by Dec. 1. While nothing has been decided in the case, it is possible that the company may secure entrance to Trenton over the tracks of the New Je sey & Pennsylvania Traction Company, which owns the New Jersey-Pennsylvania bridge across the Delaware at Calhoun Street and controls the Yardley, Morrisville & Trenton Street Railway. This would make a continuous line from this city to Philadelphia without a break, although it will be necessary to change cars at Tacony, Philadelphia. This may be overcome in time if traffic arangements should be entered into with the Philadelphia Rapid Transit Company, which is not unlikely, and then cars would be run to the center of Philadelphia.

The line is already completed from Philadelphia to Bristol, and includes the Bristol & Neshaminy Elevated Railroad, through which a notable victory was won at Croydon after seven years' litigation, in which there were a dozen charters and a dozen suits, practically, before the final victory was won.

High-speed cars, fitted with all the modern conveniences, will be used on the line. No schedule has been announced, but it is probable that the time will be about one hour and thirty minutes to Tacony and from two to two and a half hours will doubtless be the time to the center of Philadelphia. It is not expected that the fare will be over 30 cents at the most, making the round trip 60 cents, or less than one-half the steam railroad rate, which is $1.25.

The competition between the company and the Pennsylvania Railroad and the Reading Railroad will be watched with interest. Each of the steam roads operates a high-grade service between the two cities, having, combined, more than 150 trains per day. Many of these are fast express. In addition to the steam railway competition the new electric railway will have to compete with the Camden & Trenton Railway, on the New Jersey side of the river, and with the Wilmington & Delaware River Navigation Companies, both of which operate fast steamers between Philadelphia and Trenton. The completion of the Philadelphia, Bristol & Trenton road will also complete the direct electric railway connections between New York and Philadelphia, and the extension of the Trenton, Lawrenceville & Princeton Railroad to Bound Brook will complete the second line between New York and Philadelphia. The first line, via the North Jersey and other lines to New Brunswick, the Trenton & New Brunswick Railroad, the Trenton Street Railway, the Camden & Trenton Railway and the Camden & Suburban Railway will be in operation within the present month.

Meeting of the Massachusetts Street Railway Association

At the annual meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, Mass., Sept. 10, 1902, the following officers were elected: President, Elwin C. Foster, Lynn; first vice-president, Edward P. Shaw, Newburyport; second vice-president, Francis H. Dewey, Worcester; treasurer, Fred H. Smith, Quincy; secretary, Charles S. Clark, Boston. The executive committee elected consists of Elwin C. Foster, Lynn; Edward P. Shaw, Newburyport; Francis H. Dewey, Worcester; H. H. Crapo, New Bedford; P. F. Sullivan, Boston; W. S. Loomis, Holyoke; W. W. Sargent, Fitchburg, and R. S. Goff, Taunton. The auditing committee elected were H. B. Parker, Newtonville; George W. Cook, Springfield, and Charles F. Grosvenor, Palmer.

nvestigating Brakes, Jacks and Fenders in Massachusetts

Under date of Sept. to the Board of Railroad Commissioners of Massachusetts addressed the following letter to all street railway companies of the State referring to the hearing to be held Monday, Sept. 29, to consider the question of equipping cars with power brakes, jacks and fenders, which hearing was authorized by the Legislature of 1902:

COMMONWEALTH OF MASSACHUSETTS.
BOARD OF RAILROAD COMMISSIONERS.

Mr. President—————St. Ry. Co.
—————, Mass.

BOSTON, Sept. 10, 1902.

Dear Sir—The board has appointed Monday, Sept. 29, at 10:30 a. m. as the time and the office of the board in Boston as the place at which a hearing will be given in connection with the inquiries which it has been directed to make under the following resolves of the Legislature of 1902:

Chapter 29. Resolved, that the Board of Railroad Commissioners is hereby authorized and directed to investigate the practical application and operation of the power brake in use upon certain street railways in this commonwealth, and, if they see fit, of the power brake used by street railway companies elsewhere, and to report, after such public hearing or hearings as they may deem necessary, on or before the fifteenth day of January, 1903, upon the following questions:

(1) Is the power brake superior as a safety device to the hand brake?

(2) What expense would be entailed upon street railway companies by the equipment of their rolling stock with power brakes?

(3) Would public safety be furthered by the adoption of a power brake?

(4) Within what time might the street railway companies operating in this commonwealth reasonably be required to equip their rolling stock with power brakes in case the use of the device should be made obligatory?

Chap. 67. Resolved, that the Board of Railroad Commissioners is hereby authorized and directed to investigate the advisability and necessity of having all street railway cars equipped with jack-screws or other implements or machinery of sufficient power to raise the cars to such a height as will permit the extrication of injured persons held beneath them and to report thereon to the general court on or before the fifteenth day of January, in the year 1903.

Chap. 75. Resolved, that the Board of Railroad Commissioners is hereby authorized and directed to examine the fenders in use upon street railway cars in this commonwealth and such other fenders as may be brought to their attention and are in their opinion worthy of consideration. After giving such public hearings upon the subject as they may deem necessary the board shall report to the general court on or before the fifteenth day of January, 1903, and make such recommendations in regard to fenders upon street railway cars as they may deem proper.

You are requested to present at that time any information which you may have pertinent to the consideration of these matters.

Yours truly,

(Signed) WILLIAM A. CRAFTS, Clerk.

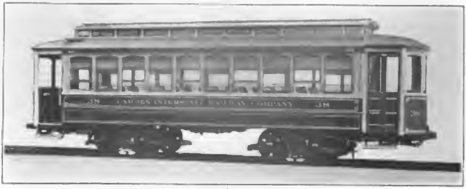
New Tr.nsfer System at Birmingham

On September 20 the Birmingham Railway, Light & Power Company, in response to an agreement with the City Council, will place in operation a new transfer system affecting all of its lines. The plan of the company is to date the tickets for a special day, as is done by a number of companies, and to each line will be issued a transfer of a color different from that of any other. The day of the week, month and year are to be printed in large type which can be seen at a glance. There will be an hour mark followed by the time in periods of fifteen mnutes. The line on which a tra ivable, the place at which it will be accepted and the direction of travel will be made plain. There will be a column marked "Emergency," which is to be used in the case of a blockade or when occasion arises for transferring passengers from one car to another on the same line.

The Youngstown & Sharon Railway Company, of Youngstown, Ohio, has notified the motormen and conductors in its employ that an increase in wages of 1 cent an hour will be given to those who have no accidents for a period of six months.

Brill Cars for West Virginia

The Camden Interstate Railway Company, of Huntington, W Va., has lately added to its rolling stock four handsome cars, built by the J. G. Brill Company, of Philadelphia. The cars, which are Brill patented semi-convertibles, are 37 ft. 5 ins. over the vestibules, 7 ft. 10½ ins. over the sills, and 8 ft. 2 ins. over the posts at belt. This form of car has come into large favor in all parts of the country within a comparatively short time, doubtless on account of the remarkable increase of interurban lines and a more



DOUBLE TRUCK CAR FOR CAMDEN

definite knowledge of their requirements. The distinctive features of the Brill cars of this type consist of roof storage of the windows by an exceedingly simple and practical system, and the elimination thereby of wall pockets, increasing the width of the car 7¼ ins. The windows raise with great ease, the lower sash automatically engaging the upper and carrying it into recesses in the roof. The parts fit snugly, and at the same time move readily in the post grooves.

The interior of the cars are finished in natural cherry, with ceilings of handsomely decorated birch. The Brill patented specialties with which the cars are equipped are as follows: Angle-iron bumpers, "Dedenda" gongs, radical draw bars, ratchet brake handles, sand boxes, Brill platform steps, etc. The trucks are Brill No. 27-G pattern.

Census Report of Electrical Manufactures

Carefully prepared statistics relating to the manufacture of electrical apparatus and supplies are intelligently presented in Census Bulletin No. 245, recently issued by the United States Government, embodying the work of Thomas Commerford Martin, of New York City, editor of the *Electrical World and Engineer*, whose report as expert special agent of the census department of manufactures forms very interesting reading, giving, as it does, the first complete statistical review of the electrical industries of this country. The figures given relate to manufacturing only, and hence do not include data to local operating companies in electric lighting, telephone, street railway or other branches, the statistics otherwise being as comprehensive as it was possible to make them. It is shown that a capital of $83,130,043 is invested in the manufacture of electrical apparatus and supplies, this sum representing the value of land, buildings, machinery, tools, implements and the live capital used, but does not include the capital stock of any of the manufacturing corporations. The value of the products is returned at $91,348,880, to produce which involved an outlay of $4,563,112 for salaries of officials, clerks, etc., $20,190,344 for wages, $6,788,314 for miscellaneous expenses, including rent, taxes, etc., and $48,916,440 for materials used, mill supplies, freight and fuel. In order to avoid the deduction of erroneous conclusions from the above figures the statement is made that the difference between the aggregate of these sums and the value of the products is not in any sense indicative of the profits in the manufacture of the products during the census year. The census schedule takes no cognizance of the cost of selling manufactured articles or of interest on capital invested, or of the mercantile losses incurred in the business, or of depreciation in plant.

The Philadelphia & Lehigh Valley Traction Company has secured the contract to carry the mails between Quakerstown and Allentown, and will begin operations Oct. 1. The schedule of the mail service has not yet been announced. A number of intervening towns will be accommodated by the new arrangement

I-T-E Switchboard Practice

This is the title of a handsome volume issued by the Cutter Electrical & Manufacturing Company, Philadelphia, Pa., as supplement to "Modern Switchboards," which was published by them in 1898, but which has for some time been out of print. The new volume embraces matter dealing with the principle on which automatic circuit breakers operate, presenting some of the advantages of circuit breakers over fuses and dealing with the use of circuit breakers as indicators on electric circuits. The book is profusely illustrated by half-tone and line engravings of superior quality—circuit breakers for direct and alternating current generators and feeders, storage battery equipments, as well as special types and their accessories being shown. An article by W. H. Tapley, an electrical engineer at the government printing office, Washington, D. C., on "Circuit Breakers and Their Use in Power Transmission" is presented, as well as matter dealing with the use of circuit breakers as protectors of various kinds of electrical machinery. Dimensional diagrams of I-T-E circuit breakers are given, together with plan drawings of various types of switchboard panels with connections. An interesting and valuable feature of the book is a treatise on electrical measuring instruments by J. Franklin Stevens, M. E., president of the Keystone Electric Company, of Philadelphia, the sales management of whose line of electrical measuring instruments was recently assumed by the Cutter Company. The treatise not only clearly describes the principles involved in the construction and operation of the instruments of which dimensional diagrams are given, but indicates what considerations should determine the selection of such apparatus. Paper and typography are of the highest class. The book, 9 x 11 ins., of nearly 200 reading pages, with a number of advertising pages at the back, is not for free distribution, but is sold at a price of $3 per copy.

Evansville & Princeton Traction Company's Affairs

It is claimed by Perry J. Freeman, president of the Evansville & Princeton Traction Company, of Princeton, Ind., that the building of the road upon which this company is engaged, is progressing steadily and satisfactorily, and that there has been no serious delay in carrying out its plans. "The company hopes to have the work completed by the spring or early summer of next year. The right of way has been surveyed and secured all the way from Princeton to Evansville, with the exception of a very few places. It has 12 miles graded, its car house and shop erected and the foundation of its power house partly in. Its rails are all purchased, and part of them delivered; they are being laid on Reed Street, in Evansville. The line material has also been secured, and contracts have been placed with the Westinghouse Company for electrical machinery to equip the power house and two sub-stations. More than 25,000 ties have been purchased, and they are being distributed daily along the lines. More than fifty teams are employed in the construction of the grade. Within a week the boilers and engines will be purchased as well as the cars, the car equipments having already been bought of the Westinghouse Company."

Another Hudson River Tunnel

The Hudson & Manhattan Railway Company, which was incorporated under the laws of New Jersey a few days ago, proposes first to build a tunnel under the land in Jersey City skirting the Hudson River from the Erie Railroad at Pavonia Avenue south to the terminal of the Jersey Central at Communipaw. It will pass under the Pennsylvania Railroad at Hudson Street. The charter also authorizes the company to operate cars in a tunnel under the Hudson as far as the boundary line between New Jersey and New York, where it will connect with a tunnel to be constructed by a company to be incorporated under the laws of New York. It will be a feeder for the river trolley tunnel and will permit passengers to go from New York to the Erie, Pennsylvania and Central Railroads in a few minutes.

The steam railroad companies are not interested financially in the Hudson & Manhattan Railway, it is said, although they are favoring its construction.

New Interurban Line Opened in Indiana

The Indianapolis, Shelbyville & Southeastern Traction Company's line between Indianapolis and Shelbyville, a distance of about 28 miles, has been placed in operation. The contract for building and equipping the road was let to Townsend, Reed & Company, of Indianapolis, on Sept. 26, 1901. Actual work was commenced on the grading on Oct. 21, making the period of building about eleven months. There are twenty-eight bridges on the line, eleven being steel structures, one a stone arch bridge, one a concrete arch, and all have solid masonry abutments. The longest bridge is at Shelbyville, being 200 ft. in length. The steepest grade on the road is only 4 per cent. The power house, the car houses and the general offices are at Shelbyville. The route traverses the towns of Norwood, Five Points, New Bethel, the Acton assembly grounds, Acton, Brookfield, London, Fairland and Shelbyville, while the country adjacent is not only very populons, bnt is exceedingly wealthy. An extension is planned to Greenburg. The officers of the company are: Ed. K. Adams, president; Albert Deprez, vice-president; Thomas E. Goodrich, secretary; John R. Messick, treasurer; Charles R. Osgood, general manager.

Location Controversies in Massachusetts

A very unique case came before the Massachusetts Railroad Commissioners, Sept. 17, it being on the petition of the Waltham Street Railway Company for authority to extend its lines into Lincoln, under the general law which permits the Railroad Commissioners to authorize extensions by street railways into adjoining territory. During the hearing the point was brought out that the Newton Street Railway Company had a franchise for Lincoln, and that it had secured a location in Weston, which lies between Waltham and Lincoln, while the efforts of the Waltham Street Railway Company to secure a location through Weston had failed. Counsel for the Waltham Company then frankly admitted that the design of the company was to secure an extension into Lincoln, get locations from the Lincoln selectmen, and return to the Railroad Commissioners and ask them to grant a location in Weston under the provisions of the "missing link" statute, which gives the Commissioners the right to grant a location when the link through a recalcitrant town is necessary to connect two parts of a line. Although it was shown that the East Taunton Street Railway secured a location in Lakeville by first securing rights in Middleboro and then getting a missing link location, the Railroad Commissioners refused to follow the precedent, and dismissed the petition, on the ground that it had no authority to act in such cases, stating that the company must appeal to the General Court for legislation. Incidentally the Chairman of the Board of Railroad Commissioners ruled that in all such cases it is necessary for the petitioning road to be in a position to go into practical operation, but that it is not necessary to build up to a town line in order to have standing, as in many cases an extension would not be made to a town line unless to connect with locations which might be granted in the adjoining town.

The Waltham Street Railway Company came before the Railroad Commissioners on Sept. 18 for approval of locations granted by the Aldermen of Newton, from the Weston line at Newton Lower Falls to a connection with the new Boston & Worcester Street Railway at Newton Highlands. The petition not only raised a question as to whether the location should be approved when the Selectmen of Weston had refnsed a connecting location from Waltham to this point, but several other interesting law questions. It was argued by L. E. Chamberlain, counsel for the company, that this should be considered an "original location" in Newton. It appears that the articles of association under which the company was formed provided for a line in both Newton and Waltham, but that before the charter was granted the Newton authorities had refused the location desired in Newton, from the Waltham line to Newtonville Square, so the charter merely gave the location in Waltham. Sometime ago, however, the company asked the right to extend into Wellesley on the strength of the fact that the articles of association gave locations in Newton, lying between Waltham and Wellesley. William H. Coolidge, counsel for the Newton Railway Company, argued that the only locations which could he held to be "original" were those between the termini named in the articles of association, and that until construction was completed on this portion the company could not ask new locations, particularly when they were far away from any connection with the original termini. This point Chairman Jackson, of the Board of Railroad Commissioners, thought well taken, but left the matter open until Counsel Chamberlain could prepare a brief citing authorities, if there are any, which would serve as precedents for the theory that naming a city in articles of association carries with it the right to obtain original locations in any part of the city.

Widener-Elkins and Pomeroy-Mandelbaum Alliance

Semi-official announcement is made in Cleveland of an alliance, financial as well as operating, between the Pomeroy-Mandelbaum syndicate, of Cleveland, and the Widener-Elkins syndicate, of Philadelphia, which controls the Cincinnati Traction Company. The great importance of this alliance can be appreciated only by a review of the causes which led up to it. Briefly, the situation is as follows: The Pomeroy-Mandelbaum syndicate controls the Cincinnati, Dayton & Toledo Traction Company, formerly the Southern Ohio Traction Company, which has operated to College Hill, 7 miles from the heart of Cincinnati. Here it has been blocked for years by the Cincinnati Traction Company, and the series of attempts made by the Cleveland syndicate to gain entrance have been reviewed from time to time in these columns. Some time ago the Pomeroy-Mandelbaum syndicate purchased a steam road operating to within 3 miles of the heart of the city, but up to very recently its plans to operate cars over the steam road have been successfully blocked. The Pomeroy-Mandelbaum syndicate also is back of the Miami & Erie Canal Transportation Company, which has a franchise for the use of the canal banks from Cincinnati to Toledo. This would afford a fine entrance to Cincinnati, but attempts to induce the Legislatnre to permit the operation of passenger cars along the canal have also been successfully blocked by the Widener-Elkins syndicate.

On the other hand, the Cincinnati Traction Company controls the Mill Creek Valley Railway, operating from Cincinnati to the outskirts of Hamilton. Retaliating for the opposition of the Widener-Elkins syndicate, the Pomeroy-Mandelbaum syndicate purchased the city lines of Hamilton, and thus thwarted numerous attempts on the part of the Widener-Elkins syndicate to gain entrance to the center of Hamilton. Last week the courts settled the Hamilton situation by deciding that the Cincinnati Traction Company could condemn right of way into Hamilton, using the tracks of the Pomeroy-Mandelbaum syndicate, and laying a third rail to allow for a difference in track gage. Whether or not this decision resulted from the acquiescence of the Pomeroy-Mandelbaum syndicate is not positively known, but it is suspected that this was the case. In any event, this break in the deadlock was followed by the negotiations that resulted in the plan of the syndicates to operate jointly.

It is announced that the Elkins-Widener syndicate will purchase large blocks of the securities of the several properties controlled by the Pomeroy-Mandelbaum syndicate, and it is probable that the sale of securities has already been effected, since, as is noted from the stock exchange transactions, large blocks of Cleveland securities have been sold to Cincinnati interests. The securities of the Miami & Erie Canal Company, the Cincinnati, Dayton & Toledo Railway, the Springfield & Xenia Traction Company, and the Western Ohio Railway nave advanced remarkably during the last few days, and the general belief is that a merger of all the interests in that section is contemplated. This would mean that the Mill Creek Valley Railway would be consolidated with the Pomeroy-Mandelbaum interests mentioned.

It is officially announced in Cleveland that in the near future the Cincinnati, Dayton & Toledo Traction Company will operate its cars to the center of Cincinnati, "over a route not at present utilized for a car line." This undoubtedly means that the Cincinnati and Cleveland interests will combine in an effort to induce the Legislature to permit the operation of cars over the canal banks into the heart of the city. If this cannot be accomplished it is pretty certain that the Cincinnati, Dayton & Toledo cars will then enter over one of the existing city lines.

There is another reason for this "community of interests" which is not generally appreciated. The Widener-Elkins syndicate has, up to date, been successful in keeping out the Pomeroy-Mandelbaum syndicate, but new projects have been springing up in Cincinnati which promise to be antagonistic to both the older interests. For instance, the syndicate is building a line to Lebanon, and is desirous of extending to Dayton. Other syndicates have the same aim in view, while the Appleyard syndicate, of Boston, has been working for many months to secure entrance for a through line from Columbus and Dayton into Cincinnati. With the Pomeroy-Mandelbaum and Widener-Elkins syndicates combined, it now seems possible that this flood of new traction lines can be coped with to better advantage.

The Detroit & Toledo Shore Line Sold

It is announced that the deal for the sale by the Everett-Moore syndicate to the Grand Trunk Railway (steam) of the Detroit & Toledo Shore Line, has been finally consummated, the price being about $1,600,000. Since the embarrassment of the Cleveland syndicate the property has been held under option by W. B. Strang, who built the line, and the sale of the property to the Grand Trunk Railway has been consummated only after lengthy negotiations. It is now probable that the Everett-Moore syndicate will redouble its efforts to repurchase the Toledo & Monroe Railway, in order that the connection of the Ohio & Michigan systems may not be broken. The closing of this deal removes the last of the Everett-Moore difficulties, so far as traction properties are concerned.

Pennsylvania Tunnel Conference

The latest advice concerning the Pennsylvania Tunnel franchise are reassuring. At the last conference between the Aldermen, Rapid Transit Commission and the Pennsylvania Railroad representatives it was agreed to insert the clause providing that the company indemnify the city and property owners for damages sustained through building the Manhattan station and closing streets, on condition that the rest of the arrangement be accepted by the city. Vice-President Green explained why the company would never agree to labor clauses. There could be no compromise on the subject, he said, because New York city was not the only place where the company carried on large undertakings. If the road were to tie itself up here, it would have all manner of trouble everywhere else. He said he wanted to impress on the committees the fact that the Pennsylvania always treated its employees well; that it expected to pay very high wages for labor in the tunnel, and that the record of the road in regard to labor ought to convince everyone of the certainty that its men on the proposed work would be treated fairly and generously. Mr. Cantor announced that he would yield on the question of wages, and Mr. Grout suggested an alternative proposition, providing for arbitration in case of strikes on the tunnel. To that Mr. Green replied: "We have considered that, but such a provision would get us in the same trouble we have tried to avoid by refusing Mr. Cantor's proposals. We expect troubles on the tunnel. I think we may have to yield more before the work is over than we would yield by consenting to make promises about the treatment of our employees. But we do not want to be tied up in the franchise, as I have explained."

Conditions Under Which Street Railway Locations Will be Granted in Massachusetts

The Railroad Commissioners of Massachusetts have issued the following statement of the conditions under which street railway locations will be approved:

In acting under the provisions of Chapter 399 of the Acts of 1902, the Board of Railroad Commissioners will make the following requirements a condition of approval of locations granted to street railway companies:

Every location must be accompanied by a plan showing the place in the highway to be occupied by the railway (including turnouts) and by trolley poles. The plan should also give grades and street lines, and such other information as may be practicable.

The following conditions should be attached to grants of location:

1. T-rails to be not less than 60 lbs. per yard in weight.
2. Ties to be of suitable timber, not less than 7 ft. in length, 6 ins. wide, with 6 in. face, and spaced not more than 2 ft. on centers.
3. The roadbed to be constructed with at least 18 ins. of suitable ballast below base of rails and porperly drained.
4. When practicable the railway to be continuously either on one side or in the center of the driveway, and separated from the driveway, with a clearance from any obstruction of at least 4½ ft. on tangents and more in proportion on curves.
5. The roadway independent of the railway to be of sufficient width to properly accommodate other travel.
6. Crossings of railway from one side to the other of the highway to be avoided; but if permitted, only with provision for proper regulation respecting the operation of cars and restriction of speed.

These requirements are not to exclude other suitable conditions and restrictions by local boards or by this board, as the circumstances in particular cases may require.

Stanley Employees to Organize for Mutual Benefit

A meeting of the employees of the Stanley Electric Manufacturing Company was held on Friday evening, Sept. 19, 1902, for the purpose of organizing a club to be known as "The Stanley Club." The object of the organization is the betterment of the individual interests of all employees, intellectual, physical, moral and material, and the company has furnished meeting rooms for the club.

Committees are to be formed to consider the following subjects: Employees' insurance, employees reading room, a series of lectures for the winter months, grievances, athletics and other questions.

Labor Troubles Arbitrated in Chicago

The arbitrators selected to settle the differences between the Chicago City Railway Company and its employees have made an award that will result in an increase in the salaries of the men.

Ten per cent is added to the wage scale of the company in the mechanical and repair shops, the nine-hour day will be inaugurated at once, and overtime is to be paid for at the rate of time and a half.

The agreement will be in force from Sept. 1, 1902, to Sept. 30, 1903.

The arbitrators were ex-Judge Samuel S. Page, for the company; James H. Bowman, for the men, and A. C. Bartlett, vice-president of Hibbard, Spencer, Bartlett & Company.

Power Station Equipment for Auburn-Syracuse Interurban Road

The Syracuse Railroad Construction Company, which is building a 25-mile electric railroad between Auburn and Syracuse, N. Y., has placed a contract with the Westinghouse Electric & Manufacturing Company for two 650-kw engine-type alternators, delivering three-phase current at 360 volts and 3,000 alternations; also five 400-kw rotary converters, together with raising and lowering transformers for operating a 15,000-volt transmission line and two sub-stations. A complete switchboard is included, and, in fact, everything for the operation of a complete railway line. The generators are to be direct connected to two 22-in. and 44-in. x 48-in. cross-compound horizontal Corliss engines, purchased from Westinghouse, Church, Kerr & Company, and built by the Westinghouse Machine Company, of Pittsburgh, Pa. The engines are to receive steam at 150 lbs., and will run at 100 r. p. m., and are rated at 1000 hp each, with a maximum rating of 1800 hp.

Work on the Boston Tunnel

The Boston Transit Commission has begun tunnelling with a construction shield on the west side of the harbor, near where the East Boston Tunnel will descend beneath the water. The shield had been standing for several weeks past at the bottom of the shaft in State Street, opposite the Custom House, and the first regular test of its operation was made on Sept. 15. Power is supplied through a 2-in. wire-wound rubber hose at a pressure of about 95 lbs., operating a pump which forces water from a tank in the centre of the shield into the tubes of the hydraulic jacks, which press forward with a force of about 900 lbs. per square inch. At present there are but three jacks on each side of the shield, but when the shield comes far enough in, so that a piece of arch may be built to furnish the necessary resistance, nine or ten more jacks will be inserted, and power will be applied to all of them. The walls of the tunnel have been built in the shaft, and the six jacks now in position push against them. The present shield is destined to the station at the foot of State Street and corner of Atlantic Avenue. It is doubtful if it will be used at all in the construction of the section between the Custom House and the old State House, as the tunnel will be so near the surface in this stretch that the ground will probably not hold the compressed air, without which miners could not work. It appears more convenient to follow the bridging method in the construction of this section. By this method, the walls of the tunnel are built first, and these are now under construction, and parts of them have been made in different places the entire length—then the arch is put on from the surface, and finally the core taken out in the ordinary way, through the shaft.

The final completion of this tunnel will work little short of a revolution in the transportation facilities of East Boston, and

the proposed connection with the new projected Washington Street Subway will add one more spoke to the Boston rapid transit wheel. The system promises to grow still more comprehensive with each succeeding decade.

Contract Awarded for Building the New Electric Railway in Cuba

At a meeting held in New York a few days ago the Cleveland, Youngstown, Chicago and New York capitalists who are interested in the building of an electric railway in Cuba organized the Havana & Jaintos Railroad Company Company, to build the road. The capital stock of the company is $2,500,000. The stockholders elected the following directors: W. H. Whipple, of New York; W. J. Hayes and L. W. Prior, of Cleveland; C. S. Fairchild, president of the New York Security & Trust Company; M. A. Devitt, of Chicago; H. A. McCoy, of Chicago; George F. Penhale, of New York; Thomas Vaughan, of the Cuba National Bank, and Judge Mandelay, of Havana. The directors elected W. H. Whipple president and W. J. Hayes vice-president. It was decided to commence construction work at once, and contracts for building the line were closed with Park & Hamilton, of Youngstown, Ohio. The New York Security & Trust Company will act as financial agents.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

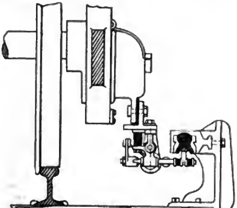
UNITED STATES PATENTS ISSUED SEPT. 16, 1902

708,980. Adjustable Truck Bearing; W. S. Adams, Philadelphia, Pa. App. filed March 7, 1902. Two screw-threaded parts by which the side bearing can be elevated or lowered, provided with a locking device to hold them at any point of adjustment.

708,994. Car Truck; J. A. Brill, Philadelphia, Pa. App. filed Jan. 10, 1902. Improvements in pivotal equalizing trucks.

709,015. Automatic Railway Switch; G. E. Janes, Cleveland, Ohio. App. filed Dec. 20, 1901. The switch is moved in one direction or the other by thrusting one of two rods downward from the car platform to engage with mechanism in the track bed.

709,063. Electric Railway System; L. E. Walkins, Springfield,



PATENT NO. 709,063

Mass. App. filed Dec. 2, 1901. An under-contact third rail suitably covered and adapted to be engaged by a shoe which can be turned by the motorman to carry it into and out of engagement as required.

709,071. Car Truck; W. S. Adams, Philadelphia, Pa., App. filed Nov. 15, 1901. The bolster is supported from the side frame and the draft tension is transmitted by inextensible devices carried by the bolster and connected directly to the side frames.

709,072. Car Truck; W. S. Adams, Philadelphia, Pa. App. filed Feb. 25, 1902. A novel construction of a certain "cross-bar carrier."

709,073. Convertible Railway Car; J. A. Brill and E. S. Bucknam, Philadelphia, Pa. App. filed Feb. 1, 1901. The side panels which move up and down in grooves in the side posts, have means for locking and unlocking the panels together as they are moved up and down in the grooves.

709,075. Convertible Railway Car; E. S. Bucknam, Philadelphia, Pa. App. filed Dec. 16, 1901. The sash inserted between the posts have extra strips secured to their edges which center the grooves in the posts.

709,076. Convertible Railway Car; E. S. Bucknam, Philadelphia, Pa. App. filed Jan. 21, 1902. A switching device is arranged in the groove traversed by the sash which automatically shifts the sash from one groove to another for storage in the roof of the car.

709,089. Trolley Guard; E. Gagne, Point St. Charles, Canada. App. filed April 16, 1902. Details.

709,111. Automatic Railway Switch-Operating Mechanism; La Fayette Pierce, Moundsville, Mo. App. filed Jan. 3, 1902. A pin carried by the car engages a crank in the roadway and rotates a sprocket wheel to move a chain geared to the switch point.

709,113. Trolley Pole; W. Pullman and C. C. Feld, Sodus, N. Y. App. filed Dec. 16, 1901. Details.

709,134. Switch-Throwing Device; U. F. Beeghly, Dayton, Ohio. App. filed Oct. 22, 1900. Details.

709,156. Electric Railroad Switch; J. A. Joyce, Cleveland, Ohio. App. filed Dec. 17, 1901. Electromagnets for throwing the switch point are in circuit with certain insnlated sections of the track, which are energized or not by the motorman while his car is on a section.

709,168. Trolley; F. A. Merrick, Johnstown, Pa. App. filed Sept. 14, 1899. A spring-mounted shoe bears on the hub of the trolley wheel.

709,208. Car Wheel; F. E. Crandal, Chicago, Ill. App. filed Feb. 6, 1902. The flange of the wheel has projections which break up packed dirt or ice in the groove of the rail.

PERSONAL MENTION

MR. G. M. GEST, the well-known conduit contractor, has secured the contract for the conduit system for the Schenectady Railway, Schenectady, N. Y. This work, which will amount to over 200,000 ft., will be a model installation, and many new features have been designed for this particular system.

MR. GEORGE C. EWING has resigned his position as president of the Morris Electric Company and also from the American Union Electric Company, of New York. He has opened offices in the Board of Trade Building, Boston, Mass., where he will establish a general agency for street railway material. He is the New England representatiev for the Nernst Lamp Company, of Pittsburgh, Pa.

MR. A. H. BERRY, who was for many years associated with the H. W. Johns Company, New York, as manger of the electrical department, recently resigned his position with that company to become the general manager of F. H. Lovell & Co., 100 William Street, New York, where he will be pleased to receive his friends and prospective purchasers of electrical insulating materials of all kind for railway switch work, motor controllers, arc lamps, etc., as well as enclosed fuses and fuse fittings for switch or panel boards. In addition to handling a general line of electrical supplies, he is prepared to furnish a full line of brass castings in the way of ears, trolley wheels, etc.

MR. D. W. DOZIER has resigned his position as chief mechanical engineer of the Metropolitan Street Railway Company, of Kansas City, Mo., to accept a more lucrative position with the Corn Product Company, which owns all the glucose and starch establishments in the United States. Mr. Dozier will be known officially as the superintendent of motive power of the Corn Product Company, and, with headquarters in Chicago, will have charge of all the power plants of the company. There could be no more fitting testimonial to the ability of Mr. Dozier than his appointment to this important position. Mr. George Lawson, for a number of years assistant to Mr. Dozier in Kansas City, has been appointed to the position vacated by Mr. Dozier.

MR. HARRY DESTEESE has recently been appointed by the Stuart-Howland Company, of Boston, Mass., manufacturers of electrical supplies and specialties, manager of its branch at 26 Cortlandt Street, New York. For twelve years Mr. DeSteese has been constantly engaged in various branches of street railway work, both in this country and in Europe, exhibiting marked ability in his line of effort. His earliest experience was gained under Postmaster-General Payne at Milwaukee, and from 1896 to 1900 he was manager of the railway department of the Western Electric Company at New York, leaving that position to take charge of the establishment of a supply business in London, England. Mr. DeSteese's friends throughout the country will doubtless be glad to learn of his new connection, and the Stuart-Howland Company are to be congratulated on having secured so able and energetic a representative.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Sept. 24, 1902.

After a period of comparative ease the money market developed decided strength this week, and rates for both call and time loans were marked up materially, the quotation for time contracts touching the highest point of the year. This was but natural in view of the condition of the banks, as revealed by the statement of averages published on last Saturday. Not only was the surplus eliminated, but the reserve held by the banks were $1,642,050 below the legal requirements. This was due almost entirely to the continued heavy collections on account of customs and the shipments of currency to the interior for crop-moving purposes. Last week the banks lost on account of sub-Treasury operations $2,605,300 and to the interior $3,039,000, making a total loss of $5,644,300. This was partly offset by the receipt of new gold on assay office checks amounting to $1,606,300, leaving a net loss by the banks of $4,038,000.

This week opened with a renewal of the heavy customs collections and a continuation of the currency movement to the interior. The situation, however, is being constantly relieved by the contraction of loans, and although some relief will be afforded by the receipt of several millions of gold, due to arrive later in the week, still there is little hope entertained for easier money. The consensus of opinion in banking circles is that rates will rule at or near the lawful rate for the balance of the year. Money on call this week loaned as low as 6 per cent and as high as 20 per cent, the bulk of the business being transacted at about 15 per cent. Time money was particularly scarce, the banks and other institutions showing a disposition to put out as little as possible in view of the high rates prevailing for call loans. Six months' accommodations were 6 per cent bid, while for the short dates 6 per cent and a commission was asked, which brought the charge up to near 7 per cent a year. The European money markets are without material change from a week ago.

The Stock Market

The monetary situation has been the chief influence in speculative circles during the past week. The publication of last Saturday's bank statement, which not only showed that the surplus had been wiped out, but that the reserves were $1,642,050 below the legal requirements, was followed on Monday by heavy liquidation by commission houses, speculative pools and large operators. Later in the week this movement gained momentum when the call money rate was marked up to 20 per cent. There was extensive calling of loans by the banks in order to strengthen their position, and stock market loans had to be thrown over. The banks not only continue to lose by the interior movement, but the losses on account of sub-Treasury operations were again heavy. Up to the close of business on Saturday the banks gained nearly $1,000,000, but their gain was reduced to a relatively small amount on account of large customs collections. Prices all along the line declined sharply, but the greatest losses were shown in the higher priced issues which have been the speculative features. The local traction shares followed the general course of the market. There was scattered selling of Brooklyn Rapid Transit on the unfavorable report of earnings, and Metropolitan Street Railway continued weak, in liquidation occasioned by the high money rates. Manhattan Railway showed comparative strength, the buying being based upon reports of remarkably good earnings and the benefits to accrue from the installation of electricity on the west side lines. Subsequently, however, this stock gave way in sympathy with the causes recorded in the general market.

Philadelphia

The week started off with a general upward tendency, and on Sept. 17 American Railways reached 54, making a new high record for the stock, while the bonds rose to 109½. There was also a big demand for Philadelphia Rapid Transit after the issue of the annual report of the Union Traction Company, showing a net profit of $1,078,038. On Sept. 19 Philadelphia Rapid Transit sold up to 16¼. There was also an active market for Philadelphia Electric, and rumors of a possible merger of this company with the Rapid Transit Company, and also of the Philadelphia Electric with the Electric Company of America, were current but were denied by the officials of the companies interested. On Sept. 22 and 23 there was some liquidation in the traction stocks in sympathy with the rest of the market, which declined with Wall Street, although nowhere near to the same extent. Call and time money remained firm at around 6 per cent, and considerable Philadelphia money was sent to New York and placed at higher figures. American Railways kept all of its advance, and closed at 54½. Philadelphia Rapid Transit reacted to 15½, which, however, is nearly a point higher than it was last week. Union Traction and Philadelphia Traction remained practically steady as a result of the week's business.

Chicago

Dealings in Chicago securities were considerably less active during the past week and prices generally inclined to a lower level as a result of the higher rates for money. City Railway, which sold as high as 224 last week, reacted quite sharply as a result of realizing sales, and was offered with some freedom at 220, with 210 bid. Union Traction lost 4 points, to 50 bid, but little stock was offered at under 58. Lake Street Elevated remained steady, with sales around 10½, and Metropolitan rose from 39½ to 41 and later was 41½ bid, while the preferred held steady at 90¼@91. South Side Elevated dropped 3 points to 111 and sales of West Chicago Street Railway were reported at 96½. The market at the close displayed some irregularity and the tone in general was heavy.

Other Traction Securities

Boston Elevated has advanced during the past week to 158, while Massachusetts Electric, common, has remained between 38 and 39. The Baltimore market has remained dull, with a general expectation toward liquidation, in sympathy with Wall Street. This, however, did not materialize to any extent, although there was an easing off in several spots. United Railways closed at 14⅞, a slight recession from last week, and the income bonds reacted to 68¾, by reason of the contemplated issue of new bonds. The 4s have remained stationary at 95. There has been a little business in Nashville, common, at 6¼. Other Baltimore transactions include Nashville 5s at 75¼, Anacostia 5s at 102½, Charleston Consolidated Railway 5s at 90⅛, Charleston Railway 5s at 106, Newport News & Old Point 5s at 109½, and Lake Roland 5s at 119¼. The Cleveland Stock Exchange was an exception to the general rule, and to say that all records were broken would be putting it mildly. The fact of the matter is Cleveland and Cincinnati people are going wild over the securities of the Cleveland syndicates, particularly those of the Pomeroy-Mandelbaum syndicate. The total sales on the Cleveland 'change were 30,646, of which 28,081 were tractions. The report of an alliance between the Cleveland syndicate and the Elkins-Widener syndicate brought out numerous blocks of Cincinnati, Dayton & Toledo, Miami & Erie Canal and Springfield & Xenia. Aurora, Elgin & Chicago, and Elgin, Aurora & Southern were also very active through the announcement that a well-known Cincinnati broker had bought up large blocks of these securities and would boom them, as he has done with other Cleveland properties. Elgin, Aurora & Southern made the best advance, going from 49½ to 63½, on sales of 4611 shares. Aurora, Elgin & Chicago preferred sold from 88½ to par, a gain of 11 points, declining again to 98. The advance was due to the Cincinnati broker mentioned and his associates taking 10,000 of the 13,000 shares issued. Sales were 3194 shares. The common of this company advanced from 37½ to 42, closing at 41. Sales numbered 2800 shares. Cincinnati, Dayton & Toledo made a gain of five points, starting at 36 and closing at 41; sales, 2484 shares. Two weeks ago this stock was selling at 26 and 27. Miami & Erie Canal advanced from 26½ to 36, dropping off again to 33; sales, 2145. The general explanation for the wonderful advance is the community of interest relations with the Cincinnati syndicate, affording a possibility for the operation of passenger cars. Springfield & Xenia advanced from 26½ to 30½, on sales of 1735. Western Ohio did not participate seriously in the movement until the last day, when it moved to 30, a gain of 2½ points in the week; sales, 615 shares. The sales of Lake Shore Electric common were 6815 shares, the stock advancing from 20 to 22¼. The preferred gained 3½ points, from 55 to 58½ on sales of 1460 shares. Northern Ohio Traction common advanced from 62½ to 70 on 672 shares. The preferred gained 3½ points, from 94½ to 98, on sales of 1166 shares. Cleveland Electric and Syracuse Rapid Transit made gains of ½ point each, on small sales. Monday was another remarkable day in Cleveland. Two thousand Elgin, Aurora & Southern sold at from 62 to 64¾, and then closed at the former figure. Western Ohio receipts experienced a decided boom, advancing from 31 to 35 on sales of 800 shares. Aurora, Elgin & Chicago sold for 700 shares, advancing from 40 to 42½. Cincinnati, Dayton & Toledo advanced from 41½ to 42 on sales of 650 shares. Lake Shore Electric common went to 22, and the preferred to 57½ on small sales. Miami & Erie Canal dropped to 30½. Stocks of the Cleveland properties

were very active on the Cincinnati exchange last week, and it is known that many of the sales in Cleveland were for Cincinnati parties.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Sept. 16	Sept. 23
American Railways Company	51½	54½
Aurora, Elgin & Chicago	36	42
Boston Elevated	154	158
Brooklyn R. T.	68½	65½
Chicago City	220	215
Chicago Union Tr. (common)	17½	18⅞
Chicago Union Tr. (preferred)	48	54
Cleveland Electric	90	90½
Columbus (common)	60	56
Columbus (preferred)	108	105½
Consolidated Traction of N. J.	69¾	70
Consolidated Traction of N. J. 5s	110¾	110½
Detroit United	a94	95
Electric People's Traction (Philadelphia) 4s	98¾	98⅝
Elgin, Aurora & Southern	46¾	62½
Indianapolis Street Railway 4s	87	—
Lake Street Elevated	10½	—
Manhattan Railway	136	134⅝
Massachusetts Elec. Cos. (common)	38	37¾
Massachusetts Elec. Cos. (preferred)	97	96
Metropolitan Elevated, Chicago (common)	40	41
Metropolitan Elevated, Chicago	89½	90
Metropolitan Street	145	—
New Orleans Railways (common)	17¾	17⅝
New Orleans Railways (preferred)	56¾	56½
North American	124	125
Northern Ohio Traction (common)	62¾	70
Northern Ohio Traction (preferred)	93½	98
North Jersey	34½	34¾
Northwestern Elevated, Chicago (common)	36¾	36
Philadelphia Rapid Transit	14⅞	15½
Philadelphia Traction	*98	98¼
St. Louis Transit Co. (common)	30½	29
South Side Elevated (Chicago)	112	111
Syracuse Rapid Transit	27	25½
Syracuse Rapid Transit (preferred)	75	78
Third Avenue	130	129
Toledo Railway & Light	35	37
Twin City Minneapolis (common)	125¼	125
United Railways, St. Louis (preferred)	84	—
United Railways, St. Louis, 4s	87	86¾
Union Traction (Philadelphia)	47¼	47½
Western Ohio Railway	27½	30

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

MACON, GA.—The City Council has passed the ordinance granting the Macon Consolidated Street Railway Company and the Macon Electric Light & Railway Company the right to consolidate as the Macon Consolidated Street Railway Company. The ordinance provides for a fifty-year franchise to the company and is said to be sufficiently liberal to warrant its acceptance by the company.

CHICAGO, ILL.—It is again reported that an announcement is shortly to be made in regard to the plan for reorganizing the Lake Street Elevated Railway. It is said that the plan now being considered provides for an assessment on the stock.

CHICAGO, ILL.—The North Chicago Street Railway Company has declared the regular quarterly dividend of 3 per cent, payable Oct. 5.

OWENSBORO, KY.—The Owensboro City Railroad Company is offering for sale $200,000 of first mortgage, 5 per cent gold bonds.

WORCESTER, MASS.—The application for permission to consolidate the street railway companies operating lines between Worcester and New London, Conn., was discussed by the Railroad Commissioners on Sept. 8. The Worcester & Connecticut Eastern Street Railway asked the approval of the Commissioners for the lease of the Webster & Dudley Street Railway. This line, in connection with the Worcester & Webster Street Railway, whose cars run upon the tracks of the Worcester Consolidated Street Railway, in Worcester, covers practically the whole district from the Connecticut and Massachusetts boundary northward to Worcester, although it does not extend quite far enough south to touch Connecticut territory. The Connecticut end of the proposed system extends 25 miles south of the Massachusetts line, and parts of it between Putnam and Danielsonville, Conn., have been in successful operation for three years. The new line, with the leased roads, would give a through line from Worcester to Norwich. The road runs principally between Connecticut manufacturing towns.

BOSTON, MASS.—The Railroad Commissioners have authorized the West End Street Railway Company to issue $3,559,000 4 per cent bonds. These bonds, dated Aug. 1, 1902, running thirty years, are issued for the following purposes: $559,000 to be used in paying the Boston Elevated Railway for permanent improvements made under the terms of the lease, and $3,000,000 to refund an issue of ten-year 5 per cent bonds of the West End Street Railway which mature Nov. 1, 1902. The Commissioners have also approved of the disposition of $19,729 realized as a premium from the proceeds of bonds issued under orders dated, respectively, Dec. 18, 1901, and June 2, 1902, to cost of permanent additions, alterations and improvements.

WORCESTER, MASS.—The Hampshire & Worcester Street Railway Company has asked the Railroad Commissioners for approval of a stock issue of $80,000, making its total capital $156,000. This increase is desired by the company for the purpose of paying its floating indebtedness, making extensions and increasing its rolling stock.

WORCESTER, MASS.—The Worcester & Southbridge Street Railway Company has asked the Railroad Commissioners for authority to issue bonds equal to its capital stock of $500,000. These bonds are to be issued for the purpose of refunding floating debt.

STOUGHTON, MASS.—The receiver's sale at auction of the Stoughton & Randolph Street Railway, which was to have been held at the office of the United States Marshal on Sept. 17, was postponed until Oct. 1, by order of Judge Colt, of the Circuit Court.

JACKSON, MICH.—Application has been made to the Berrien Circuit Court to have a receiver appointed for the West Michigan Traction Company, which proposed a couple of years ago to tunnel under a portion of this city. Sixty carloads of steel rails were shipped to Benton Harbor for the road, but, although there was apparently nothing in the way of building the road, not one rail was ever laid.

MINNEAPOLIS, MINN.—The directors of the Twin City Rapid Transit Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Oct. 1.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company reports earnings as follows:

August	1902	1901
Gross receipts	$323,533	$283,589
Operating expenses	137,969	122,035
Earnings from operation	$185,564	$161,554
Deductions	77,733	75,350
Net earnings	$107,831	$86,204
Eight months		
Gross receipts	$2,327,425	$2,031,771
Operating expenses	1,060,709	945,715
Earnings from operation	$1,266,716	$1,086,056
Deductions	610,500	585,398
Net earnings	$656,216	$500,657

ST. LOUIS, MO.—The stock transfer books of the United Railways Company, it was announced last week, will close Sept. 27 and reopen Oct. 12. This is understood to mean that the regular dividend will be paid on United Railways preferred stock October.

NEW YORK, N. Y.—The Metropolitan Street Railway Company has declared the regular quarterly dividend of 1¾ per cent on its capital stock, payable Oct. 15 out of and from the rent guaranteed and paid by the Interurban Street Railway Company, under lease dated Feb. 14, 1902.

TRENTON, N. J.—The Cuba Railroad Company has filed with the Secretary of State papers certifying to an increase in capital from $500,000 to $30,000,000. The company will construct and operate a railway from the Bay of Nipes, Province of Santiago, to meet the Railroad of Cuba Company near Alto Cedro. It is understood that both steam and electricity will be used as a motive power.

CAMDEN, N. J.—The Camden & Suburban Railway has increased its authorized capital stock from $2,000,000 to $3,000,000.

BROOKLYN, N. Y.—The annual report of the Brooklyn Rapid Transit Company for the fiscal year just ended, not including the operating figures of the Brooklyn, Queens County & Suburban Railway, was issued Sept. 22. The report shows:

	1902
Gross earnings	$11,525,202
Operating expenses	7,717,129
Net earnings	$3,808,073
Other income	331,524
Total income	$4,139,597
Charges	4,268,753
Deficit	$129,156

BUFFALO, N. Y.—The Central Crosstown Railroad Company has been granted permission by the State Railroad Commission to issue a first consolidated mortgage for $3,000,000. The proceeds are to be applied to refunding former bond issues on the property and for improvements.

DAYTON, OHIO.—A meeting of the stockholders of the Dayton, Springfield & Urbana Electric Railway is to be held October 15 to consider the advisability of increasing the capital stock of the company from $750,000 to $1,500,000.

WHATCOM, WASH.—S. Z. Mitchell, president of the General Electric Company, which owns the street railway lines in Whatcom, denies the reported sale of the railway system to a Philadelphia syndicate.

LONDON, ONT.—The option held by Claude Ashbrooke, of Cincinnati, on the London Street Railway, owned by the Everett-Moore syndicate, has expired, and will not be renewed. It is said that the syndicate will retain this property.

TORONTO, ONT.—A meeting of the stockholders of the Toronto Railway Company has been called for Oct. 6 to vote on a plan to issue $1,000,000 of additional stock, providing for the development of additional power and for acquiring and operating radial lines.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Aug. '02	84,300	42,191	42,140	12,737	29,412
	1 " " '01	67,089	34,024	33,060	11,653	22,016
	6 " June '02	318,887	185,362	133,575	77,556	56,018
	6 " " '01	268,967	164,456	104,510	63,494	41,016
	12 " Dec. '01	617,011	*320,845	296,166	136,162	130,004
	12 " " '00	518,725	*341,475	136,249	111,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., Aug. '02	141,830	80,736	61,094	23,895	37,218
	2 " " '02	292,029	180,740	111,289	47,732	64,549
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Aug. '02	23,543	12,321	11,221		
	1 " " '01	21,490	10,886	10,604		
	2 " " '02	46,810	23,522	23,294	......	
	2 " " '01	[illegible]	31,168	22,512		
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,326,597	3,542,899	2,906,850	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos.	12 m., Sept. '01	5,779,133	3,916,496	1,862,640	937,206	925,442
	12 " " '00	5,518,837	3,672,337	1,850,500	994,294	866,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., July '02	1,246,400	*706,196	539,254	......	......
	1 " " '01	1,201,761	*758,495	443,266	......	
	12 " June '02	12,780,706	*8,963,216	3,817,490		
	12 " " '01	12,101,198	*7,970,845	4,130,353		......
BUFFALO, N. Y.						
International Tr. Co.	1 m., June '02	251,205	147,624	123,632	97,043	26,590
	1 " " '01	400,206	192,295	210,941	94,098	122,842
	1 " " '00	214,749	105,174	112,565	65,848	47,217
	3 " " '02	790,290	439,915	310,366	250,063	60,303
	3 " " '01	952,702	485,899	466,801	272,804	194,099
	3 " " '00	631,351	333,927	297,444	221,844	75,601
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., Aug. '02	45,217	31,191	14,026	13,337	689
	1 " " '01	45,454	28,276	17,178	13,037	8,481
	6 " " '02	359,984	203,200	155,784	81,061	74,720
	6 " " '01	246,439	163,145	83,293	82,618	674
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Aug. '02	25,580	7,221	18,300	......	......
	1 " " '01	24,338	7,470	16,868	......	......
	8 " " '02	128,060	52,856	75,201	......	......
	8 " " '01	112,962	49,571	63,391	......	......
CLEVELAND, O.						
Cleveland & Eastern Ohio Traction Co.	1 m., July '02	20,277	10,534	9,690	5,416	4,283
	1 " " '01	[illegible]	8,301	4,799	5,399	3,400
	7 " " '02	111,990	60,511	51,381	35,474	4,907
Cleveland, Elyria & Western	1 m., July '02	28,542	13,877	14,667	......	......
	1 " " '01	21,229	10,809	12,419	......	
	7 " " '02	156,984	91,653	65,331		......
	7 " " '01	131,255	76,089	55,167	......	
	12 " Dec. '01	240,990	128,626	112,364	57,093	55,871
	12 " " '00	170,096	102,303	71,794	34,582	42,742
Cleveland, Painesville & Eastern	1 m., Aug. '02	23,700	11,746	11,954	......	......
	1 " " '01	20,770	9,617	11,154	......	......
	8 " " '02	125,900	66,940	59,055	......	......
	8 " " '01	105,362	53,594	51,768	......	......
	12 " Dec. '01	164,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,812	*69,562	71,520	72,500	†980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., Aug. '02	77,886	*42,853	35,034	15,969	19,066
	1 " " '01	70,621	*40,092	30,529	15,117	15,183
	8 " " '02	540,088	*290,771	249,317	106,902	140,311
	8 " " '01	461,226	*281,474	179,185	109,321	69,864
DENVER, COL.						
Denver City Tramway Co.	1 m., Aug. '02	124,516	66,381	57,988	32,865	25,119
	1 " " '01	116,257	62,866	53,490	31,304	22,186
	8 " " '02	481,545	231,118	250,230	131,259	98,972
	8 " " '01	432,257	236,015	196,302	125,722	72,759
	12 " Dec. '01	1,307,259	818,521	688,905	283,180	305,795
	12 " " '00	1,162,367	722,458	539,839	374,291	305,548
DETROIT, MICH.						
Detroit United Ry.	1 m., July '02	325,808	[illegible]	143,159		
	1 " " '01	302,986	[illegible]	133,170		
	6 " June '02	[illegible]	[illegible]	663,631	395,739	267,892
	6 " " '01	1,384,184	[illegible]	605,834	341,119	264,715
	12 " Dec. '01	[illegible]	[illegible]	[illegible]	[illegible]	871,129
	12 " " '00	2,573,577	[illegible]	[illegible]	610,456	519,751
Detroit and Port Huron Shore Line	[illegible]	11,090	[illegible]	13,012		
	[illegible]	[illegible]	[illegible]	11,250		
	[illegible]	240,[illegible]	[illegible]	[illegible]		
	[illegible]	211,128	[illegible]	87,758		
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Aug. '02	51,457	26,505	24,952	9,671	15,282
	1 " " '01	41,763	19,890	21,873	9,204	12,669
	8 " " '02	349,496	183,938	165,558	77,910	88,648
	8 " " '01	296,085	161,610	134,475	73,186	61,287
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Aug. '02	43,507	22,129	21,378	8,333	13,045
	1 " " '01	37,305	17,104	20,201	8,333	11,868
	8 " " '02	270,435	158,851	111,584	66,667	44,917
	8 " " '01	241,397	136,236	105,161	66,667	38,494
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., Aug. '02	24,340	12,033	12,307	......	......
	1 " " '01	16,949	9,125	7,824	......	......
	6 " June '02	111,072	60,938	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Traction Co.	1 m., Aug. '02	49,301	24,483	24,819	15,850	9,969
	3 " " '02	140,412	68,156	72,256	47,659	24,597
LONDON, ONT.						
London St. Ry. Co.	1 m., Aug. '02	16,102	9,694	6,408	2,270	4,138
	1 " " '01	16,260	9,347	6,913	1,865	5,048
	8 " " '02	97,504	62,164	35,340	18,174	17,166
	8 " " '01	91,678	58,064	33,611	15,971	17,641
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Aug. '02	245,343	112,540	132,806	66,677	66,129
	1 " " '01	211,808	96,193	115,614	61,088	54,526
	8 " " '02	1,735,350	835,772	919,578	526,219	393,359
	8 " " '01	1,574,615	784,752	789,864	497,404	292,460
	12 " Dec. '01	2,442,312	1,185,581	1,256,848	756,139	501,609
	12 " " '00	2,297,698	1,129,787	1,090,911	894,065	196,346
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Aug. '02	338,554	187,989	183,565	60,833	125,932
	1 " " '01	283,560	122,086	161,554	57,850	103,704
	8 " " '02	2,327,426	1,030,700	1,296,716	470,580	796,136
	8 " " '01	2,031,771	945,715	1,086,056	445,398	640,657
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., July '02	198,656	93,966	104,690	19,929	84,760
	1 " " '01	178,190	91,464	87,716	14,142	73,573
	10 " " '02	1,643,857	941,880	702,977	164,229	538,748
	10 " " '01	1,583,236	981,963	601,272	104,409	496,863
NEW YORK CITY.						
Manhattan Ry. Co.	12 m., June '02	11,291,711	5,518,585	5,773,126	2,690,616	3,073,450
	12 " " '01	10,958,271	5,958,229	5,000,042	2,677,706	2,322,336
Metropolitan St. Ry.	3 m., Dec. '01	3,987,099	1,788,978	2,148,964	1,151,110	992,854
	3 " " '00	3,796,090	1,699,649	2,096,381	1,138,465	957,916
	12 " June '02	15,806,641	7,395,883	8,490,758	4,815,421	3,665,337
	12 " " '01	14,720,767	6,755,161	7,965,606	4,334,006	3,631,[illegible]
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., July '02	6,569	3,216	3,353	1,775	1,578
	1 " " '01	5,954	2,207	3,747	1,709	2,038
	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	54,018	28,228	25,790	16,756	9,035
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co.	1 m., July '02	9,387	5,290	4,097	2,083	2,014
	12 " June '02	86,795	*56,392	30,402	23,165	7,237
PHILADELPHIA, PA.						
American Railways	1 m., Aug. '02	125,150	......	......	......	......
	1 " " '01	91,152	......	......	......	......
	2 " " '02	240,455	......	......	......	......
	2 " " '01	180,811	......	......	......	......
	12 " June '02	1,009,509	......	......	......	......
	12 " " '01	844,298	......	......	......	......
ROCHESTER, N. Y.						
Rochester Ry.	1 m., June '02	89,236	46,809	42,426	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	537,742	298,005	239,737	148,605	91,132
	6 " " '01	495,236	306,986	188,250	147,167	41,183
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., July '02	62,571	34,265	28,306	19,085	9,221
	1 " " '01	59,488	31,670	27,818	13,371	4,442
	12 " " '02	693,284	384,265	309,019	228,246	80,773
	12 " " '01	621,289	340,830	280,459	228,915	56,54[illegible]
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Aug. '02	138,643	69,890	68,753	34,999	33,754
	1 " " '01	124,491	53,357	71,134	33,514	37,620
	8 " " '02	941,419	484,567	456,852	303,787	152,065
	8 " " '01	844,432	410,373	434,059	303,918	130,141
	12 " Dec. '01	1,331,084	*656,407	674,677	415,168	259,509
	12 " " '00	1,182,517	*616,945	565,572	409,061	156,51[illegible]
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	
	1 " " '01	39,447	21,837	17,610	......	
	7 " " '02	237,455	158,911	78,044	......	
	7 " " '01	187,270	133,283	53,987	......	
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	†3,987
	3 " " '01	56,836	35,500	21,336	25,000	†3,664

Street Railway Journal

Vol. XX. NEW YORK AND CHICAGO, OCTOBER 4, 1902. No. 14.

DETROIT AS AN INTERURBAN ELECTRIC RAILWAY CENTER

DETROIT is now the terminus of about 400 miles of electric interurban railway, and has 187 miles of city street railway lines. The various interurban electric lines radiating from Detroit were originally built by different companies, and some of these roads were among the first electric interurbans built in the United States. At the present time the nearest to a purely interurban company operating cars into Detroit is the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company. In 1901 all the other interurban lines entering Detroit came under the control of the Detroit United Railway Company, which company also owns all the city lines. The interurban lines controlled by the Detroit United Railway are now designated as the various divisions of the Detroit United Railway, except the Rapid Railway system, which has a separate organization and operating officers. In the following list both the former name and the present division name are included: Detroit & Pontiac Railway (Pontiac Division), 36.52 miles; Detroit, Rochester, Romeo & Lake Orion Railway (Flint Division), 85.31 miles; Detroit & Northwestern Railway (Orchard Lake Division), 58.77 miles; Wyandotte & Detroit River Railway (Wyandotte Division), 10.78 miles, and Detroit & Port Huron Shore Line Railway (operated independently as the Rapid Railway System), 109.57 miles. The total interurban mileage therefore controlled by the Detroit United Railway Company amounts to 301.15 miles.

ON WOODWARD AVENUE AT INTERURBAN WAITING ROOM

Adding to this the 100 miles owned and operated by the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company gives a total of 401.15 miles of interurban road terminating in Detroit.

The interurban lines centering in Detroit are shown by

the map accompanying this article. They reach out a distance of about 70 miles to the north and west, Jackson being 76 miles west, Flint 68 miles north, and Port Huron 73 miles northeast. Nothing gives a better general idea of the electric interurban service that is being maintained out of Detroit than the accompanying map in conjunction with the following list of towns reached by these interurban lines, in which is given the running time from Detroit, distance and rate of fare. The running time given includes that consumed in the city.

DISTANCES, ETC., FROM DETROIT TO TOWNS AND RESORTS REACHED BY ELECTRIC RAILWAYS

Towns.	Division	Distance from Detroit, Miles	Fare from Detroit One Way.	* Round Trip Rate from Detroit.	Running Time From Detroit
Anchorville	Rapid Ry...	35	$0.45	$0.85	1 hr. 46 min.
Algonac	Rapid Ry....	46	.55	1.00	2 hr. 14 min.
Ann Arbor	D.Y.A.A. & J.	38	.50	....	2 hr. 15 min.
Atlas	Flint Div	58	.83	....	2 hr. 46 min.
Birmingham....	Pontiac Div..	18	.15	....	1 hr.
Canton.........	D.Y.A.A. & J.	22	.25	....	1 hr. 24 min.
Cass Lake......	Orc. Lk. Div	29	.35	....	1 hr. 35 min.
Chelsea........	D.Y.A.A. & J.	53	.69	....	2 hr. 50 min.
Circle City.....	Pontiac Div..	24	.20	....	1 hr. 10 min.
Clarenceville...	Orc. Lk. Div.	17	.25	....	55 min.
Dearborn	D.Y.A.A. & J.	10	.15	....	45 min.
Denton	D.Y.A.A. & J.	25	.30	....	1 hr. 31 min.
Ecorces	Wyandotte...	9	.10	....	35 min.
Eloise (Wayne Co. House)..	D.Y.A.A. & J.	15½	.20	...	1 hr. 3 min.
Fair Haven.....	Rapid Ry....	36	.45	.85	1 hr. 50 min.
Farmington	Orc. Lk. Div.	20	.25	....	1 hr. 5 min.
Farmington Jct.	Orc. Lk. Div.	19	.25	....	1 hr.
Flint...........	Flint Div	68	1.00	....	3 hr. 15 min.
Francisco	D.Y.A.A. & J.	60	.80	....	3 hr. 5 min.
Goodison	Flint Div.....	32	.40	....	1 hr. 35 min.
Goodrich	Flint Div	56	.80	....	2 hr. 39 min.
Grass Lake	D.Y.A.A. & J.	64½	.87	....	3 hr. 15 min.
Greenfield	Orc. Lk. Div..	9	.10	....	30 min.
Inkster.........	D.Y.A.A. & J.	13½	.15	....	1 hr.
Jackson........	D.Y.A.A. & J.	76	1.05	....	3 hr. 45 min.
Leoni..........	D.Y.A.A. & J.	67½	.92	....	3 hr. 22 min.
Lake Orion	Flint Div	37	.50	....	1 hr. 51 min.
Lima Center ...	D.Y.A.A. & J.	49½	.65	....	2 hr. 41 min.
Marine City	Rapid Ry....	53	.65	1.20	2 hr. 29 min.
Marysville......	Rapid Ry....	67	.85	1.50	3 hr. 14 min.
Michigan Cen ..	D.Y.A.A. & J.	70½	.97	....	3 hr. 30 min.
Mt. Clemens....	Rapid Ry.... (Main Line)	21	.25	....	1 hr. 9 min.
Mt. Clemens....	Rapid Ry.... (Shore Line)	24	.30	....	1 hr. 30 min.
New Baltimore.	Rapid Ry....	32	.40	.75	1 hr. 42 min.
Northville	Orc. Lk. Div.	27	.35	....	1 hr. 30 min.
Orchard Lake..	Orc. Lk. Div.	28	.35	....	1 hr. 30 min.
Orion	Flint Div	37	.50	....	1 hr. 51 min.
Ortonville	Flint Div	51	.71	....	2 hr. 24 min.
Oxford	Flint Div	41	.55	...	2 hr.
Pearl Beach....	Rapid Ry....	42	.50	.90	2 hr. 5 min.
Plymouth	D. P. & N.Ry.	33	.40	....	1 hr. 53 min.
Pontiac	Pontiac Div..	26	.25	....	1 hr. 20 min.
Pontiac	Orc. Lk. Div	34	.35	....	1 hr. 50 min.
Port Huron....	Rapid Ry....	73	.90	1.50	3 hr. 25 min.
River Rouge ...	Wyandotte...	7	.10	....	30 min.
Roberts Landi'g	Rapid Ry....	49	.60	1.10	2 hr. 19 min.
Rochester......	Flint Div	28	.32	...	1 hr. 25 min.
Romeo	Flint Div	40	.50	....	2 hr.
Royal Oak.....	Pontiac Div..	14	.10	....	45 min.
Saline..........	D.Y.A.A. & J.	40	.50	....	2 hr. 15 min.
Sand Hill	Orc. Lk. Div	13	.15	...	45 min.
St. Clair	Rapid Ry....	61	.75	1.30	2 hr. 59 min.
Stony Creek ...	Flint Div	30	.35	....	1 hr. 35 min.
Sylvan Lake ...	Orc. Lk. Div	30	.35	....	1 hr. 40 min.
Trenton........	Wyandotte...	17	.20	.35	1 hr. 10 min.
Troy	Flint Div	22	.22	....	1 hr. 10 min.
Washington....	Flint Div .	34	.41	....	1 hr. 45 min.
Wayne	D.Y.A.A. & J.	18	.20	....	1 hr. 9 min.
Wyandotte.....	Wyandotte...	12	.15	.25	53 min.
Ypsilanti.......	D.Y.A.A. & J.	30	.40	....	1 hr. 45 min.

* Round trip rates are given only where tickets are on sale.

The service to all points is hourly, except that to Mount Clemens, Trenton, Ann Arbor and intermediate points half-hourly service is given. It will be appreciated that the Detroit United Railway, in operating so many miles of interurban line, becomes much more than a local company, covering as it does the entire southeastern part of Michigan, and the management of this property is therefore materially different from that of a company operating city lines only.

The capitalization of interurban electric lines around Detroit will average in the neighborhood of $40,000 per mile of track, about one-half of which would be in most cases represented by bonds. The earnings per mile of track per year are in the neighborhood of $3,500. Of course, these figures are only approximate, and cannot be applied to the various particular cases, but the foregoing figures, together with the data on population, which is to follow, will give a good general idea of the interurban situation in the vicinity of Detroit.

The population of Detroit, according to the census of 1900, was 285,704. The population of the towns and villages served by the interurban roads terminating at Detroit, outside of the Detroit city limits, is 130,255. This, however, includes only the villages of sufficient size to be given independent of their townships in the census of 1900, with the addition of a few villages which have grown very rapidly in the last two years, and upon which a local estimate of the population has been made. The rural population on these interurban lines outside of the villages is an important factor, as is evident to any observing person patronizing these lines, and this was not included in the foregoing estimate. Assuming this rural population to be 20,000, so as to bring the total population served outside of Detroit up to about 150,000, the population per mile at interurban track terminating in Detroit would be 374, exclusive of Detroit's population.

Going into population figures more in detail, the Rapid Railway system has in towns and villages along its line 36,236, or an average population per mile of 329. This includes the mileage of the city lines in Port Huron.

The Detroit, Ypsilanti, Ann Arbor & Jackson Railway has a population in towns and villages along its line of 48,660, or 486 per mile of track. This includes a small city mileage in Ann Arbor.

The Wyandotte Division of the Detroit United Railway serves towns and villages of a total population of 13,121, or 1193 per mile of track. This division runs along a thickly settled river bank which might almost be termed a continuation of the city of Detroit, although not within its limits.

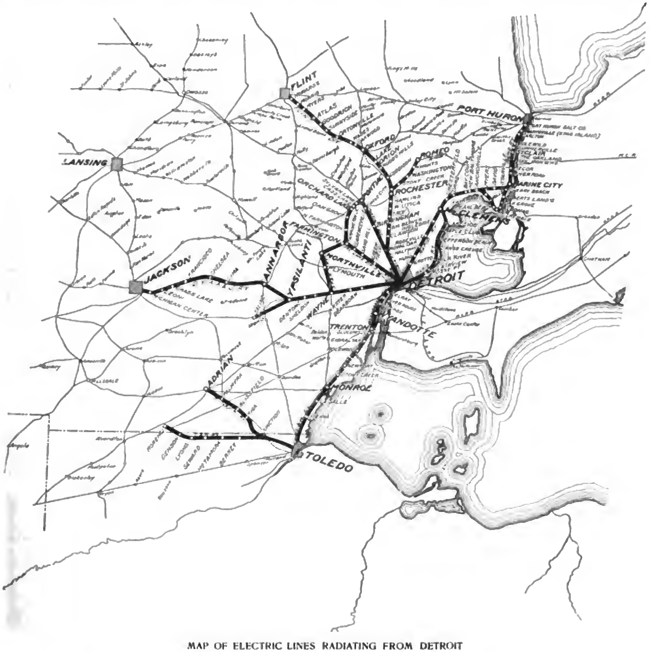
The Pontiac Division of the Detroit United Railway serves towns and villages outside of Detroit with a population of 11,407, or 317 per mile of track. Most of this road is double track.

The Flint Division of the Detroit United Railway serves towns and villages with a total population of 19,014, or 223 per mile of track. This, however, includes the population of Royal Oak (468), which is also served by the Pontiac Division.

The Orchard Lake Division of the Detroit United Railway reaches towns and villages with a total population of 12,054, or 204 per mile of track. However, the greater part of this is also reached by the Pontiac Division. Deducting the population of Pontiac, 9760, leaves only 2285 in villages along the line. The rural population, however,

is heavy along this road, and the travel from this source serves to keep cars fairly well filled.

Detroit being one of the oldest interurban centers in the United States, the results of operations there and the conclusions that have been reached have a value in connection with interurban work in other parts of the country. The great variety in track and line construction and rolling stock which is to be found on the various interurban lines and thickly settled community in the neighborhood of a large city. Much of the interurban mileage around Detroit was constructed before the days when the private right of way became popular with roads of this kind, and consequently much of it will be found along the highways. The construction has in most cases been carried on so as to interfere very little with the use of the highway for its original purposes, and for those who attempt the use of



MAP OF ELECTRIC LINES RADIATING FROM DETROIT

may not be ideal from the standpoint of the officers of the Detroit United Railway Company, who are earnestly at work getting interurban divisions of that system on as near a uniform basis of equipment and operation as practicable, but it does offer the outsider an opportunity to study a great many different kinds of construction and equipment and to note the results obtained with each and the constructions adopted as a result of experience.

The conditions which have favored the building of electric interurban lines around Detroit are practically the same as those which prevail around other cities where such work has been extensively carried on, namely, a fairly level highways for the building of interurban roads there may be found many suggestions in the construction around Detroit. It is notable, however, that around Detroit, as elsewhere, the tendency in building new lines is to buy a private right of way. The experience around Detroit has also demonstrated that there is sometimes danger that the eager promoter of interurban lines will consent to franchise terms which will cause a great deal of annoyance or great burden when it comes to operating the road. The private right of way, of course, does away with such inconveniences in so far as they relate to the portions of the line between towns.

Unlike many other interurban lines about the country, the Detroit companies have kept passenger and express business entirely independent. Passenger cars carry no express and express cars carry no passengers. Freight and express business has probably been developed to a greater extent around Detroit than in any other interurban center.

The general character of the service given on the various Detroit interurban lines is very similar. The schedule speeds from end to end of trip averages about 20 miles per hour, which the number of stops that must be made, both inside and outside the city, calls for car equipments that will make from 40 to 45 miles per hour maximum speed in the country with occasional bursts as high as 50 miles an hour. Four motors per car have been found more satisfactory than two, as elsewhere, and the latest interurban cars built, which embody the results of past experience, have four motors of 60 hp to 75 hp per car seating forty-nine to sixty people, being about 50 ft. over all and weighing 32 tons to 35 tons.

More detailed accounts of the various features which go to make up the Detroit interurban railway systems are to be found in various special articles in this issue.

The Merit System on the Detroit United Railway

BY ALBERT H. STANLEY, GENERAL SUPERINTENDENT

The idea of placing the merit system in effect on the Detroit United Railway originated with our president, Mr. Hutchins, who for three or four years previous to its adoption, the first of this year, had discussed with the executive officers of the company the advisability of instituting what is known as the Brown system of disciplining conductors and motormen. On Jan. 1, 1902, this system, as stated, was put in effect on all the properties of the Detroit United Railway. It affected some 1200 conductors and motormen; on both the city and interurban lines, operating on the regular schedule, 186 city cars and 24 suburban cars, and on the maximum schedule 400 city cars and 50 interurban cars.

A circular was issued on Dec. 23, 1901, addressed "To Conductors and Motormen," notifying them that: "Commencing Jan. 1, 1902, all punishment of conductors and motormen by suspension from duty with loss of time will be abandoned, and thereafter punishment for neglect of duty, violation of rules and bad conduct shall be by reprimand, demerit marks, or dismissal from the service.

"On that date, every conductor and motorman starts with a clear record, except that when subsequent records show that past offenses are being repeated, the persons concerned will be either dismissed from the service or double the demerit marks will be entered against them.

"It will be understood that disloyalty, intemperance, insubordination, wilful negligence, immorality, making false reports or statements, or concealing facts surrounding matters under investigation, will be considered as dischargeable offenses.

"A complete record of all conductors and motormen will be kept, and all discipline imposed will be shown thereon, and credit given for excellent conduct, deeds of heroism, loyalty, etc., and these records will be given full consideration in connection with the charges entered against any conductor or motorman. This record will be a private one, and no employee will be shown any record therein except his own.

"For every twelve (12) consecutive months (this has since been changed to every 3 months) of service free from demerit marks, or free from necessity for imposing a reprimand, ten marks (this has since been changed to 5) will be deducted from any that may have been previously entered against an employee's record. When sixty marks are entered against the record of any employee, his services will be dispensed with.

"On Jan. 1 of each succeeding year, the name of each conductor and motorman who has gone through the previous year with a perfect record will be posted at each of the car houses.

"In the promotion of employees, their previous records will be fully considered.

"Record Bulletins will be issued at least weekly and posted at all of the car houses on a special bulletin board. These bulletins will be educational, and will give a brief account of each case that has resulted in discipline, giving the number of demerit marks that have been inflicted, but will omit all reference that would identify the person at fault. A copy of the same will be sent to the person at fault.

"Each employee will be afforded an opportunity for appealing against any decision regarding the number of demerit marks imposed, but such appeal must be made to his division superintendent within ten days of receipt of notice.

"The objects to be obtained under this new system are:

"First—To avoid loss of wages by persons employed and consequent suffering to those who are dependent upon their earnings.

"Second—To stimulate and encourage all persons engaged in the company's service in the faithful and intelligent performance of their respective duties.

"This system is introduced with the belief that it will be directly beneficial and that it willl meet with the approval and cordial co-operation of all concerned."

Our records for the first six months of service under the merit system show as follows:

Two hundred and thirty-seven conductors and 341 motormen have no demerit marks.

Eighty-nine conductors and 124 motormen have between ten and twenty merit marks.

Three conductors and 16 motormen have over twenty merit marks.

Two hundred and sixty-seven conductors and 180 motormen have under thirty demerit marks.

Thirteen conductors and 22 motormen have over 30 demerit marks and under 60 demerit marks.

Discharged, 21 conductors and 16 motormen.

At first the general superintendent and division superintendents of the company met weekly to review all of the cases, which were pending, and to have a personal hearing with the employees at fault, and, if necessary, to give the employee an opportunity to explain his case.

The marks now given are the result of some six months' experiment. To-day we are satisfied that the marks as given for the different offenses are just, both to the employee and the company. No marks, either merit or demerit, are entered until the employee has been given a

VIEW LOOKING UP WOODWARD AVENUE FROM THE CAMPUS MARTIUS, DETROIT

hearing and full opportunity afforded to explain his case. After the marks are entered he is immediately notified by letter, a copy of which is kept at the office, and the employee is required to receipt for this letter. The receipt is returned to the office and filed. The blank forms used for these letters and receipts are reproduced herewith. The reason for obtaining this receipt is to prevent the employee claiming he has never been advised that any demerit marks have been entered against him. The books are open at all

Detroit United Railway

OPERATING DEPARTMENT

Detroit, Mich................19..

Mr.......................................

.........................Division.

Dear Sir:

You are hereby notified that Five Merit Marks have been entered to your credit for three months of continuous service without demerit marks or warning.

....

No.......... General Superintendent.

....

No..........

I hereby acknowledge receipt of letter No....

Detroit, Mich...............190..

....

NOTICE OF MERIT MARKS

times for inspection and a page is allowed for each conductor and each motorman, but nobody is permitted to see anybody's record but his own.

Now that we have practically decided on a schedule of marks, the division superintendent interviews the employee

Detroit United Railway

OPERATING DEPARTMENT

Detroit, Mich................19..

Mr.......................................

Conductor }
Motorman }

.........................Division.

Dear Sir:

Your are hereby notified that.................................
have been entered against you for..............................
....
....
....

....

No.......... Gen'l Supt

....

No..........

I hereby acknowledge receipt of letter No....

Detroit, Mich...............19..

....

NOTICE OF DEMERIT MARKS

at fault, and sends to this office a report of the offense and the number of marks given, which, of course, is subject to revision at this office before the marks are entered against the employee.

The chief benefits of the merit system are:

First—That it thoroughly systematizes our system of discipline. Our property is divided into divisions; each division incharge of a division superintendent. We have seven division superintendents. Previous to putting into effect this system, each division superintendent was governed by his own idea in the infliction of punishments, as to the num- of days a man should be suspended for a certain offense. We now practically have a standard schedule of what the offense deserves in the way of demerit marks.

Second—It prevents any favoritism being shown on the part of any division superintendent toward certain conductors or motormen. It also does away with having to punish a good man the same as a poor man, both having committed the same offense. For example, under this system a good motorman and a poor motorman might each have a collision. Under this system they would both get the same number of demerit marks if neither had committed this offense previously; but the good man will wipe out his demerit marks through the accumulation of good marks, while the poor man will eventually be discharged through demerits inflicted for this and other offenses. If a man does his work faithfully and efficiently he is not suspended for any dereliction from duty; while a poor man will go on and discharge himself. All the operating officers have to do is to watch the men and see that the work is done right, and the proper number of marks given.

Third—It is not detrimental to the men. I have known more than one instance under the former method where an efficient man has been suspended a number of days for the offense. He has gone back on his car after that time very much deteriorated on account of his lay-off; perhaps merely from the loafing habit acquired by doing nothing, perhaps through getting in the habit of visiting drinking places during his suspension and becoming confirmed in the use of liquor. It has also resulted in his family losing the use of his pay for the time he was off duty. The family thus suffers. A man will often go back on his car with a feeling of revenge for what he thinks a too severe punishment. With this system he gets demerit marks, but has an opportunity of wiping them out by months of good service or the performance of meritorious acts.

We receive many reports from the public of particularly courteous or meritorious acts or acts of bravery. We always take cognizance of such reports, and if found correct after investigation accord a suitable reward. It greatly encourages men in the performance of their duties to have any deserving acts they perform brought to the attention of the officers of the company, and in that way get a word of praise or encouragement for it. Since this system was inaugurated it has been a very rare occurrence that our lines have been blockaded by broken trolleys. We give merit marks to the conductors and motormen who clean up trolley trouble, and it very rarely happens that cars are delayed longer than the time necessary for the crew of the first car which reaches the break, to pick up the line, using the trolley rope or bell cord. We have also escaped several very serious wrecks which might have occurred from washouts had not the crews been particularly alert because of their wish to obtain merit marks, and having heard of trouble from washouts, observed extra caution and discovered the danger in time to stop the car and avoid accident.

This system has received the approval of the great majority of the conductors and motormen; and has aroused among all of them a strong desire to avoid demerit marks and to take advantage of every circumstance to get merit marks; and those who have been given merit marks have been very much encouraged. The intelligent performance

of the duties of conductors and motormen has very materially advanced.

Applications for employment with the Detroit United Railway are received every Wednesday and Friday morning at 11 o'clock. The applicant is required to appear in person and make application for a blank. If his appearance and recommendations are satisfactory he is given an application blank. After filling it out, he presents it at the office on the next application day. His application is then received and he is questioned closely on the application, and told if his services are required he will be notified by mail. If his appearance and endorsers are satisfactory,

Detroit United Railway

OPERATING DEPARTMENT

EDUCATIONAL BULLETIN.

No. ...... **Detroit, Mich**........

Notice to Conductors and Motormen, all Divisions:

....

....

....

FORM OF BULLETIN POSTED

the latter are communicated with personally if they live in the city or nearby, otherwise by mail. If the reports from these persons are satisfactory and a vacancy occurs the prospective employee is requested to call, and is then sent to one of the car houses with a letter to the division superintendent in charge instructing him to put him on with a careful conductor or motorman (whichever position he applies for) to instruct him in the respective duties. If a motorman he is kept at practice every day for about two weeks; if a conductor, about seven days. He is then turned over to a night man and kept at night work for a week or three days longer. If the motorman or conductor in charge reports him competent to take charge of the car alone, the division superintendent rides with the man and closely watches him in the performance of his duties. If satisfactory to the division superintendent he is given a letter to the general superintendent. He is then supplied with an outfit, consisting of cap badge, riding badge, rule book and (if he is a conductor) with a punch. He is then placed at the bottom of the run board as "last extra" and does not lose his place on that board unless he is discharged from the company's service. He moves up only as those above him are moved. That portion of the merit system bulletin which relates to promotion refers only to promotions to positions in the car house or office, and does not relate to the change in position on the board. The man is then kept in service for a period of sixty days, after which he is sent to the company's physician for examination as to his eyesight, hearing and physical condition, which examination he must pass. The examination costs the applicant $2. There probably remain in our service after sixty days, about 40 percent of the total number of men employed. The reason for this sixty-day limit is that after that time the man is required to become a member of the union and is amenable to the conditions of an agreement between the company and the union. Previous to that the company can do what it pleases as to accepting the man.

It is the policy of the company to promote conductors and motormen to positions in the car houses and as division and assistant division superintendents. The division superintendents do not employ or discharge conductors or motormen. The employment is all done in the regular employment bureau, and in discharging a man the case comes before the general superintendent. A man has the right to appeal to the president of the company should he question the decision.

Detroit City Schedules and Rush Hour Traffic

One prominent characteristic in the operation of the city lines of the Detroit United Railway is the unusual provision made for carrying passengers during the morning and evening rush hours and also on all special occasions and all times when great crowds are to be taken away from certain points within a short period, as, for example, at the close of theaters and baseball games. There is probably no city in the United States where so great a proportion

HANDLING A BASE-BALL CROWD, DETROIT

of the passengers carried during the rush hours are given seats. The number of cars in operation during the evening rush hours is 125 per cent more than during the middle of the day in the winter, and 75 per cent more during the rush hours in the morning. In the summer the midday schedule is increased to accommodate the large number of out-of-town visitors who are always present in Detroit during the summer, since it is a favorite point for excursions and conventions from all over the country. The ordinary schedule in the summer during the day is 186 city cars and 24 interurban cars. The maximum schedule is 400 city cars and 50 interurban cars. The maximum interurban schedules, however, are put on only on holidays and Sundays.

One factor which goes to materially increase the number of cars required during the evening rush hours is that working men's tickets are sold eight for a quarter by the terms of the company's franchises, and these tickets are good from 5:30 to 7:00 in the morning, and from 5:15 to 6:15 in the evening. This has a tendency to crowd all the traffic of the evening rush hours into the hour between 5:15 and 6:15. In this respect the workingman's ticket has proved anything but a benefit to the people of Detroit, because it has tended to congest the service at the very time when every means should be taken to prevent con-

gestion. However, the Detroit United Railway Company has to meet these conditions, since they have been established, and is giving an excellent service. The making of time schedules to meet all the requirements on the Detroit United Railway would drive to distraction any ordinary person who had not had long experience in this line, because of the necessity of providing work enough for the trippers to give them living wages, and because of the existence of an agreement with the local division of the Amalgamated Association of Street Railway Employees of America, by which every man must be able to perform his entire day's work within twelve and one-half consecutive hours. About one extra crew is kept for every two and one-half regular crews on the city lines. To illustrate the way the runs are divided, the Sherman line may be taken as an example. On this line there are thirty-seven regular and swing crews, having full paid runs of eight hours and over. Out of these thirty-seven men twenty-four are regular crews and thirteen swing crews. There are in addition thirteen crews on the tripper and extra list. These average about four and three-quarters hours' work per day, the minimum being a little over three hours. Those at the top of the tripper list may be able to get in as much as eight hours by supplying places of men absent higher up the list.

Motive Power and Rolling Stock of the Detroit United Railway

BY THOMAS FARMER, SUPERINTENDENT OF MOTIVE POWER.

The Detroit United Railway System is operated by power from six power houses and three storage battery stations, these different power houses being, of course, originally built to supply the various lines which have now been consolidated to form the Detroit United System. The two stations supplying the lines in the city of Detroit are designated as Stations A and B, those supplying interurban lines as D, E, F and G, and the storage battery stations as C and H. Reference to a map elsewhere in this issue in an article on power distribution will show the location of these various stations, as mentioned in the following paragraphs:

Station A was originally built by the Detroit Citizens' Street Railway Company, and Station B was built by the Detroit Railway Company, which latter, soon after the building of its power house, was acquired by stockholders of the Citizens' Company. These two power houses are situated near the river front at Riopelle Street, one being on the south side of Atwater Street, the other diagonally across the street from it. The switchboard for both stations is located in Station A. Station A has an engine room 65 x 243 ft., and boiler room 58 x 253 ft. The engine room is spanned by a 25-ton Brown traveling crane. This room now contains four Reynolds-Corliss tandem compound condensing engines, 28 and 52 x 48 ins., direct connected to 1000-kw Siemens & Halske outside armature generators. The boiler plant supplying these consists of Babcock & Wilcox boilers of 250 hp. each set in batteries of two. These boilers have Murphy automatic stokers. The stack of this station is 180 ft. high, with 11 ft. 6 ins. flue. The boilers are fed through Hoppes' live steam purifiers. For each of the four engines is a Worthington duplex jet condenser, 14 ins. x 22 ins. x 15 ins. For boiler feed there are two Worthington duplex compound pumps with outside packed plungers, 10 ins. x 16 ins. x 8¼ ins. x 10 ins. A Worthington duplex pump 10 ins. x 5½ ins. x 10 ins. is kept for fire protection. Two pumps of the same type, 2 ins. x 3 ins. x 3 ins. do service on the oil distributing system, and there is also a Davidson, 3 ins. x 2¼ ins. x 4 ins. pump working on oil distribution. A Davidson pump, 6 ins. x 4 ins. x 7 ins., and a Gordon, 6 ins. x 4 ins. x 6 ins., are installed as pit pumps. A Worthington air pump supplies compressed air for cleaning armatures. A Hunt conveyor brings coal in and carries ashes out. This latter is run by a double 4-in. x 6-in. engine.

In both Stations A and B the gravity oiling system is used. All the piping of this oiling system is painted so as to easily distinguish supply and return pipes. The supply pipes are light yellow, the return pipes dark yellow, and the by-pass to the sewer dark red. This simplifies the manipulation of the system very much, because at best there is a multiplicity of pipes and valves. In case it were desirable to flood a bearing with water, the by-pass to the sewer would be open, and the return valve for this bearing would be closed. This would run to waste the oil used in that particular bearing, but would obviate filling up the whole oiling system with water and wasting all of the oil. However, it is a matter of record that water has not been used in a single bearing in over six years.

The method of lubricating low-pressure cylinders is original with these power houses. For this purpose a hole is drilled on both sides of the cylinder directly through its walls on its center line, these holes being connected by piping to a special double sight feed lubricator. The piston in passing these openings acts as a wiper, thus spreading the oil over the cylinder surface and giving most perfect lubrication. Not only has this scheme effected a great saving of oil during the seven years of its use, but has demonstrated its efficiency by giving such an excellent lubrication that but two of the sylinders have had to be rebored in that time. This is a rather unusual performance for tandem engines.

Station B, across the street from Station A, has an engine room 67 ft. x 227 ft., and a boiler room of the same size. Two of the units in this station are 20 ins. and 40 ins. x 48 ins. Reynolds cross compound Corliss condensing engines direct connected to 400-kw Walker generators. Two more units are 24 ins. x 48 ins. Reynolds cross compound condensing engines direct connected to 800-kw Walker generators. The last unit installed was a 32-in. and 64-in. x 60-in. Filer & Stowell cross compound condensing engine direct connected to a 1500-kw Westinghouse generator. A duplicate of this last unit is now going in. The boiler plant in this station consists of eight 300-hp Stirling boilers and eight 250-hp Stirling boilers. These have Murphy stokers and Green economizers. The stack for this station is 185 ft. high, wi h 10-ft. flue. There is one Blake vertical duplex compound jet condenser, 15 ins. x 24 ins. x 38 ins. x 21 ins. The other four units are served by Davidson jet condensers. Four Davidson pumps, 12 ins. x 8 ins. x 12 ins. are used for boiler feed. On the oil distribution, pumps 2 ins. x 2 ins. x 4 ins. are doing service. One Marsh 4-in. x 2-in. x 4-in. pump is connected to the bleeder. Two Davidson pumps are on the automatic feed and receiver.

For feeding on long lines this station has a double booster set, consisting of a Westinghouse motor direct connected to

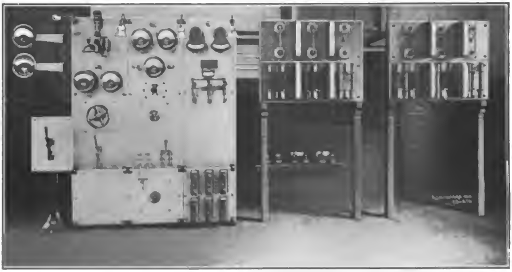
two 250-kw railway generators which are run with very weak field.

The switchboard, which has both the generator and feeder panels for both stations, is located in Station A, and has nine generator panels, thirty-six feeder panels, two booster panels and two main instrument panels. This board has three sets of bus-bars, so that three different voltages can be supplied the feeders as explained in an article in this issue on electrical distribution. Part of the generators were built to maintain a high voltage for supplying outlying lines, and these generators are put on the higher bus-bars, leaving the nearer lines for the lower voltage machines. When desired, all bus-bars can be connected together and the night load carried by a generator in either station. A log sheet of Stations A and B for twenty-four hours is reproduced herewith, which illustrates our method of keeping records, and shows the storage battery charge and discharge.

The power houses just described were both built in 1895, and no additions have been made since then except the 1500-kw unit in Station B. The Filer & Stowell engine on this unit differs somewhat from that company's standard.

A duplicate of this is now being installed. The crank-shaft is 29 ins. in diameter at the wheel fit. The total length of the shaft is 26 ft. The bearings are 26 ins. x 48 ins. The shaft is Bethlehem hollow forged steel, with 10-in. hole. It weighs alone 41,574 lbs., and with crank discs, pins and hub 102,200 lbs. The fly-wheel is 160,000 lbs., 23 ft. in diameter. The cross-heads are fitted with an extension, so that the slippers are fastened by means of studs to the cross-head proper. The slippers will therefore be retained in case the adjusting screws break. No wrist plates are used in either the admission or exhaust. The valve gear is connected straight through. Both high and low pressure piston junk rings are babbitted. Both ends of the connecting rod are also babbitted. To give access to the low-pressure piston without removing the cylinder head, a man-hole is provided in the head. This engine weighs, complete, without generator, 640,000 lbs.

POWER HOUSE AND CAR HOUSE AT ROCHESTER, FOR FLINT DIVISION



SWITCHBOARD AT ROCHESTER STATION

Station D supplies what is known as the Orchard Lake Division, formerly the Detroit & Northwestern Railway, and is located at Farmington Junction, 18½ miles from the Detroit City Hall. The engine room of this power house

is 52 x 120 ft., with boiler room of the same size. There are at present three Reynolds-Corliss engines, 26 ins. x 48 ins. direct connected to 400-kw Siemens & Halske outside field generators. There are eight Aultman & Taylor boilers of 250-hp each, with Murphy stokers. All the pumps are Davidson. For use with unusual loads there are two General Electric 100-kw boosters, for operating distant portions of the road. In ordinary operation these are not used. An air compressor is located at this power house which compresses air for the Magann storage air brake system on the cars of this division, which stop at the power house to fill their air storage tanks each trip. The storage air pressure is 250 lbs. per square inch.

SUB-STATION, WAITING ROOM AND FREIGHT DEPOT, AT OXFORD

The Pontiac Division from Detroit to Pontiac is operated from Station E at Birmingham, 17½ miles from Detroit City Hall. Here two Westinghouse compound condensing engines, 16 ins. and 30 ins. x 18 ins., are belted to Westinghouse 250-kw generators. There is one Babcock & Wilcox 250-hp water tube boiler with a Roney stocker and three 125-hp horizontal return flue boilers. Worthington pumps have been installed throughout at this plant. An air compressor, 7 ins. x 4 ins. x 12 ins. compresses air for the storage tank, from which the cars on this division obtain compressed air for operating air brakes by Magann storage air system. At this station the Wefugo system of water purifying and filtering has been installed for treating boiler and feed water.

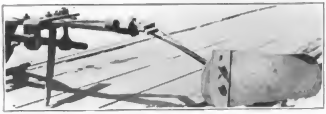
Station F is a small station situated at Pontiac, and is only used in an emergency. It was originally built to operate local lines in Pontiac. No men are regularly employed at this plant, but operators are transferred there from the shops when the plant is to be run.

Station G, operating the Flint division, is located at Rochester, 26 miles out. The building is at present 72 ft. x 104 ft. There are two Ball & Wood horizontal tandem compound condensing engines, 15½ ins. and 128 ins. x 16 ins., each direct connected to Crocker-Wheeler 200-kw generators. There is also a large vertical unit consisting of a Ball & Wood compound condensing engine, 22½ ins. and 45 ins. x 20 ins. direct connected to a 400-kw Crocker-Wheeler generator. For operating the alternating current transmission a 250-kw Stanley inverted rotary converter is at present used. Further particulars of this rotary and of this station are given in the article on electric power distribution of the Detroit United Railway. Adjoining the inverted rotary is a high-tension Stanley switchboard, illustrated herewith. There is also in the station a 60-kw booster and a 90-kw alternating current lighting generator for the town of Rochester. The boilers in this plant are four Aultman & Taylor water tube, 25 hp each. The pumps are all Deane, made at Holyoke, Mass. A compressor at this plant furnishes the storage air for braking the cars on this division.

ROLLING STOCK

There is considerable variety in the interurban rolling stock of the Detroit United system, although the differences are not as great as might be expected where a number of different companies have contributed to the consolidation. None of the interurban cars has been designed to carry on anything but a strictly passenger business, and all have smoking compartments in the front.

The heaviest interurban car owned by the company is the type belonging originally to the Detroit & Northwestern Railway. This car weighs about 33 tons loaded, is 51 ft. over all, with 40-ft. body. The width is 8 ft. 9 in. These cars seat nineteen in the smoking compartment, and thirty in the rear compartment, and have closet, hot water heater and drinking water tank in the left-hand rear corner. Most of these cars are mounted on Dupont trucks with 33-in. wheels, 5-ft. 2-in. wheel base and 4½-in. axles. A few have Brill No. 27 trucks. These cars were built by the G. C. Kuhlman Car Company.



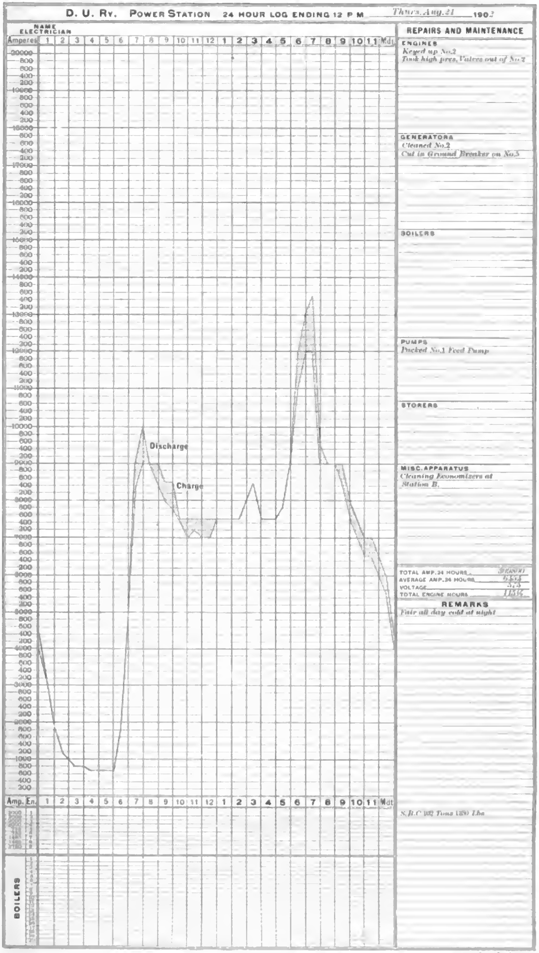
EARLY FORM OF RAIL GROOVE SCRAPER

All of the various types of cars used on the Detroit United system are illustrated in this issue, either in this article, or, in a few instances, in the article on interurban rolling stock.

A parlor car built originally for interurban service on what is now the Flint division has a length over all of 45 ft. The length of the body is 37 ft. and the width 8 ft. 4 ins. They are on Peckham trucks, with 33-in. wheels and 5-in. axles. These cars were built with a parlor compartment in front, the idea being to charge an extra fare for the parlor car service, which idea, however, was never carried out.

LATEST FORM OF TRACK AND GROOVE SCRAPER

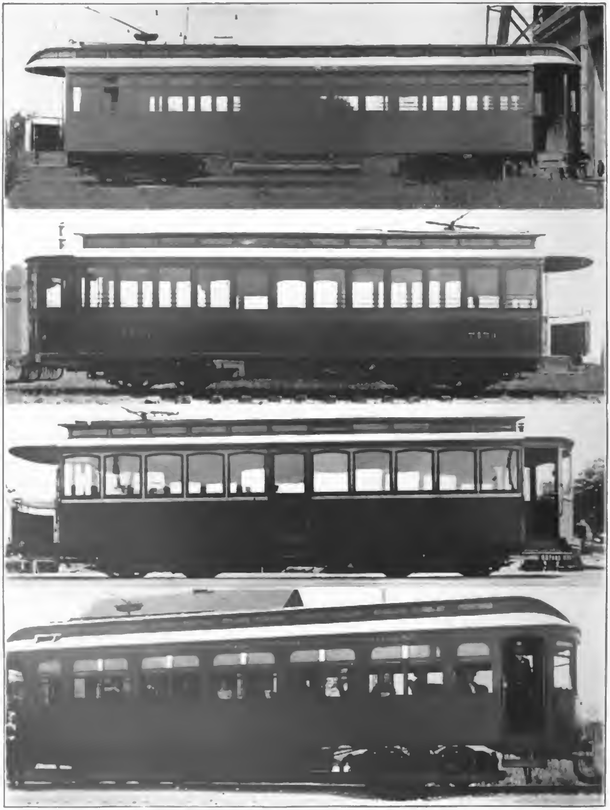
On the Wyandotte division the closed car used is 44 ft. 5



Street Ry. Journal

POWER STATION LOG USED BY THE DETROIT UNITED RAILWAY

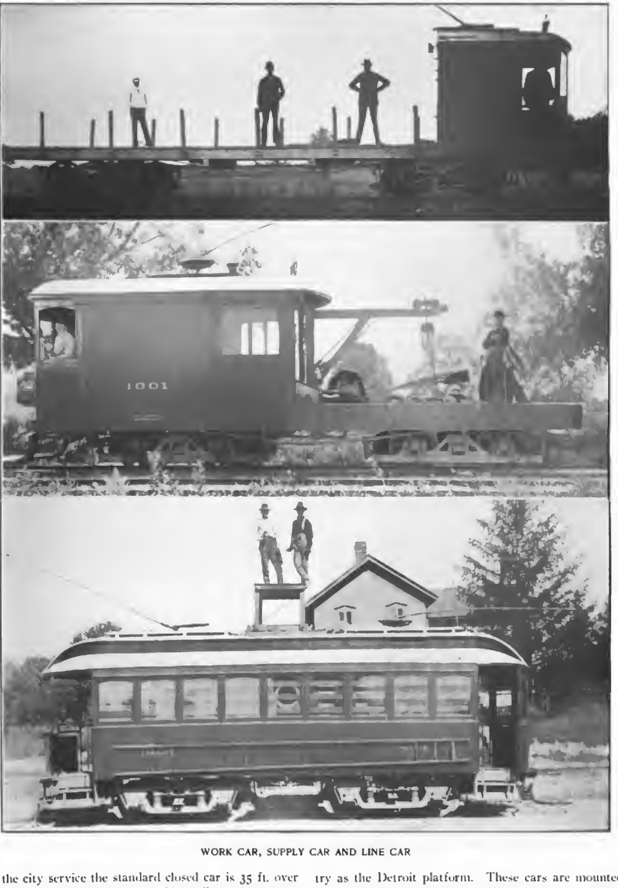
ins. long over all, with 33-ft. 2-in. body, 8 ft. 6 ins. wide. These are on Dupont trucks, 33-in. wheels, 4-in. axles and 5-ft. wheel base. These cars were made in the company's own shops.



INTERURBAN PASSENGER CARS, DETROIT UNITED RAILWAY

A number of interurban cars will be found on the various divisions with side door and side aisle in place of the usual center aisle. Those built originally for use on the Flint division are 43 ft. 6 ins. over all, with 33-ft. 6-in. body, 8 ft. 4 ins. wide, on Peckham trucks, 33-in. wheels and 4½-in. axle. There is also a side door car which is 45 ft. over all, with 34-ft. bodies, 8 ft. 6 ins. wide, on Brill No. 27 trucks, with 4-in. axles and 6 ft. wheel base. Both these side-entrance cars were built by the Kuhlman Car Company. A good idea of the general interior appearance of the forward ends of some of our interurban cars is given by the two views shown of the ends of the Rochester & Lake

Orion cars are given in this article. These cars were built by the Jewett Car Company. All interurban cars are heated by Peter Smith hot water heaters.



WORK CAR, SUPPLY CAR AND LINE CAR

In the city service the standard closed car is 35 ft. over all, with 22-ft. body, 8 ft. 3 ins. wide, built by the Detroit United Railway. The rear platform is 6 ft. in the clear, and has a railing which divides the rear part of the platform from the exit of the car, thus providing standing room for smokers in winter. This is the type of platform which originated in Detroit, and is commonly known all over the country as the Detroit platform. These cars are mounted on single Dupont trucks with 8-ft. wheel base and 33-in. wheels. The heating is by hot air through a heater located in the motorman's vestibule.

The standard open car has a length over all of 34 ft. 6 ins. and 7 ft. 6 ins. wide with twelve cross seats. Dupont trucks are used with 8-ft. wheel base, 33-in. wheels and 4-in. axles. The seat supports are castings bolted firmly

CAR SIGN

to the iron sill of the car, and these castings are of such a form as to give a long, firm socket for the upright posts. This construction was illustrated in the STREET RAILWAY JOURNAL for July 6, 1901. All open cars have push buttons for the conductor's signal bell located in the middle of the back of each seat. Wires are run in both directions from the push button under a moulding, and connection is made through the metal fittings at the ends of the seats. Practically all cars on the Detroit United Railway system run single-ended, and have a controller on one end only.

A SIDE AISLE AND SIDE ENTRANCE CAR

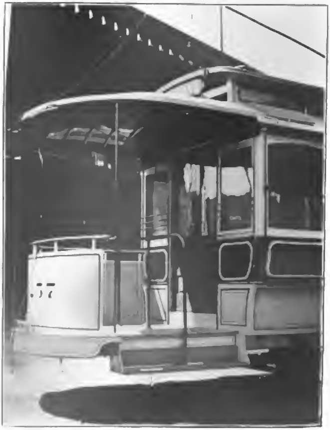
All cars on the system are equipped with the Wilson trolley catcher. This device is especially important on the interurban divisions where cars run at such high speed that the trolley coming off might do a great deal of damage if no means were provided for automatically catching it at once upon its leaving the wire. Both the standard open and closed cars for city use have been built in the company's own shops on Jefferson Avenue. An order of forty-five double-truck closed cars is now being filled by the Niles Car & Manufacturing Company. Twenty fourteen-bench open cars on double trucks have recently been purchased and used the past summer on the Wyandotte division, and for special service over the interurban lines.

OPEN CAR SHOWING PUSH BUTTONS

The old Detroit Railway System, popularly known as the 3-cent fare line, was equipped with closed cars having a side entrance in the middle as well as at the rear, and a side aisle with cross seats. A large number of these cars are still in use.

SIDE ENTRANCE CITY CAR

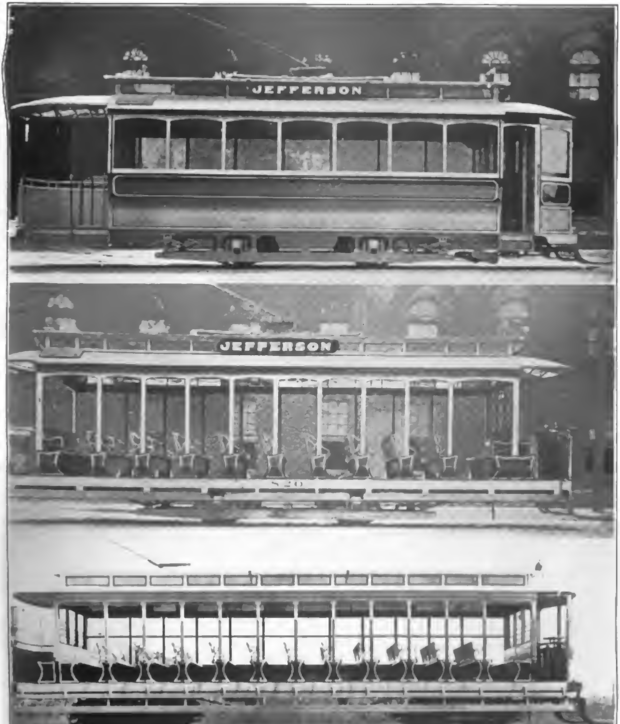
Up to within two years ago, sheet iron panels were used extensively in Detroit in place of wood panels. The use of these panels has been abandoned mainly because of the rusting around the screw heads which fastened them on. This rusting, together with the working of the car body, resulted in loose car panels.



THE DETROIT PLATFORM

The destination signs on Detroit cars are somewhat similar to those used in a number of other cities, and an

example is shown herewith. The letters are cut in the sign-board and a white celluloid back put behind the letters so that light from the car hood may shine through the sign at night. To assist in making the sign prominent the letters form. Both forms have means of renewing the tongue which enters the groove and bears on top of the rail. In the earlier form the wearing part is fastened on by bolts. In the later form it is riveted.



STANDARD OPEN AND CLOSED CITY CARS, DETROIT

are emphasized by trimming of white paint around the edges of the carving.

The use of a narrow-grooved rail in Detroit as required by the city gives rise to considerable difficulty in keeping the grooves free of snow in the winter and dust in the summer. The grooved rail scraper employed at first is shown by an accompanying engraving, as is also a later

The wheel flanges on both city and interurban cars are limited in depth and width by the groove rail required on all track inside the city limits. The flange adopted for Detroit United Railway cars is $\frac{5}{8}$ in. deep x $1\frac{1}{4}$ ins. wide at the throat, and the tread is $2\frac{3}{8}$ ins. wide. Wheels are pressed on between the limits of 25 tons and 40 tons.

Kalamazoo trolley wheels are run on the interurban cars.

The latest form of trolley wheel we are using on the city cars is one made in our own shops. Drawings of the wheel and harp are shown herewith. No bushing whatever is used with this wheel. The bearing is directly on the brass. The pin on which the wheel runs is a piece of steel bicycle tubing with ends plugged up. A slot is cut in the tube lengthwise, and the space inside the tube is filled with wicking. The wicking is kept soaked with oil, of which enough escapes through the slot to lubricate the bearing. The bearing surface is large, both for wear and for electrical contact, and the bearing will remain in good condition until the wheel is discarded for flange wear. Longer bearing life than this is unnecessary. Trolley bases and springs are adjusted to give an upward pressure on the trolley wire of 20 lbs. to 25 lbs. for interurban work and 15 lbs. for city cars.

All extensive repairs for the Detroit United Railway system, and the car painting and varnishing for the Rapid Railway system are carried out in the Jefferson Avenue shops. Ordinary renewals of worn out or broken parts are made at the car houses. For distributing and collecting armatures, fields, brake-shoes, car wheels and other renewal parts to the four interurban division car houses a special supply car has been built which makes the rounds daily. This car is illustrated herewith. The closed part is fitted up comfortably for the men and for any officers who may wish to make use of this car on inspection tours over the road without the expense incident to a special car. The rear part is open and has a crane with a capacity of 2000 lbs. for loading and unloading heavy parts. It has also a windlass for pulling heavy machinery up an incline onto the car. Grooved tracks are laid into the floor of the car for car wheels. There are two tracks, so that the wheels can be staggered. The car has a four-motor equipment as speedy as any regular passenger car on the road, which is a more important point than would seem at first, because the dispatcher can allow this car to proceed ahead of regular passenger cars, where otherwise it would have to wait for them to pass. This enables the car and crew to cover more ground in a day than would otherwise be possible.

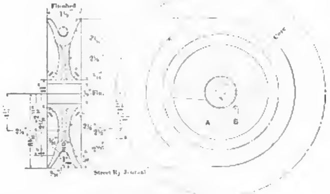

CAR HOIST


INSULATION SCRAPER AND TAPING MACHINE



INTERIOR VIEW OF FRONT ENDS OF CARS ON ROCHESTER AND LAKE ORION RAILWAY

For the rapid removal of trucks from under single truck cars in the Jefferson Avenue shops two car hoists have been fitted up, part of one of which is shown in one of the engravings herewith. The first thing was to build a timber frame strong enough to allow a car to be suspended from it. On top of this frame is a winding drum with four ropes which pass over four different pulleys and down to the four hooks shown, which run in guides under the floor and are so placed as to come under the four corners of a car. The winding drum is geared to a motor, the controller of which is on the main floor close to the hoisting hooks. When a car is run in, the hooks are placed under the corners and the motor is started, hoisting the body clear of the truck in less time than it takes to tell of it. The truck is run off to the transfer table and a fresh truck run under the car. On some of our older cars all work is done from the pit by means of hydraulic jacks and the bodies are not lifted off the trucks.

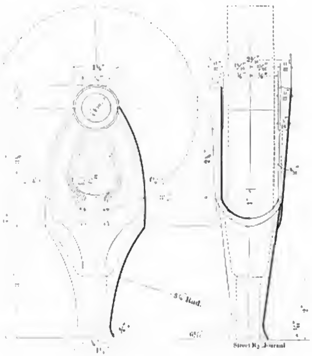


STANDARD TROLLEY WHEEL

We wind all armature and field coils used in repair work and for armature coils use some of the Anderson formers and armature coil-taking machines, as used in the St. Louis Transit Company armature shops and described in the Street Railway Journal for July, 1901. Burned out field coils are used over again by running the wire through a machine of our own make, which takes off the burned insulation and winds on tape to recover the wire. But a single strip of tape is used, but it is so wound as to give two thicknesses over all of the wire. This tape covering is fully as good, if not better, than the original cotton covering. The machine passes the wire first quarter turn around a grooved pulley, consisting of an old trolley wheel, then once around a pulley with a corrugated tool steel face. The corrugations run lengthwise of the wire and are sharp enough to "chew up" the insulation as the wire passes around under tension. After passing a half turn around a second corrugated wheel the wire is drawn past scrapers which take off the insulations. Just as it passes out of the machine the tape is wound on by a revolving spool.

VIEW ON THE ROCHESTER DIVISION

Before putting commutators in service on motors the "juice is cooked out" of the micaline used for rings and insulating segments, by heating the commutators near a forge fire and then applying pressure.



STANDARD TROLLEY HARP

Gear cases are now planed off in a milling machine, which is much quicker than putting them in a shaper for this. A man can turn off eight cases a day with the milling machine, where two was a day's work with the shaper.

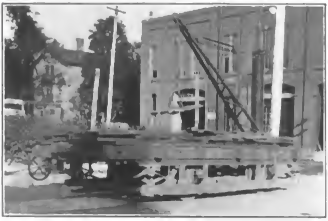
The rolling stock of the Detroit United Railway system is summarized as follows:

Single truck closed city passenger cars	457
Single truck open city passenger cars	308
Double truck interurban passengers cars	47
Double truck city or interurban open cars	20
Plow cars	16
Vestibuled front double truck flat work motor cars	4
Flat cars, all kinds	31
Dump cars	9
Construction box cars	4
Overhead line cars	5
Sprinkling cars	7
Freight motor cars	11
Freight trail cars	1

For interurban cars with 40-ft. bodies such as first described in our list of interurban cars, we have come to the conclusion that the motor equipment of four motors should be as large as No. 56 Westinghouse motors to give the best results in low repair bills. These cars make from 40 miles to 45 miles per hour on a level, with full voltage, and are scheduled for speeds of about 20 miles per hour, including all city and interurban stops for a trip.

Track Construction and Maintenance on the Detroit United Railway

The track department of the Detroit United Railway has under its care a great variety of construction, including not only 187.8 miles of city track laid according to various ideas, but 192 miles of interurban track laid alongside the highway and on private right of way. This department is under the charge of John Kerwin, a man of many resources in devising means for cutting down labor expenses by using machinery. With so many miles of interurban track to take care of it is imperative that the amount of hand labor required be cut down to the very lowest point. The cost of track maintenance on the interurban lines runs about $12 per month per mile of interurban track in the winter months and $19 in the summer months, making the average per mile of track for the year about $15.50 per month. Of course, with this amount of track labor, which is about one-third that expended on some of the more important steam railroad trunk lines, it is impossible to keep the interurban roadbed in as good condition as such trunk lines, but it must be remembered that the traffic over these interurban lines is small in proportion to that on the steam trunk lines spoken of. Everything considered, the condition of these interurban lines of road is as good in proportion to the traffic they have to withstand as the condition of steam trunk lines. They are in better shape than many steam road branch lines which carry an equal tonnage of rolling stock per day. These interurban lines are kept in good enough condition to operate over at speeds of from 40 to 50 miles per hour without danger or discomfort to passengers. On some of the divisions the surface and alignment are excellent and comparable with that on the best steam roads.



DERRICK CAR.

RAIL GROOVE SPREADER USED IN DETROIT

GRAVEL LOADER AND PIT

It is worthy of note that in spite of much that was said in engineering circles a few years ago as to the hammer-blow

effect of electric motor cars on rail joints, that the joints on all the interurban lines around Detroit are in excellent condition, and what roughness there may be in the track is due to the inequalities of the roadbed and ballast and not to low joints. It is very difficult for even an experienced car to detect the passage of the wheels over the rail-joints, and there are very few steam roads about which the same can be said. Judging from the life of rail-joints on Detroit interurban lines, there is much encouragement for the belief that the joints will prove less troublesome on electric interurban lines than on the steam roads. Of course, the weight of rolling stock on steam roads is heavier in proportion to the weight of the rail. Practically all the rail in the neighborhood of Detroit is 60-lb. and 70-lb. standard T section. The amount of weight per wheel on an interurban car is not equal to that of even a light steam locomotive, but is in the neighborhood of that on light steam road freight and passenger cars. Taken altogether, there seems to be little ground for any fear that if the joints are looked after carefully there will be a sufficient joint depreciation on electric interurban railway lines to force the abandonment of a rail on account of joint wear before it is sufficiently reduced in cross section to make it advisable to replace it for other reasons. On the greater part of the Detroit United Railway interurban mileage ordinary angle-bar joints are used. On the Orchard Lake Division, however, the wedge joint made by the American Rail Joint Manufacturing Company has been extensively employed. Considerable 60-ft. rail has been laid in various places. While this has given freedom from the expense and maintenance of one-half the number of joints required by 30-ft. rail, it has also given more trouble from creeping and drawing apart on grades. Those divisions having 60-lb. rail are much more expensive and troublesome to maintain than those having 70-lb. rail. This is partly, however, because the heaviest grades are on divisions laid with a 60-lb. rail.

In handling gravel for construction and ballasting along interurban lines Mr. Kerwin found it very desirable to cut down the expense of a shoveling gang at the gravel pit, and accordingly devised a loader built on the automatic-conveyor principle and shown in the accompanying engravings. This loader has an old railway motor geared to a couple of endless chains. On these chains are mounted buckets which scoop up gravel from the bank and deposit it on flat cars in a manner which is made plain by the accompanying engravings, one of which shows the loader in detail and the other a general view of the loader and gravel pit. The loader is moved along on its track as occasion requires, and deposits gravel on flat cars standing on the track parallel with it. As the supply of gravel is exhausted in one place the loader is moved along so that it dips into the bank. The bank is kept broken down so that the loader always has loose gravel to work upon. This apparatus cost about $800, and when there is any new construction so that a large amount of gravel is required, the loader will replace the services of a gang of thirty men, who would otherwise be engaged in shoveling gravel on to the flat cars. Working steadily, it will load about one flat car every thirty minutes.

GRAVEL LOADER

At the present writing it is saving the wages of six men who would otherwise be required to shovel sufficient gravel on the cars to keep ballasting crews busy. The motor, of course, secures current from the trolley and connection therewith is established by a hook and fishpole.

In order to save the expenses of using horses where plowing is necessary along interurban lines, as is frequently the case where they run alongside of a highway, a motor car is used to pull the plow, and thus considerable time and expense is saved.

During the past season washouts have been numerous on interurban lines around Detroit as well as upon steam

roads in that vicinity. Some 60-ft. rails on false work have been used to span these washouts in some cases, and

TRACKS IN SOD IN SUBURBAN STREETS

they have thus saved what otherwise would have been a long delay in getting the road in operation.

Practically all the switches on the interurban lines have double-spring tongues and No. 9 spring frogs so as to leave an uninterrupted main line at sidings not frequently used, or in the case of turnouts at regular meeting points they are set so as to obviate the necessity of throwing the switch. In the latter case, of course, the switch is always set to send a car on the right-hand track. As common target signals when used on such spring switches are not very satisfactory, since they will not surely show the displacement of a switch point which may be sufficiently out of place to cause a wreck, Mr. Kerwin has invented a semaphore switch signal which will show clear only when the switch point is entirely closed. One of these signals now in use at Log Cabin Loop is shown in the accompanying engraving. The semaphore is worked by a bell crank lever connected to a rod fastened directly to the switch point. The signal falls to danger as soon as the switch point is moved a small fraction of an inch away from the main-line position. The rest of the movement of the switch point does not affect the semaphore, as a slot in the

EMERY WHEEL TRACK GRINDER

signal switch-rod permits the switch to be moved the balance of the distance without moving the semaphore.

Switches when located in the traveled roadway along interurban lines, as for example at Royal Oak Junction, are covered with iron trap doors, and the switch handle is located between the tracks.

At the main line steam-road crossings, interlocking signals and derailing switches are used. Semaphore signals are located several hundred feet back from the crossings on the steam road, and these are interlocked with derailing switches on the electric road. The derailing switches are normally at danger, and can only be set for the passage of a car on the electric road when the semaphore signals of the steam road are at danger. The levers for working these are near the steam-road track, so that when the conductor goes to throw them he can see whether a train is approaching.

For unloading gravel in ballasting track, the dump-car with a sectional bottom has been used to some extent. This dump-car throws an even layer of gravel in the entire space between the tracks, thereby doing away with the second handling, which

NEW SWITCH SIGNAL.

would be necessary if the gravel were unloaded at one side of the track. The bottom of this car consists of slats 3 ins. wide. In the middle of the car, instead of a slat there is a boiler plate wide enough so that one slat can be slipped under it. When the car is to be dumped the first slat next to the boiler plate is slipped under the plate, thereby leaving an opening 3 ins. wide for the gravel to fall through. When the gravel has fallen through this opening as much as it will, the next slat is moved along, and so on for half the width of the car. The operation is repeated for the other half.

The rail required on city lines in Detroit is a narrow-groved rail, and in one instance on Michigan Street a section had been laid which was so narrow in the groove that it would not permit the passage of interurban cars

from the Detroit, Ypsilanti & Ann Arbor Railway. A device was made for spreading the groove of this rail, an engraving of which is shown herewith. It consists simply of a massive lever with a hard tool steel portion which fits down over the lip of the grooved rail. The lever is then raised by jack-screws, as shown in the accompanying engraving, until the lip of the rail has been bent outward enough to widen the groove. To keep the lip from springing back and to determine when the groove has been widened enough, a gage-bar is used with a tongue just large enough to go into the widened groove.

One excellent feature of track construction in Detroit now being laid by Mr. Kerwin is that there are no combination angle-bar joints joining different sections of rail. At special work, at crossings and at all other places where transition is made from one section of rail to another, cast-welded joints are put in so that angle-bars are used only between rails of the same cross section. Special work all has a short piece of the standard grooved section of rail cast welded to each rail for connection with the regular grooved rail.

Grooved rails which are worn out on city lines so that the flanges of the wheels ride in the rail grooves are taken out and laid on suburban and interurban track with the grooves on the outside.

On Woodward Avenue, in the business part of the city, just north of Campus Martius, there is some 77-lb. grooved rail which has been down thirteen years, carrying the heaviest traffic of any track in the city, cars averaging about one per minute over it. This rail has now almost reached the limit of its usefulness, having been worn down in cross section until the flanges of the car wheels begin to touch the bottom of the groove.

PILE DRIVER FOLDED UP

It will be remembered by some that the first track construction to be laid without ties on concrete stringers was that in Detroit. This was in 1894 and 1895. Two kinds of construction were employed. The Detroit Citizens' Street Railway laid a 6-in. x 18-in. concrete beam under each rail and placed metal ties every 5 ft. The same construction is now used on new track, except that the concrete beam is now made 12 ins. deep instead of 6 ins. deep, because it has been found that the concrete beam 6 ins. deep is so thin that the beam will crack a short distance outside of the rail on each side, thus letting the rail down.

PILE DRIVER AS A CONCRETE BREAKER

PILE DRIVER AT A WASHOUT

The Detroit Railway Company laid track without entirely removing the pavement between the tracks. This was done by simply cutting a trench wide enough for the rails and concrete supporting beams and for the tie-rods, which were used to hold the track in gage. This construction has practically gone to pieces since it had no foundation in common with the pavement.

SAND DRYING PLANT AT A GRAVEL PIT

In regard to the present standard concrete stringer construction with metal ties to hold the tracks in gage, Mr. Kerwin does not agree with the popular idea among track men that the concrete stringer is a more expensive type of construction than that with wood ties. Wood ties require considerable more excavation if their concrete foundation is carried to a proper depth below the ties, and there is the further possibility of wood ties rotting. Even considering the durability to be the same, which it is not, the first cost of good concrete stringer construction, without ties as against wood tie construction, he considers to be in favor of the concrete ties.

SOME INTERURBAN TRACK

For breaking up concrete in laying new tracks, Mr. Kerwin has devised a blunt cutting tool, which is fitted on the pile driver used in interurban construction and repair work. This pile driver with the cutting tool will break up as much concrete in a day as a gang of twenty men. It is, furthermore, much easier to keep at work than track labor, because breaking up concrete seems to be especially distasteful to track laborers, and it is difficult to find men who will stay at his work. Views of this pile driver accompany this article.

In some cases low joints have been raised by putting in continuous rail joints, and it is desirable to surface off the joint after having raised it. For use in this connection and around special work a portable emery wheel grinder has been built, an illustration of which is shown. This grinder is mounted on a three-wheeled truck, and the height of the emery wheel can be governed at will. It is operated by a motor connected to the emery wheel by a flexible shaft. The motor and flexible shaft are not shown in the engraving. The wheel can be run up or down by means of the worm operated by the crank on top. The end of the flexible shaft where it enters the grinder is supported in a bearing, which bearing is supported by a link hung from a counterbalance lever with a sliding weight which can be adjusted to just take the weight and so cause a minimum of friction in the emery wheel bearing to which the shaft is attached.

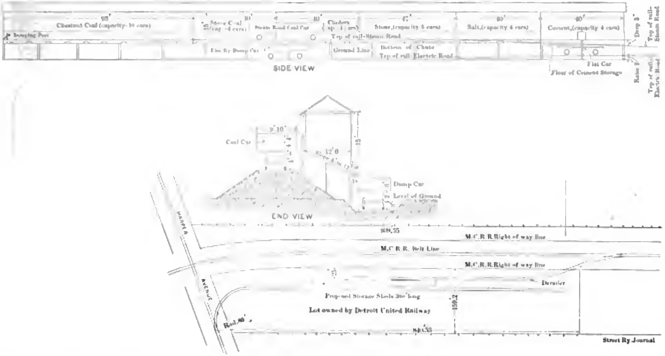
Track tools are especially liable to get lost or broken or to get into possession of track men other than those to whom they were originally given out. All tools in this department are numbered with the box number from which they came. Each foreman has his box and is responsible for tools therein, making reports once each month as to the number and condition of tools in his box. One track gang cannot, therefore, take tools from another without evidence of that fact appearing in the report, and the necessity of making frequent tool reports is a constant reminder to men to keep track of all tools belonging in the box.

A sand-drying plant is maintained at a gravel pit near Farmington. The sand dryer is built somewhat on the

principle of a grain elevator. Sand is dried in a revolving cylinder under which a fire is built. The cylinder is slightly inclined, so that the sand and gravel are fed in at one end and come out at the other. At the discharge end is a screen which separates the sand from the gravel. Sand is taken in conveyers to a bin in the upper part of the building, from whence it is drawn on to cars as necessity requires. Gravel is discharged by the outlet pipe, seen in the accompanying engraving. This gravel, after screening, yields roofing gravel and coarse gravel, the income from which is sufficient to nearly pay the expenses of operating the sand-drying plant.

In previous years coal for use in the car heaters has been hauled by wagons to the various car houses from coal yards on the steam railroads at a cost of about $13 per car. At the Harper Avenue yards of the company, which are located at the Michigan Central Belt Line, a very complete storage shed will be built for the storage of chestnut coal, stove coal, cinders, stone, salt and cement and for the easy transfer from steam to electric cars. The steam road tracks will be elevated on a 6½-ft. bank, from which they will be unloaded into a storage house with sloping floors. This storage house is 12 ft. wide, the floor having a slope of 6 ft. 2 ins. On the opposite side of the storage house is the electric railway track, placed 3 ft. below the level of the ground. As seen by the accompanying drawing, the material can be unloaded from the storage house to the dump car by simply opening slide doors. The dump car on the electric road will have a slanting bottom that will unload itself, and to compensate for the consequent unevenness of the load on the two sides of the car, the car box will be mounted slightly to one side of the center.

On the north end of Woodward Avenue some track was laid several years ago with a lawn between tracks as a substitute for asphalt paving. The street is wide, and since this was in a suburban district the space between the street railway tracks was not needed for driving purposes, hence the experiment was tried with the grass plot. At street intersections the space between tracks was paved in the regular manner. In the sod of the roadbed T-rail was laid, while at the paved street intersections the grooved rail required by the city was put down. The transition from grooved T-rail was made by cast-welded joints. This has permitted the use of T-rail on part of the road, has saved the cost of paving, and has kept teams from driving on the track to a certain extent. There is, however, a tendency for the ties to rot under the sod, and the grass plot must be kept cut very short to prevent its wiping grease from the motors and trucks. The frequent transition from T to grooved rail has hardly proved an economy, and the use of the same section of rail for the entire distance would be advisable for future work of this kind.



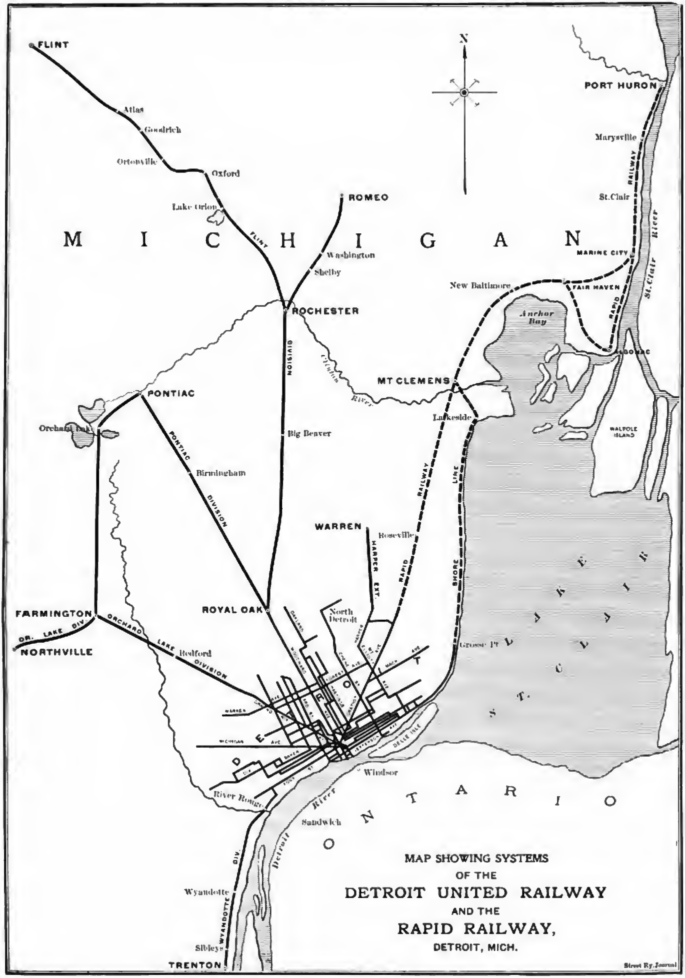
PLAN OF STORAGE SHEDS AT HARPER AVENUE

Freight Business on Detroit Interurban Roads

The freight business handled by electric interurban roads around Detroit is probably the greatest of that done at any of the interurban centers of the United States. The freight and express business, as carried on by these interurban roads in competition with steam roads in the vicinity of Detroit, has brought out the fact very forcibly that the same elements which have gone to build up a successful electric interurban passenger business are the elements which must be depended upon for the success of the interurban freight and express business. One of the great reasons for the success of the electric interurban passenger business is the frequency of cars as compared with trains on steam railroads. The lower fares, of course, have also had something to do with it. It has been found that the element of frequent service is a most important one in determining whether shippers sending goods from Detroit to nearby towns will patronize the electric road in preference to the steam railways. The electric road offers to the shipper practically the same advantages as to convenience and quickness of transit in comparison with the steam railways for short distances as it offers to the passenger: that is, for shipping short distances, the electric road, with

A Load of Freight.
Freight Motor with Milk Trailer.
The Union Freight House (Car Side.)
Along the Way.

The Milk Trailer.
A Country Freight Depot and Waiting Room.
The Union Freight House (Team Side.)
In the Union Freight House.



MAP SHOWING SYSTEMS OF THE DETROIT UNITED RAILWAY AND THE RAPID RAILWAY, DETROIT, MICH.

its freight cars running frequently and at definite times, can make sure of the delivery of goods from Detroit to suburban and interurban points in the shortest possible time. Shipping by steam road for such short distances involves considerable uncertainty as to the time of delivery, and it frequently happens that owing to the infrequency of the steam road trains, there is a long interval before the goods delivered at the Detroit freight houses are actually shipped. In other words, steam roads are built and operated mainly for through business, both passenger and freight. Their methods are not such as cater best to the small local traffic of either passenger or freight classification. The strength of the electric lines lies in their ability to deliver goods frequently and promptly between city and suburban points. The frequency of express service on the electric roads is conducive to building up a small shipment business, because it makes it possible for the grocers and merchants in towns several miles from the city to order goods in smaller lots and more frequently than they would if they were dependent on steam railroad freight service. This is especially true of perishable goods. Of course, the competition is bitter at points where both steam and electric roads have freight depots. Steam railroads having seen the electric interurbans take their local passenger business and create a lot more are now making a hard fight to retain local freight business. To an unprejudiced observer it would seem that in the course of a few years these matters would adjust themselves into their legitimate places, and that the result would be that the local business for short and frequent service would be carried on by the electric roads, which would in a way act as feeders for the through business of the steam railroads. In other words, there is a place for each, and they can best work in harmony.

The following facts and figures give an idea as to the extent of interurban freight business around Detroit. On the Rapid Railway system freight cars leave the electric union freight depot in Detroit three times per day to distribute freight over the 109 miles of track which constitutes the Rapid Railway system. The accompanying map is of the entire system, while the small map shows the extent of the interurban freight service and also indicates the number of freight cars per day over various portions of the different divisions. On the Flint Division of the Detroit United Railway there are two cars per day; on the Pontiac Division, two cars; on the Orchard Lake Division, two cars; on the Wyandotte Division, two cars, and on the Detroit, Ypsilanti, Ann Arbor & Jackson Railway there are three cars per day. On the latter line the competition with the steam railroad is probably the most severe, the Michigan Central having cut its rates in half between Detroit and the competitive points in order to meet the electric competition. The electric rates remain the same as the rates of the steam railroad before the reduction was made. In Ypsilanti and Ann Arbor, however, the electric road gives a free delivery for ordinary freight. The methods of freight handling as carried on by the various electric railway systems are similar to those used on steam roads.

A. R. Patterson, joint express agent in the Detroit freight depot, is a former steam road freight man. The same classification of freight that is used on steam roads prevails on the Detroit United Railway, and the rates are the same to points where there is competition with the steam railroads. There are two men in an express car crew. In addition to the regular express business, a large milk business is carried on in connection with it. There are four milk routes. On the Flint Division there is a milk route from Rochester and intermediate points to Detroit, 27 miles. On the Pontiac Division milk is taken by special cars from Pontiac to Detroit, 28 miles, and on the Rapid Railway system, 25 miles. The milk car is hauled as a trailer on the regular express cars, and a good idea of the business can be obtained from the accompanying engravings. On the Detroit United Railway system the number of cans hauled per month is as follows:

Flint Division	3,900
Pontiac Division	6,000
Orchard Lake Division	3,800
Total	13,700

The revenue from this milk business is about $1,850 per month. The rates are 10 cents per can for distances under 30 miles, and 12½ cents per can for distances over 30 miles, but near the city where there is a possibility that the milk would be hauled in by team this rate has to be reduced.

Regular freight cars are substantially built and of neat outside appearance. They are from 35 ft. to 40 ft. long, and are equipped with air brakes. Tools for handling freight in the way of beef hooks, hay hooks and skids, are provided. At the joint express depot in Detroit, which is at the corner of Fifth and Congress Streets, near some of the steam road freight depots, the companies maintain a joint express agent, as before mentioned. At this depot freight is received from the wagons on one side and delivered to cars on the opposite side. Besides the road track next to the freight platform of this depot there is an extra siding for temporary storage of express and milk cars. No baggage or express is carried on passenger cars. Baggage is checked, but is carried only on express cars, and it must be delivered to the joint express depot in Detroit or at one of the depots along the line. A good example of a rural freight depot and waiting room, that of Clawson, on the Flint Division, is illustrated in the group on the preceding page. The companies interested in the joint express depot in Detroit issue a card something larger than an office calendar, giving an alphabetical list of towns reached by electric express and the time at which express cars leave for the various towns enumerated. Goods must be left at the electric depot one hour before leaving time of cars.

Agents are maintained at eighteen points on the Detroit United Railway system; at ten points on the Rapid Railway system, and at twelve points on the Detroit, Ypsilanti, Ann Arbor & Jackson Railway.

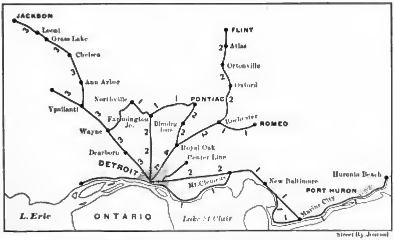
The greater part of the express and freight carried on the electric roads passes through the Detroit joint electric depot, but a small per cent going from one point on a line to another. The following figures showing the tonnage of freight passing to or from the Detroit depot will give a good idea of the volume of business done:

March, 1902	Tons
D., Y., A. A. & J. Ry	934.071
Detroit United Railway	3,311.497
Rapid Railway	1,353.504
April, 1902	
D., Y., A. A. & J. Ry	907.202
Detroit United Railway	3,461.067
Rapid Railway	966.678

May, 1902	
D., Y., A. A. & J. Ry	1,066,358
Detroit United Railway	3,680,720
Rapid Railway	1,049,167
June, 1902	
D., Y., A. A. & J. Ry	1,033,773
Detroit United Railway	3,433,521
Rapid Railway	915,684
July, 1902	
D., Y., A. A. & J. Ry	1,111,828
Detroit United Railway	3,677,636
Rapid Railway	1,155,725

The freight business on the Detroit United Railway and Rapid Railway systems is under the charge of George W. Parker, general express and passenger agent, who is ably assisted by A. F. Eastman, traveling express agent, who keeps closely in touch with shippers along the line.

An arrangement has recently been made whereby baggage can be checked by passengers at any point on the Detroit United interurban system, to the railroad depots or to points touched by the steamers of the White Star Line, the Detroit & Buffalo Line or the Detroit & Cleveland Line. This is by an arrangement made with the Detroit Omnibus Line. Passengers must, of course, pay for the cost of transfer of baggage from the electric depot to the depot or dock desired. Baggage is not handled free on the interurban lines because of the low rates of fare which already prevail. A charge of 25 cents each for trunks under 150 lbs. is made.



MAP SHOWING DISTRIBUTION OF FREIGHT CARS ON DETROIT INTERURBAN RAILWAYS

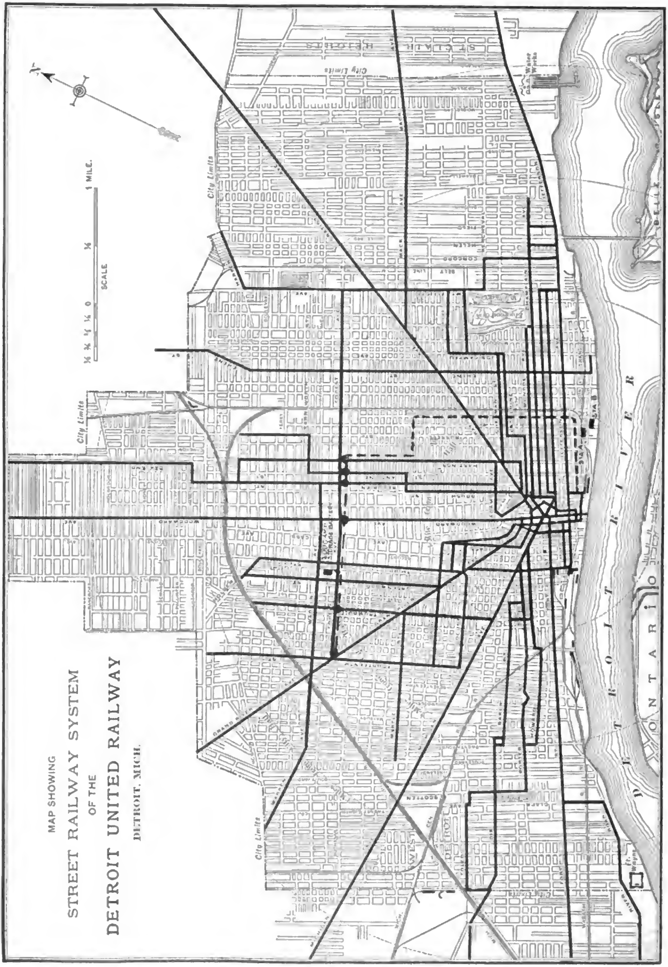
Overhead Construction and Electric Power Distribution of the Detroit United Railway System

The overhead line construction on the interurban lines of the Detroit United Railway is decidedly varied on the different divisions, because of the different ideas of the original builders of these lines. The illustrations herewith, and with the article on the track department, elsewhere in this issue, from photographs taken on the different divisions, illustrate this well. However, a certain standard type of overhead construction is now being put in wherever new work is called for. This is shown in the engraving on another page, giving the two forms adopted for future work, one with a supporting brace below the bracket, the other without. A truss rod is used in both cases, because of the large amount of support it gives with a small weight of material. The drawing shows the bracket fittings of the Ohio Brass Company. The tubing is 1½ ins. and the truss rod ½ in. Two figure 8 trolley wires are used. All poles are numbered with miles and tenths of miles from Detroit, which proves a great convenience in many ways. The exact location of track or line defects can be reported by motormen, and it saves the taking of measurements for distances in planning new work or making tests of various kinds.

GENERATOR LEADS BETWEEN STATIONS A AND B

INTERURBAN POWER DISTRIBUTION

While the system of the Detroit United Railway, taken as a whole, offers splendid opportunities for a comprehensive system of alternating current high-tension distribution with sub-stations for supplying both city and interurban lines, no such comprehensive system has yet been begun, since it is but recently that the four interurban divisions were brought under the same ownership. The power distribution is therefore by a somewhat temporary patchwork of direct current and alternating current. The accompanying map shows the present arrangement of power supply.



MAP OF DETROIT CITY DISTRIBUTION, SHOWING POWER HOUSES, BATTERY STATION AND EQUALIZATION SCHEME

On the Orchard Lake division running to Farmington, Northville and Orchard Lake the power distribution is all by direct current with boosters from a power house at Farmington Junction. On the Pontiac division the distribution is all by direct current from a power house at Birmingham. On the Flint division, running from Royal Oak Junction to Rochester, Romeo, Lake Orion and Flint, there is a direct-current power house, at Rochester, which, with the aid of a booster, feeds south 14.6 miles towards Detroit as far as Royal Oak, and also to Romeo and toward Lake Orion. In the power house at Rochester there is an inverted rotary converter run as a motor from the direct current bus-bars of the station. This is a Stanley machine of 250-kw rated capacity, but is being run regularly to tide over present emergencies at 100 per cent. without going above its heating or sparkless commutation limit. This converter gives alternating current at 360 volts three-phase from its collector rings. This is raised by step-up transformers to 15,000 volts, and transmitted over two circuits of No. 4 aluminum cable to sub-stations at Oxford,

SOME SAMPLES OF OVERHEAD CONSTRUCTION

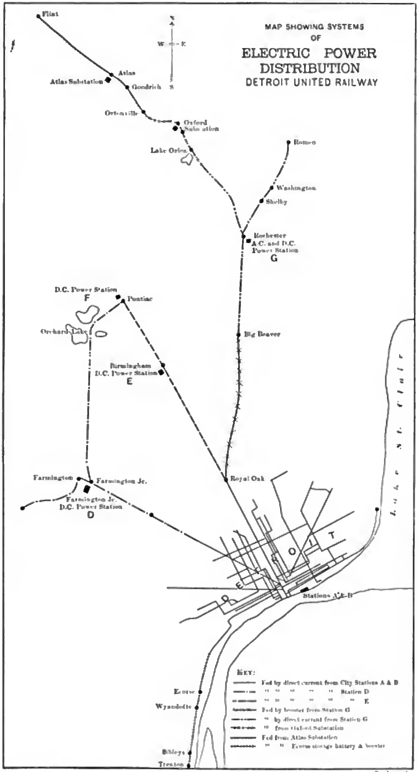
13 miles north, and Atlas, 30.4 miles north. The rotary converters in these sub-stations are started ordinarily (if the voltage on the trolley lines is not being lowered by the presence of a car drawing current between the power house and the sub-station) by starting them as shunt direct-current motors from the trolley line. When the direct-current voltage is so low that it will not bring the rotary converter up to synchronism by this means, the rotary is run up to as high a speed as the direct current will bring it, and the main switch throwing it onto the alternating-current mains is partially closed. By the auxiliary contacts on this switch when it is partially closed, the rotary converter armature is connected with the three-phase bus-bars through an inductance coil in each leg of the circuit. This cuts down the current to a permissible amount until the converter is jerked into step. When this latter occurs, the main switch is entirely closed, connecting the converter directly to the alternating current bus-bars. Of course, this is heroic treatment to get machines into step, but no evil results seem to come of it. Another method of starting these rotary converters, of course, would be to weaken the fields when running as a shunt motor and so increase the speed until a point was reached where the machine would synchronize. To do this more field resistance than is ordinarily provided would have to be used. A modification of this plan has ben successfully tried, though not regularly used. This is to run the machine up to the highest speed possible as a shunt motor, cutting in as much field resistance as possible, and then momentarily opening the field circuit altogether, letting the machine run on the residual magnetism in the fields. Of course with a field so greatly weakened the motor speeds up rapidly and must be cut out of circuit before attaining a dangerous speed. As the speed falls, the switch on the alternating current side can be closed as the point of synchronism is reached. As before mentioned, the high-tension lines are of aluminum No. 4. These two aluminum lines are of stranded conductor on Provo type glass insulators made by the Hemingray Glass Company, of Mun-

EMERGENCY TOWER WAGON, SPECIAL DETROIT DELIVERY

cie, Ind. Experiences with this aluminum line when first strung have demonstrated the importance of educating linemen who are used to stringing copper to the necessity of allowing a liberal amount of contraction in cold weather, as aluminum contracts more than copper, and is not strong enough to stand the tension that could be put on copper.

An alternating current generator has been ordered for the Rochester power house, which will do away with the inverted rotary.

The interurban line to Wyandotte is run from the city power houses with the aid of a booster and a 280-amp. hour storage batter at Ecorse.



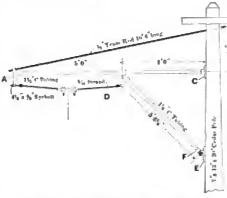
MAP SHOWING SYSTEM OF ELECTRIC POWER DISTRIBUTION, DETROIT UNITED RAILWAY

CITY POWER DISTRIBUTION

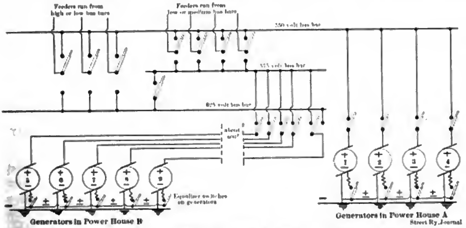
The city power distribution of the Detroit United Railway Company is all by direct current from two power houses, located diagonally across the street from each other near Riopelle Street and the river front. One of these power houses was originally built by the Detroit Citizens' Street Railway Company, and is called Station A. The other was built by the Detroit Railway Company, and is called Station B. Since the consolidation the operation of these two power houses has been combined in a rather unusual manner, which, as it affects the electrical distribution, will be described here. The switchboard for both power houses is all combined in one power house, and the two power houses are operated electrically, just as if they were one, although the engines and generators are under different roofs with a street intervening, and nothing but telephonic means of quick communication between them. The positive generator switchboard leads and shunt field leads in Station B are run across the street to the other power house, and there terminate on regular generator panels. No switches are located in the Station B, save the equalizing switches on the generators, and these are on the negative side. The negative leads have no switches, but are connected permanently to the negative and ground. All other switches are in Station A. The average length of the leads from the Station B generators to their switchboard panels in the other power house is about 600 ft. The generator leads between the two power houses are carried on poles just as if they were feeders. The accompanying engraving shows these generator leads between the two power houses at the right side of the street, and also the feeders leaving Station A, at the left side of the street. Only the positive leads are brought to the switchboard in any case, and consequently all switching is on the positive side. The equalizing switches being on the machines, the only main switch needed on a generator panel is a positive switch and circuit breaker. This arrangement has worked to the entire satisfaction of all concerned. Its object, of course, is to simplify switchboard attendance, and to make it possible to run all the feeders from one board. This makes the operation of the two power houses more flexible, makes it easy to shut down either one of the power houses at night, and practically makes one power house of them, as far as carrying the load is concerned. The number and capacity of the generators in operation can be adjusted to the load so as to give the generators a more economical load with this ar-

rangement than if they were supplying different sets of feeders.

Another feature of interest about the switchboard is the use of three sets of bus-bars, which makes it possible to run feeders on any one of three different voltages. The diagram below shows the arrangement. Two sets of bus-bars are run the entire length of the feeder board. A third bus-bar runs part of the length of the feeder board. Part of the feeders can be connected onto either the high or low bus-bars, and part can be thrown onto the low or medium bus-bars. Each feeder has a double throw single-pole switch for connecting to either set of bus-bars. There is a paralleling switch between the medium and high voltage bus, so that these can be thrown together. The voltage of the highest bus is about 625, that of the medium 575, and that of the lowest 550 when operated independently. Generators 1, 2, 3 and 4, which are located in Station A (the one in which the switchboard is located) are arranged to connect with the low-voltage bus-bars as shown. Generators 5, 6, 7 and 8 in Station B, across the street, have their main switches arranged to connect the medium or 575-volt bus. Generator 9 in Station B has on its switchboard panel two single-pole single-throw main switches, by which it can be connected to either the medium bus in parallel with 5, 6, 7 and 8, or, on the high-voltage bus-bars, by itself as a 625-volt machine. A new generator now going in will be connected as No. 9 now is. When the two switches on the panel of No. 9 are closed the effect is that of throwing the medium and high voltage bus-bars in parallel, just as if the paralleling switch between the two were closed, and, in fact, both the paralleling switch and the two generator switches are usually closed when these busses are to be run in parallel. The 625-volt bus is run separately when the load is heavy on outlying trolley sections. When there is not

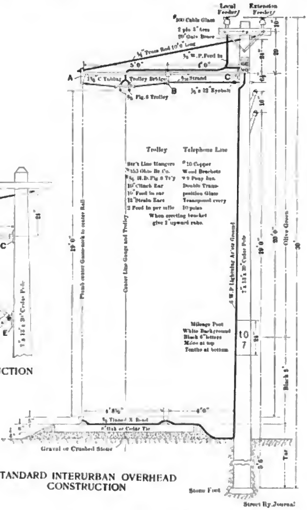


STANDARD OVERHEAD CONSTRUCTION WITH BOTTOM BRACE



SCHEME OF SWITCHBOARD FOR THE TWO DETROIT DIRECT CURRENT POWER STATIONS OPERATED AS ONE

such a load, and for purposes of economical loading of machines, it is desirable to run the high and medium voltage bus-bars in parallel, they are so connected. Out of 32 feeders leaving this board, 22 are arranged for connection to the high and medium bus-bars, and 10 can be connected



STANDARD INTERURBAN OVERHEAD CONSTRUCTION

to the low or medium bus. One matter which influenced the arrangement of the switchboard as it exists at present was the fact that the generators 1 to 8 cannot be raised as high as 625 volts. With the present arrangement they can be run on the shorter feeders, while generator 9, in power house B, supplies the feeders requiring the higher voltages, when a higher voltage is necessary.

In connection with this company's direct-current distribution in the city of Detroit, two sets of storage batteries are employed and on the Wyandotte & Trenton interurban line, which is fed by direct current and boosters from these city power houses, there is also a storage battery. One of these city batteries is located at Station A, and the other in the northern central part of the city. A map of the street railway lines of the city is shown herewith, giving the locations of power houses and the storage-battery station with reference to the system. The feeder lines along each trolley line are omitted for the sake of clearness, but they parallel practically every trolley line, and in addition a special feeder pole

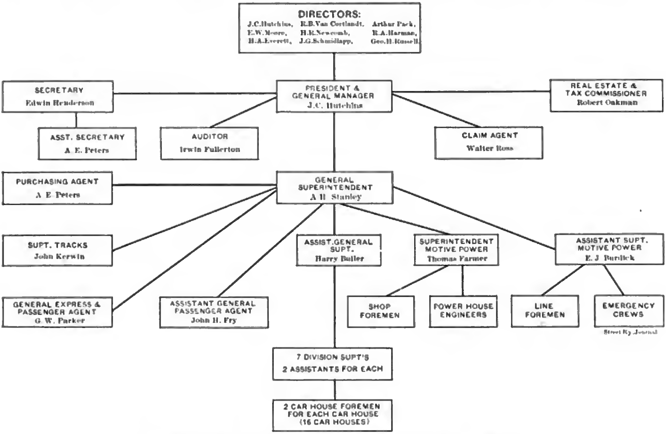
line runs directly north from the power house, supplying a number of intersecting streets, and also connecting with a feeder along Forest Avenue, which acts as an equalizer between lines which it intersects. The storage battery is located near Forest Avenue and Third Street, and equalizing feeders are run east and west on that avenue, connecting to the regular feeders at intersecting streets through Westinghouse "Type A" circuit breakers located in boxes on the poles. In shunt around each circuit breaker is a series of five incandescent lamps, one of which is put in a Dayton Manufacturing Company's signal lamp box on top of the circuit breaker box to protect it from injury. When the lamps are lighted, the employees have a sign in the signal lamp that the circuit breaker is open. When the circuit breaker is closed, of course the lamps are out. A lever at the side of the circuit breaker box makes it possible for employees to close the circuit breaker as soon as the trouble has been cleared from the line. These circuit breakers are necessary to make possible the disconnection of any section from the equalizing feeders and storage battery. The use of automatic circuit breakers outside of power houses, sub-stations and cars, where someone is constantly in attendance, is by no means common, nor has it, as a rule, been found satisfactory in most cases where it has been tried. Under the particular conditions here, however, the plan works well. The type of circuit breaker employed is simple and requires little attention, and the closing of these equalizing circuit breakers is not absolutely necessary to the operation of cars, since the direct feeders from the power houses can supply the lines until such time as these circuit breakers may be closed.

After cars cease operation at night on the interurban lines the interurban power houses are shut down, and switches between the interurban and city lines are closed to supply the interurban car houses with light and power for shunting cars.

The overhead emergency wagons used in Detroit differ in several respects from those kept by most city roads. They are pulled by one horse, and consequently are made light, with a ladder instead of a tower. The chief novelty, however, is in having the lower part enclosed. This closed top is simply the strong frame for supporting the ladder covered with canvas as a delivery wagon top.

In the emergency houses at St. Antoine Street, near Jefferson Avenue, four one-horse emergency wagons are kept in readiness at all times. Two of these are overhead line wagons of the type just described and shown in the accompanying engraving, one is a wreck wagon with tools for derailed cars and broken down wagons, and one is a wagon loaded with hose jumpers for fires.

The work outlined in this article is under the charge of E. J. Burdick, assistant superintendent of motive power.



ORGANIZATION CHART OF THE DETROIT UNITED RAILWAY COMPANY

The Organization of the Detroit United Railway Company

The scheme of organization and relation of departments of the Detroit United Railway Company is shown by the accompanying diagram. In some cases the titles are rather misleading, because they are an inheritance from a former different arrangement of departments. As on every well-managed electric railway system the plan of organization and assignment of duties to different departments has been made in accordance with the talent most available to carry on the work of the company.

Legal and financial departments report direct to the

president and general manager. All other officers report to the general superintendent, who in turn reports to the president.

The offices of assistant secretary and purchasing agent are combined in one man. The superintendent of tracks has charge of all construction and maintenance of way, both on city and interurban lines. The general express and passenger agent looks after the handling and building up of the freight business. The assistant general passenger agent has charge of all matters relating to tickets, rates of interurban fare and promotion of both regular and excursion passenger traffic. The division superintendents have supervision of the motormen and conductors and car service on each division. The superintendent of motive power is responsible for the operation of all power houses, the maintenance of rolling stock and the repair shops. The assistant superintendent of motive power, who is practically the electrical engineer of the company, has charge of all line construction and repairs, plans all electrical work, supervises all electrical testing and advises with the superintendent of motive power in power house electrical work. The duties of the other officers are evident from their titles.

Three-Cent Fares in Detroit

As it has been an impression on the part of the uninformed in various parts of the United States, that a number of street railway lines in Detroit are profitably operated with a 3-cent fare, in place of the usual 5-cent fare, and as arguments based on this erroneous impression are sometimes advanced when street railway legislation is pending in other cities, a statement of the true state of affairs in Detroit will be in order. There is no street railway company which ever carried passengers in Detroit for 3 cents, and there is nothing in the experience at Detroit to indicate that a cash fare of 3 cents could ever be made the basis of successful street railway operation.

In 1895 there was constructed in Detroit a system of street railway lines, which under the terms of the franchises granted must carry a passenger for a 5-cent cash fare, or a ticket costing $3\frac{1}{8}$ cents (8 for 25 cents) between the hours of 5 a. m. and 8 p. m. Between 8 p. m. and 5 a. m. the fare was to be 5 cents cash, or a ticket costing $4\frac{1}{6}$ cents (6 for 25 cents) with universal transfers over the system for one fare.

This system, built under the foregoing franchise terms, was the property of the Detroit Railway Company. This will be designated hereafter in this article as the low-fare line, and constitutes what is popularly known as the "3-cent fare" road. Previous to the building of this system the

VIEW ON ONE OF DETROIT'S NARROW RESIDENTIAL STREETS

Detroit Citizens' Street Railway Company, which was the principal company in the field, and the Detroit, Fort Wayne & Belle Isle Railway Company were carrying passengers on a 5-cent cash fare basis, with six-for-a-quarter tickets, but were required by their franchise to honor eight-for-a-quarter "workingmen's tickets," as they were called, between 5:30 a.m. and 7 a.m. and 5:15 p. m. and 6:15 p. m. The Detroit Railway Company owning the low-fare lines was operated as an independent concern for about two years, after which it fell into the hands of the stockholders of the Detroit Citizens' Street Railway Company and Detroit, Fort Wayne & Belle Isle Railway Company. Since then all the roads have been practically operated as one, although actual consolidation into the one company, the Detroit United Railway Company, was not effected until early in 1901. All the lines are, of course, operated in compliance with the terms of the franchises under which they were built. The six-for-a-quarter tickets were discontinued on the 5-cent lines in 1898, after the consolidation of management.

As the present management has never been able to get an accurate statement of the operating expenses of the Detroit Railway under its original owners, it is impossible to say how long the system could have been operated inde-

pendently, before requiring a receiver, but enough is known from present conditions to make sure that it could not have been for long. The merging of the two systems has made the profits of the combined lines average up fairly well by making the earnings of the 5-cent lines supply the deficit on the cheaper lines, and by making possible greater economies in operation through the elimination of one set of operating officers and assistants, as well as in numerous other small ways.

In the year 1901 the average fare received per passenger on the city lines of the Detroit United Railway, including both the high and low fare lines, but not including interurban lines, was $0.0425. The average fare per passenger on the low-fare line was about $0.0360. Of all the passengers carried in the city, 33 per cent were carried on eight-for-a-quarter tickets. Twenty per cent of all the passengers carried in the city were carried on the low-fare line, and 13 per cent were carried on workingmen's eight-for-a-quarter tickets, between 5:30 a. m. and 7 a. m. and 5:15 p. m. and 6:15 p. m. on the 5-cent lines. The mileage of the low-fare line is 57.9, and that of the high-fare lines is 129.1, so that the low-fare line has not only failed to attract by virtue of the low fares a larger proportionate share of the business in dollars and cents than the high-fare lines, but has failed even to carry as many passengers in proportion to mileage of track at a low rate as the high-fare lines have at 5-cent rates. Of course all the passengers carried on the low-fare line do not get the low rate since the cash fare is 5 cents and transfers to 5-cent lines are given only upon payment of a 5-cent fare. But this does not alter the fact that the 3⅛-cent fares taken on the low-fare line, are only 20 per cent of the total, while the mileage is 30 per cent of the total.

The usual argument made for financial justification by advocates of 3-cent fares is that they increase traffic and gross receipts enough to compensate for the lower revenue per passenger. This is disproved by the results in Detroit just stated, since both lines serve almost identically the same territory. Great care is exercised by the management to maintain the car service as fully up to the traffic demands on the low-fare line as on the high, to avoid any appearance of attempting to force the public to use the higher fare lines. The lower fare line is under some inherent disadvantages as to routes, because it was built after all the widest streets and most direct routes were occupied.

VIEW ON ONE OF DETROIT'S WIDE RESIDENTIAL STREETS

From the foregoing figures it is evident that the eight-for-a-quarter ticket does not appeal strongly enough to the pocketbook of the majority of the people so that they will take the trouble to take advantage of it.

Prior to August, 1898, as stated, there was a universal voluntary six-for-a-quarter ticket on the high-fare lines. The average fare per passenger on all the city lines was $0.0404. The six-for-a-quarter tickets were then abolished on the high-fare lines, which had the result of bringing the average fare on all city lines up to $0.0425, although some had urged that this move would decrease the average fare by driving passengers to the cheaper lines or to walking.

From the maps in this issue it will be seen that Detroit has a number of broad thoroughfares radiating directly from the business part of the city to the outskirts. These streets were occupied by 5-cent fare lines, with eight-for-a-quarter workingmen's tickets morning and evening, long before the low-fare line came into the field. When the low-fare line was built it had to take more indirect routes and narrower streets, but they reached nearly every portion of the city served by the 5-cent lines, and hence the greater portion of the people of Detroit have but to choose between the two.

In 1901 the Detroit United Railway operated for about

54 per cent of the gross receipts. The gross receipts on the city lines averaged $0.0425 per passenger, so that operating expenses, exclusive of fixed charges and sinking fund, to retire the bonds at the expiration of franchises, were $0.0229 per passenger. It does not require elaborate argument to demonstrate that with a fare averaging $0.036 on the low-fare lines, and operating expenses $0.0229 per passenger, the remaining $0.0131 will not begin to pay interest on the investment and sinking fund, which sums, on the majority of large street railway systems of to-day, amount to from $0.015 to $0.025 per passenger. In this connection it should be borne in mind that the average receipts per passenger on the low-fare line would be lower than $0.036 but for the fact that in order to obtain transfers to 5-cent lines a 5-cent fare is often paid on the low-fare line. However, it is not within the province of this article to speculate on what would be the case if the conditions were different. Its purpose is rather to set forth a few facts and figures on experiences with low fares in the city of Detroit.

From the foregoing the following conclusions can be reached.:

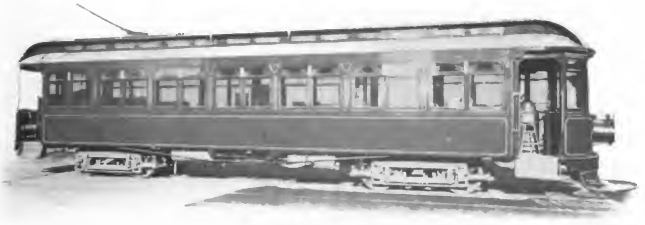
1. The greater part of the street car-riding public cares very little for saving fares, as is shown by the small percentage taking advantage of the privilege.

2. The slight difference in directness of the routes and the necessity of purchasing tickets to obtain low fares, are sufficient to counteract much of the advantage of the low fare in the public mind, and the public seeks the convenience of the moment and saving of time rather than a saving of 1½ cents in car fare.

3. The low fares carry so little weight with patrons that there is no increase of riding due to the reduction of fares below 5 cents; hence there is nothing in the argument that an increase in passengers carried will follow reduction of fares below 5 cents.

4. It costs as much to carry the passenger who pays 3½ cents as the one who pays 5 cents, and the deficit which would occur in the former case is only made up by the fact that on the entire city system the number of 5-cent passengers brings the average receipts up to $0.0425 per passenger.

5. There is always a happy medium. If passengers were charged $1 per ride the income, gross or net, would not be as great on street railways as it is now in America. The nickel seems to be the happy medium.



THE YOLANDE PARLOR CAR

The General Passenger Department of the Detroit United Railway System

Before discussing the work of the general passenger department of the Detroit United Railway, it will be in order to explain the conditions which make necessary the establishment of such a department on the part of this company. The company owns, not only all the city lines of Detroit but owns or controls 301 miles of interurban lines. On the interurban lines there is as much necessity for a passenger department to take care of the matter of tickets, rates, promotion of traffic and excursion business as there would be on any steam road. Furthermore, as regards the city lines, Detroit has a class of business which is but little considered in many cities, but which is a very important one in Detroit, namely, that coming from summer visitors and excursionists, who are in the city but a short time, and would naturally wish to see as much of the city as possible in that time. There is probably no city in the United States which has as many excursions and conventions visiting it during the summer months as Detroit.

INTERIOR OF THE YOLANDE

Several factors have combined to produce this state of affairs. Detroit is in itself an attractive city, and as it is located at a central point on the system of Great Lakes, all the traffic of the Great Lakes passes up and down the

Detroit River, and all passenger boats stop at Detroit. Excursion steamers run daily from Detroit to many points on Lake Erie and Lake Huron, the excursion business from Toledo and Cleveland being especially large. Thus, while the Detroit United Railway is forced, in a measure, to divide its pleasure traffic with the various steamboat lines, those very steamboat lines also bring it a large number of out-of-town visitors, who are among its best patrons, provided the business is properly looked after. This work comes under the supervision of John H. Fry, assistant general passenger agent, who has recently been giving special tages of the Detroit United cars for sightseeing by some particular excursion.

In the way of more permanent and expensive literature there is one pamphlet entitled "Detroit, 1902," of sixty-four pages, well illustrated, with half-tone engravings, artistically grouped, several to each page. These engravings are from photographs taken of various attractive spots around the city of Detroit. Eighteen pages are devoted to Detroit; the balance of the book to points around Detroit, timetables, rates and advertisement of steamboat lines. The idea of this book was primarily to call attention to Detroit as a desirable place to make a summer visit. Another booklet, entitled "Along the Way," has been published especially to advertise the Rapid Railway System, the passenger department of which is in common with the Detroit United Railway. The company makes liberal use of the camera and half-tone engravings in the preparation of all of its advertising literature where this is possible.

DETROIT UNITED WEEKLY.

VOL. I. THURSDAY, JULY 17, 1902. No. 4

Knowledge with the general public of how the electric railways and the boats unite during the summer in rendering an ideal service to those traveling during that period, is in the nature of valuable information. If for any reason it is inconvenient to visit the Flats at the time you can reach them by boat, a trolley car will land you there, the time that you have to enjoy that delightful resort before taking a down boat depending upon the time you can take the car. The same is true of all points on the American shore between Detroit and Port Huron, as it is as to Grosse Ile, Trenton and such other points as the boats touch down the river.

To those living out of the city, to whom the suburban lines are available, the advantages are exceptional. For instance, and just by way of illustration, a party may run in from Flint over the electric road in the morning, see the prettiest parts and chief points of interest in Detroit on the Yolande, board one of the magnificent liners for Buffalo at 4 p. m., reach that city at 7 a. m. the next day, take a trolley ride to the Falls, see all that is most imposing and beautiful at Niagara, having ample time and opportunity, return to the boat in the afternoon and be back in Detroit the next morning. This is a particularly attractive outing, to be commenced on Saturday morning and to end with the return home on the Monday following. The same opportunity and scores of others that cannot be mentioned in so brief an article are open to all within the large territory tributary to this service

He—They tell me that your friend Madge is connected with the best families in Detroit.
She—Yes—by telephone.

The Bible Conference will open at Lake Orion July 18th and continue until July 29th. The big suburban cars take you to the doors of the meeting hall.

If a trolley meets an auto going to the Fair,
There's the trolley, where's the auto?
Echo answers "Where?"—*Cleveland Plain Dealer*

DETROIT UNITED WEEKLY.

HOW AND WHERE TO GO.

This time table is subject to change without notice.

SUBURBAN RAILWAYS, DETROIT UNITED RAILWAY, (Operates all Detroit City Lines.) Time Tables—Suburban Lines. Cars run on Detroit local time.

Wyandotte Division.—For Trenton half hourly, 6:08 a. m. to 10:35 p. m. and 11:35 p. m. First car one hour later on Sundays.

Pontiac Division.—For Pontiac, 6 a. m., 7 a. m. and half hourly until 7 p. m. Hourly until 11 p. m. First car one hour later on Sundays

Orchard Lake Division.—For Northville, Orchard Lake and Pontiac, hourly, from 6 a. m. until 11 p. m. First car one hour later on Sundays.

Flint Division.—For Rochester and Romeo at 6 a. m., and every hour thereafter until 11 p. m. For Orion, Oxford and Flint, every hour from 6 a. m. to 9 p. m.; also for Orion and Oxford, at 10 and 11 p. m. Cars on Wyandotte division start fro mCadillac Square, and all other cars from corner Woodward and Jefferson avenues. Last car on all suburban lines leaving Detroit wait for the theaters. Waiting room, 70 Woodward avenue.

Rapid Railway System.—For Port Huron hourly, 7 a. m. to 6 p. m. For Mt. Clemens half hourly, 7 a. m. to 7 p. m., and hourly until 11 p. m. For Mt. Clemens via Shore Line, hourly, 6:30 a. m. to 9:30 p. m. and 11 p. m. Waiting room, 70 Woodward avenue. All cars start from Michigan Central depot.

Detroit, Ypsilanti, Ann Arbor & Jackson Ry.—(Standard time.)—Through cars Detroit to Jackson hourly from 6:00 a. m. until 9:00 p. m. For Ann Arbor half hourly from 6:00 a. m. until 10:45 p. m. First car one hour later on Sundays.

PLEASE NOTICE THIS.

The yellows, greens and reds, which since the installation of the service have been used to distinguish the suburban cars, will soon be disposed of. Soon there will be only one color for these cars that rush you past farm houses and quiet lakes and sylvan scenes. All our suburban cars will be but one color, and that a wine-maroon. The colors of Joseph's coat were all right for a while when the suburban service was new and the people were yet unfamiliar with our out-goings and in-comings. But now we are all pretty well accustomed to it, the lines, the routes and the time-tables. We not only know now where we want to go, but we know on what corner to take the Big Cars and the times of the leaving.

After this, you must look for the sign on the lower right hand side of the front vestibule, which will be absolutely unmistakable. It will by day be large and black, and unequivocable. By night it will be illuminated. Even in the heart of the city, where these Big Cars cross and intersect one another's lines and leave on about the same minute, there can be no confusion—no mistaking colors, no futile attempts to convince the conductor that he is on the wrong track, if you will read those signs, carefully, dispassionately, thoughtfully. These are one of the few varieties of signs to which one can pin his faith and retain one's self-respect.

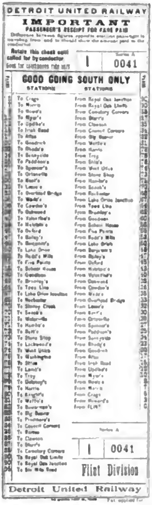
TWO PAGES OF THE DETROIT UNITED WEEKLY FOR JULY 17

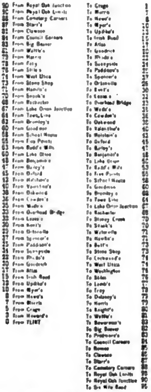
attention to various excursions coming to Detroit from out-of-town points. It has been the experience that unless the members of an excursion are posted before arriving in Detroit as to the possibilities of sight-seeing by means of the electric lines, that the patronage of many of them will be lost, and that it is useless to attempt to reach these people after they have arrived at the dock or railroad depot in Detroit. The practice has been begun, therefore, of sending out traveling passenger agents to distribute literature advertising the Detroit United Railway lines on excursion boats on the way to Detroit. Detroit United Railway literature has also been scattered among northern Ohio cities, from which there is considerable traveling to Detroit. The advertising literature published by the general passenger department forms an interesting collection. This literature takes the form of both small folders and more pretentious pamphlets. The small folders are usually gotten up for some special occasion—advertising advan-

For the special benefit of visitors from out of town, an observation parlor car, "The Yolande," makes five two-hour trips daily over the Detroit United Railway system within the city. These cars leave Cadillac Square at 9:00 a. m., 11:00 a. m., 1:00, 3:00 and 5:00 p. m., giving a two hours' ride over the most interesting and attractive streets. The fare for the round trip is 25 cents. When large excursions come to town, calling for greater seating capacity, additional open cars are run in the summer. "The Yolande" is well advertised around the hotels and also by

itself, as it stands waiting for passengers in front of the Russell House, on Cadillac Square. It carries a full length sign, reading: "Take This Car to See Detroit in Two Hours." The sign is prominent without being obtrusive.

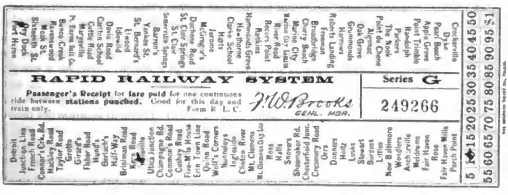
The Rapid Railway system has for some time published a timetable and folder, after the order of a steam railroad timetable, but containing rather





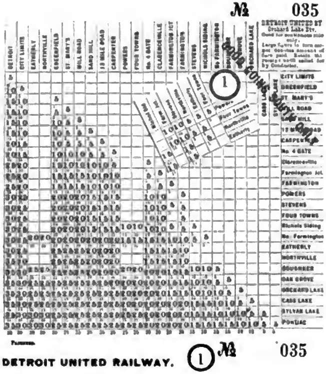
FLINT DIVISION FARE RECEIPT, FRONT AND BACK

more descriptive matter than the ordinary steam road timetable. This is the standard timetable folder, size 4 ins. x 8½ ins. No special timetable folder of the interurban lines of the Detroit United Railway lines is published, but the timetables of all these lines



RAPID RAILWAY FARE RECEIPT

are given in the official railway guide of the interurban lines of Cleveland, Detroit and Toledo, which is issued monthly by the Electric Railway Publishing Company, of Detroit. This is a company of which several officials of the Detroit United Railway are directors. This guide is distributed free on all interurban cars of the lines to which it relates, and at all hotels, depots and waiting rooms. Formerly this company published timetables of all the cities enumerated, but recently only those radiating from Detroit and Toledo have been given in full in the Detroit edition, and more detailed information has been given in regard to Detroit lines. This folder contains a map of electric railway lines diverging from Detroit, timetables of all these lines and an index of towns and villages reached by electric interurban lines, giving the line on which they are located, the distance from Detroit, the fare and running time from Detroit.



ORCHARD LAKE DIVISION FARE RECEIPT

In order to keep more closely in touch with the riding public, the "Detroit United Weekly" has been started for free distribution on cars, and judging from the demand it is being well read. This is a four-page folder, 4 ins. x 6 ins., printed on cheap paper, and the present edition of 10,000 was soon exhausted. This weekly publication serves two purposes. First, to call the attention of the riding public to some of the inherent difficulties of street railway operation, which can be much relieved by the co-operation and thoughtfulness of the public; and, second, to keep the attractions along the street and interurban lines before both strangers and the people who live in Detroit, and who are consequently very naturally inclined to become indifferent to the good things close at hand. This is the only way a street railway company has of talking with the public, and it is undoubtedly often the case that the company's rules and regulations are misunderstood and

condemned, as they would not be if the company could talk to the public through the medium of such a publication. To put it briefly, the "Detroit United Weekly" is published with the purpose of keeping the public in closer touch and sympathy with the aims of the company to give good service.

This department has the adjusting of rates of fare and the selection of tickets under its charge. Different forms of tickets are used on each of the interurban divisions. These divisions were originally built by different companies under different franchises. In some cases the too eager promoters accepted franchises with regulations as to rates of fares in the various villages passed through, which have caused much trouble in the regulating of through fares. This simply serves to call the attention of interurban promoters to the importance of hampering themselves as little as possible by the acceptance of franchises requiring different rates per mile over different portions of the road, since it is desirable that the rates be as uniform as possible. They will be complicated at best on most interurban systems, and simplicity is worth a great deal.

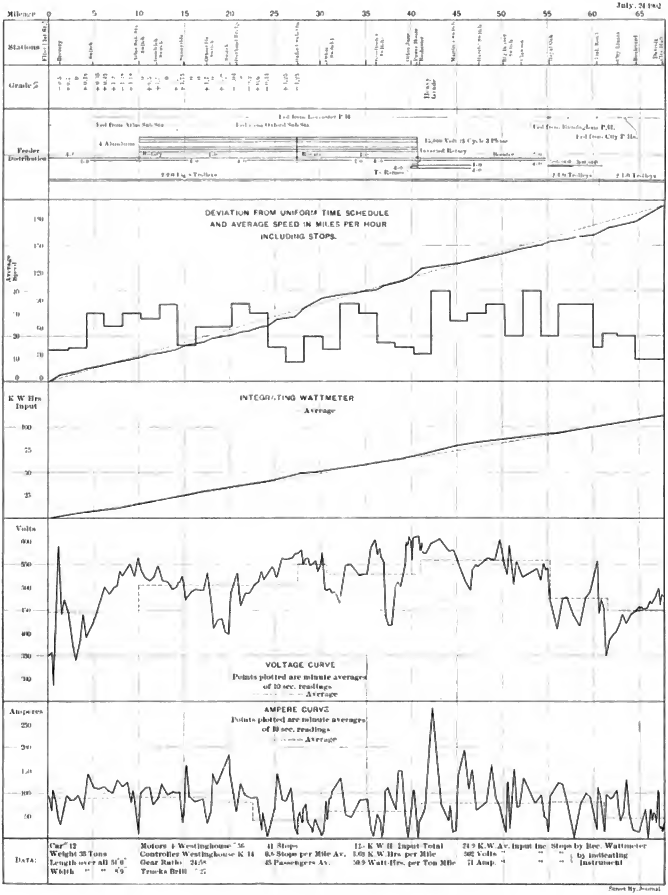
On the Pontiac Division there is practically no ticket problem at all, as there are but four rates of fare outside of the city limits, namely, 5, 10, 15 and 20 cents. On all cars of whatever division the fare inside the city limits is 5 cents, and is collected in the city and rung up on a register, just as if it were a city fare. The interurban cars belonging to the Detroit United Railway proper are run into the city by the same crews that handle them over the interurban lines. The cars of the Rapid Railway and the Detroit, Ypsilanti, Ann Arbor & Jackson Railway are taken into the city by different crews than those which operate them inside of the city, the city crews being in both cases employees of the Detroit United Railway Company, and a collection of fares being made just as if it were a city car. On the Pontiac Division the four rates of fare are registered on an Ohmer register, adapted for them. On the Flint Division the rates are more complicated. A long ticket, made by the American Ticket Company, of Toledo, is used. This has on its face in consecutive order all the stations on the line with the fare from the city limits. A different color is used for each direction. These tickets are carried in a holder, which can be set to tear the tickets at any desired point. The face of the ticket is torn so as to read from one point to another, and the difference between the fares opposite these two points indicates the fare paid. The back of this ticket is arranged in reverse order to the front. The stub, which is left to the conductor, is turned in to the auditor's office, and on the reverse side can be found the reading to correspond with the face, which was torn off and given to the passenger. On the Orchard Lake Division affairs were most complicated; a ticket made by the National Ticket Company, of Cleveland, has been adopted. On this ticket the apparatus instead of consisting of two slides, both of which must be adjusted, consists of a square, which is carried in the conductor's ticket book. Having brought the square to the two towns between which fare is to be paid, the conductor tears off that part of the ticket not covered by the square, giving it to the passenger, who then has the amount of fare paid in the bold-face type in the lower left-hand corner of his receipt. For the benefit of the auditor's office this same figure is put in small type in the next space below, so that the fare which has been paid can be read on the stub.

On the Rapid Railway system the regular steam road duplex cash fare receipt is used, and as far as possible tickets are sold at stations, though the number of passengers carried on tickets is very limited.

Tests on Energy Consumption of Electric Cars in Interurban Service Around Detroit

Tests on the power consumed by electric cars in electric interurban service having not as yet been very extensively carried on, the results of a few tests made on cars in regular service on interurban electric lines radiating from Detroit may be of value as showing the power requirements of cars in such service.

On the Detroit United Railway Company's system, E. J. Burdick, assistant superintendent of motive power, who has charge of the electrical work of the company, has not made any great number of tests, but the few which have been made were carried on with great care as to accuracy of instruments and observation. Car tests No. 10 and 12, made by Mr. Burdick on interurban cars of the Detroit United Railway, have resulted as shown by the accompanying curve and data sheets. These two tests were both made between the interurban waiting room in the city of Detroit and Flint, Mich., a distance of 67.8 miles. Cars were in actual service in each case, and these tests may be taken as representing fairly well the average conditions of interurban service on the Detroit United Railway system. Car test No. 10 covers a complete round trip. Car test No. 12 covers only the distance southbound from Flint to Detroit. Test No. 10 is recorded by two sets of curves, one set relating to schedule speed, and the other set relating to power consumption, as recorded by a carefully calibrated Thomson recording wattmeter. On the test sheet No. 10 the power consumption and schedule speed curves are both laid out on the same general plan, and both are distance curves. The schedule speed curves shown are from time readings taken at various mile posts. The average schedule speed is shown by straight lines between terminals, so that the variation from the average schedule speed for various parts of the line can be seen at a glance. In addition to these curves there are curves on the same sheet showing the schedule speed between various points along the line. This, of course, varies considerably. In this test the highest schedule speed noted between any two points was slightly over 35 miles per hour, for a distance of about 3 miles. In car test No. 12, made on the same kind of car and over the same route as No. 10, curves are given similar to those in No. 10, and in addition are plotted the readings of ammeter and voltmeter. As the data in connection with both of these tests is incorporated on the curve sheets, it will not be necessary here to recapitulate those figures, but as going to show the probable accuracy of the results, attention may be called to the fact that the average power input, as taken from the readings of the recording wattmeter in test No. 12, is 34.9 kw. The power input, as figured from the ammeter and voltmeter readings (502 volts multiplied by 71 amps.), is 35.6 kw. The difference between the results arrived at by the two separate means is therefore so close as to justify considerable confi-



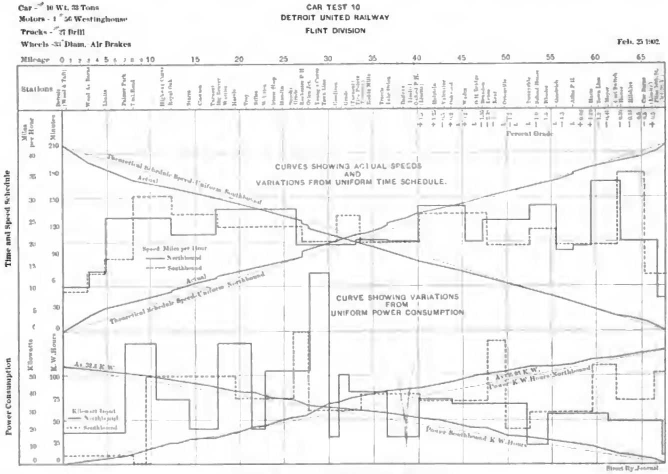
CAR TEST NO. 12, DETROIT UNITED RAILWAY

dence that the results can be depended upon, and a further check on their accuracy is that tests No. 10 and 12 also correspond very closely, as can be seen from the following table, which gives the comparative figures on the southbound trip for both tests:

Comparison of car tests on Flint Division, Detroit United Railway, southbound trips:

Date	Car 10 Feb. 25, '02	Car 10 July 24, '02
Car weight	33 tons	33 tons
Car length over all	51 feet	51 feet
Mileage of trip	67.8 mile	67.8 mile
Number of stops	43	41
Stops per mile	0.65	0.60
Time consumed on trip	3.57 hours	3.25 hours
Average speed, miles per hour	19.0	20.8
Kilowatt hours, total	111	113
Kilowatt hours, per car mile	1.64	1.68
Watt hours, per ton mile	49.6	50.9

The cars upon which these tests were made were the



CAR TEST NO. 10, DETROIT UNITED RAILWAY

same in weight and equipment, as seen from the data given. They have seats for nineteen in the smoking compartment and thirty in the rear compartment. The hot-water heater and closet in the rear of the main compartment take the room of four seats on one side of the car, and the space opposite is left vacant as an aisle, being at the rear of the car, where unobstructed exit is desirable. Although no accurate information is available as to the maximum speed these cars will make on a level, with 500 volts at the motor terminals, this speed is probably in the neighborhood of 43 miles an hour.

Cars of this type, when running at full speed over ordinary interurban track, take from 150 amps. to 200 amps. The accelerating current will usually reach a maximum of 300 amps. to 350 amps., when the motors are thrown in multiple, though if the car is behind time or the grade slightly ascending, this will reach 450 amps. The track over which the two foregoing tests were made is mainly 60-lb. standard T-rail.

Train Despatching on Interurban Railways Around Detroit

All the electric interurban railways radiating from Detroit operate under despatcher's orders given by telephone. The methods used by the three different managements which operate these lines are very similar and differ only in detail. In each case telephones are located in cabins or booths at sidings along the line, and no attempt is made to carry telephone instruments on the cars. The orders are all received verbally, and no written record is kept on any of the lines.

The Detroit United Railway system operates all its interurban lines, except the Wyandotte Division, from one despatcher's office located at Royal Oak Junction, 14 miles from Detroit. From this point the despatcher has telephonic communication with the whole interurban system controlled by the Detroit United Railway. His office is on the second floor of the freight office and waiting room at that point, and commands a good view of the interurban lines which approach it from three directions.

Although the telephone lines are essentially for train despatching, they are also used in a limited way for transac-

tion of general business. Their use, however, for this purpose is not encouraged, and it is understood that train despatching business has the right of way over anything else on these telephone lines. Should a line be in use for a conversation other than despatching business the employees have strict orders to immediately cease talking the instant a train crew calls the despatcher for orders, and not to continue conversation again until orders have been given. The despatchers work in three watches. They are men thoroughly familiar with the business as carried on by steam railroads and keep train sheets just as on steam roads.

Orders are received at the telephone booths of this company by the conductors and are repeated to the despatcher by the conductor. The motorman must be within hearing to hear the order repeated back. The telephone lines are mainly No. 10 Washburn & Moen gage B.B. iron wire. In the city and when passing through trees a waterproof insulator is used on telephone lines. Telephone lines outside the city are run on brackets with pony insulators, and are transposed every ten poles, except under high-tension alternating-current lines, where they are transposed every five poles. The transposition insulator made by the Hemingray Glass Company is employed for this purpose. The standard telephone equipment for booths consist of Stromsberg-Carlson telephone instrument No. 17 with an 1800-ohm ringer, a five-bar magneto generator which will ring through 60,000 ohms resistance. The instruments in each booth are connected with the line through a double-pole, single-throw baby switch. This switch is open when the telephone is not in use, and strict orders are given that it shall be so opened when not in use that the line may not be rendered inefficient by having a large number of instruments bridged across it. It is possible that some arrangement for automatically cutting out the telephone instrument when the booth is not in use will be employed. At the despatcher's office, the interior of which is illustrated herewith, there are two switchboards in duplicate for the despatcher, so that in case anything goes wrong with one board the other can be immediately switched in. The despatcher has four despatching lines entering his office, as can be seen from the map. Connection with any one of these four lines is established by simply throwing an operator's switch. The plugs shown on the operator's switchboard are for making connections between different despatchers' lines when they are used for general business.

In the ordinary despatching operations the despatcher has only to throw his keys to connect his head telephone with the various lines. The circuits are so arranged that communication can be had with many points on the system from two directions, and double-pole switches are placed in a line at frequent intervals. In case a line is short circuited or grounded at a certain point the switches on both sides of the trouble can be opened and the work of despatching can then be carried on without interruption. Between Royal Oak and the general offices of the Detroit United Railway at No. 12 Woodward Avenue there is a main trunk line, and in addition to this there is a line solely for despatching extending from Royal Oak toward the city as far as Six-Mile Road. In case of an emergency the trunk line can be connected with the despatcher's circuit by means of switches located at the two telephone booths between Royal Oak and Six-Mile Road. A private telephone line is maintained by the company between the general offices at Woodward Avenue and the Jefferson Avenue shops. Another line runs from Woodward Avenue to the St. Antoine car house and the two power houses A and B. There is also a line to the Clark Avenue car house, from which car house the despatching of the Wyandotte line is carried on. In the city resort is frequently had to the expedient of running telephone lines suspended from the electric railway span wires by means of porcelain insulators. In some cases a common porcelain insulator is used tied to the span wire with the telephone line wire pulled through the hole in the center, and in other cases a porcelain insulator especially made for this kind of work has been put up. This location for the telephone wire keeps it free from interference with trees, which in Detroit and neighboring towns is a very important consideration, as the foliage is very heavy along many streets traversed by the electric roads.

INTERIOR AND EXTERIOR OF DESPATCHER'S OFFICE AT ROYAL OAK JUNCTION

In general, it may be said that the greatest care is exercised to maintain telephonic communication without interruption, and in case there is trouble on any of the telephone lines its repair has the preference over any other work, as communication for despatching is the first essential in the operation of long lines of road. The despatcher not only governs the operation of cars on interurban lines, but is very helpful to all departments because he is in closer touch than anyone else with the actual operation of the entire system and just what is going on from hour to hour

on the various parts of the road. He receives the first reports of troubles along the line, both large and small, and is of great assistance to track and overhead departments by reporting to them defects reported by trainmen

The number of passenger cars under the despatcher's care on the interurban lines on the ordinary schedule is twenty-two. On special occasions this may be increased to forty. To this should be added the work cars, freight cars and supply cars, which, being irregular, run as extras, and so add to the despatcher's cares much more than in proportion to their numbers.

On the Rapid Railway system the telephones used for despatching are rented from the Bell Telephone Company, and are maintained by that company. The orders are received by the motorman and are carefully repeated back to the despatcher. The conductor stands close at hand while the motorman repeats the order back, and then the conductor also steps to the telephone and repeats the order. On the Ypsilanti road the orders are received and repeated back by the motorman.

SUB-STATION AND FREIGHT DEPOT ON RAPID RAILWAY

Motive Power and Rolling Stock on the Rapid Railway

The Detroit & Port Huron Shore Line Railway Company, commonly known to the public as the Rapid Railway system, was among the first of the interurban electric roads of the country to adopt an extensive system of alternating-current distribution. The power house which generates all the electrical energy used by the Rapid Railway system is located at New Baltimore, on Lake St. Clair, close to the line of the road. The power house supplies about 110 miles of city and interurban line. The interurban lines are shown by the accompanying map, upon which also are indicated the sub-stations from which direct current is supplied to the trolley line. The power house at New Baltimore is the work of Westinghouse, Church, Kerr & Company, and bears all the familiar engineering features common to the plants erected by that company. At this power house there are three units of 500 kw each. The generators are three-phase, 390-volt machines, and the engines are Westinghouse tandem compound condensing 21½-in. and 37-in. x 22-in. stroke. The two exciters are 35-kw, 125-volt direct-current generators, direct connected to Westinghouse compound engines. In the boiler plant four Babcock & Wilcox water-tube boilers are equipped with Roney mechanical stokers. A centrifugal pump raises the water about 21 ft. for use in the Worthington jet condensers, which are located just under the boiler-room roof. Induced draft is,

EXTERIOR OF STATION AT NEW BALTIMORE

JEFFERSON AVENUE SHOPS

of course, used, there being two steam-driven draft fans, either one of which is sufficient to maintain draft for the plant. Before passing to the draft fans and the low stack, the flue gases are put through Green economizers, which reduce the temperature of the stack gases from about 520 degs. to 440 degs. A continuous record of flue-gas temperature is kept on the power-station log, which is kept daily by the engineer, reproduced herewith. The three alternating-current generators are connected to a common set of three-phase bus-bars through single-

INTERIOR OF NEW BALTIMORE STATION, RAPID RAILWAY

throw, three-pole switches. There are no circuit breakers in the generator circuits, the generator panels containing only synchronizing lamps and synchronizing plug receptacles, a three-pole switch, a double-pole field switch, a field rheostat, an alternating-current ammeter in each of the three legs, and an indicating wattmeter. From the 390-volt, three-phase bus-bars two rotary converters of 200-kw capacity each are operated directly. These supply the trolley lines near the power house. There are two sets of step-up transformers also operated from the alternating-current bus-bars. One set supplies the 16,000-volt high-tension transmission lines running north and the other set the high-tension line running south. There are, therefore, six transformers in regular service, with a seventh as reserve. Each bank of three transformers has a low-tension panel, through which the current to it passes. In this panel there are automatic circuit breakers in each leg of the circuit. From this description it will be noticed that the circuit breakers are placed only in the transformer circuits, and not in the generator circuits. The two rotary converters, which are run from the power-house bus-bars, are protected by fuses in each leg. The frequency of the alternating current in this station is 28 cycles, which is rather unusual. The high-tension lines, as indicated by the accompanying map, extend 40 miles north to Port Huron, and 21 miles south toward Detroit, as far as Roseville sub-station. The high-tension mains are all No. 1 copper wire on Locke porcelain insulators, Nos. 3 and 4. As indicated by the map, in addition to the current supplied to the trolley line from the rotary converters at New Baltimore power station, there are sub-stations at Mt. Clemens, at Roseville, at Algonac, at St. Clair, and at Port Huron. The latter supplies city lines in Port Huron. The majority of these sub-stations are equipped with two 200-kw rotary converters.

The arrangement for feeding direct current from the sub-stations to the trolley lines is of interest. The trolley line is sectioned opposite each sub-station, as is customary in alternating-current transmission practice for interurban lines, and, as usual, there are two feeders leaving the direct-current bus-bars at the sub-station, one for supplying the trolley line in one direction and the other for supplying the

trolley line in the other direction. Each trolley section, therefore, is fed by the sub-station at each end, so that the sub-stations can, to a certain extent, help each other in carrying the load, and as long as all the feeder-panel switches and circuit breakers are closed all the trolley-wire sections on the road are connected together. In case of short circuit on one section the feeder-panel circuit breakers in the sub-station at each end will open. The peculiar thing about the direct-current feed on the Rapid Railway system is that instead of connecting the feeders directly to the trolley line at the sub-station no tap is made to the trolley line until about a mile from the sub-station. Mr. Marshall, the chief engineer, believes that this is a very good plan, because it does not throw so great a strain on the sub-station machinery in case there is a ground or short circuit near the sub-station. The current that will flow in case of a short circuit is reduced somewhat by the resistance of the feed wire between the sub-station and the first trolley tap, and, even though this resistance may be small, it serves in a measure to reduce the current which may flow. After a direct-current feeder has been tapped into the trolley line about a mile from the sub-station, taps are made to the trolley line after that every twelve to fifteen poles. On the lines between Mt. Clemens and Port Huron the direct-current copper consists of two No. 00 trolley wires supplemented by a 450,000 cm feeder. From Mt. Clemens to Detroit along the Shore Line there are two No. 00 trolleys supplemented at Mt. Clemens by a 450,000-cm feeder from the Mt. Clemens sub-station and at the Detroit end by a 450,000-cm feeder run across country from the Roseville sub-station. On the Shore Line between Mt. Clemens and Detroit, where interurban traffic is the heaviest, there are two No. 00 trolleys and three No. 0000 running each direction, as indicated on the map.

Before the Port Huron and city lines were operated from the New Baltimore power house a good opportunity was

RAPID RAILWAY SYSTEM NEW BALTIMORE POWER HOUSE
Daily log for twenty-four hours ending 5 a. m. Monday, August 25, 1902

Machinery in Service	Record	Time Started Up	Time Shut Down	Time Run
Generator No. 1	390 voltage	6.00 a. m.	1.45 a. m.	19.45
Generator No. 2	390 "	9.00 a. m.	11.20 p. m	14.20
Generator No. 3	390 "	5.30 a. m.	12.30 a. m	19.00
Exciter No. 4				
Exciter No. 5	1 0 "	5.00 a. m.	5.00 a. m.	24.00
Rotary No. 1	600 "	6.00 a. m.	1.45 a. m.	19.45
Rotary No 2	600 "	6.00 a. m.	12.00 m.	18.00
Boiler No. 1	155 pressure	5.00 a. m.	5.00 a. m.	24.00
Boiler No. 2	155 "	"	"	24.00
Boiler No. 3	155 "	"	"	24.00
Boiler No. 4	155 "	"	"	24.00
Boiler feed pump No. 1		5.00 a. m.	2.30 a. m.	21.30
Boiler feed pump No. 2				
Rotary Pump No. 1		5.00 a. m.	1.45 a. m.	20.45
Air pump No. 1		5.00 a. m.	7.00 a. m.	2.00
Auxiliary pump				
Stoker engine		5.00 a. m.	1.45	20.45
Fan Engine No. 1		5.00 a. m.	1.45	20.45
Fan engine No. 2				
Economizer		5.00 a. m.	5.00 a. m.	24.00
Feed water temp at pump	70 degs. Fah.			
" " after first heater	115 "			
" " after second heater	177 "			
" " after economizer	237 "			
Flue gas temperature	515 "			
Flue gas temp. after economizer	433 "			
Temperature condensing water	88 "			
Vacuum gage	25 inches			
Insulation of high tension line	Volt. to ground			
South line, leg 1	0 volts			
" leg 2	0 "			
" leg 3	0 "			
North line, leg 1	0 "			
" leg 2	0 "			
" leg 3	0 "			
Weather— 6 a. m., fair				
" 12 noon "				
" 6 p. m., cloudy				
" 12 m., clear				

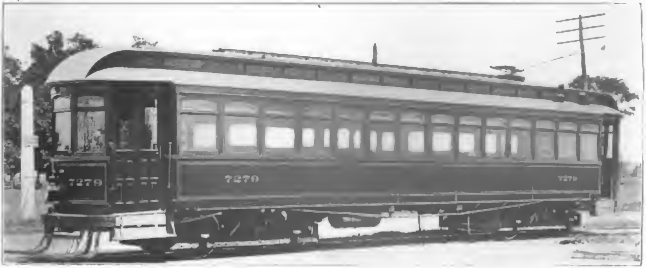
Men on Duty	On	Off	Hours On
Engineers			
D. J. Richards	5.30 a. m.	4.00 p. m.	
Thos. Hubbard	4.00 p. m.	2.30 a. m.	
Fireman			
Geo. Rivard	6.00 a. m.	4.00 p. m.	
Ed. Munion	4.00 p. m.	2.00 a. m.	
Oilers			
Robt. Kleehammer	5.30 a. m.	4.00 p. m.	
Arthur Rivard	4.00 p. m.	2.00 a. m.	
Dynamo Tenders			
Steven Mildrum	7.00 a. m.	5.00 p. m.	
Coal & Ash Handlers			
Joe Heuser	6.00 a. m.	4.00 p. m.	
Dan McEachran	6.00 a. m.	4.00 p. m.	
A. Lapouse	4.00 p. m.	2.00 a. m	
Abe. Rivard	4.00 p. m.	2.00 a. m.	
John Hubarth	7.00 a. m.	5.00 p. m.	
Boiler Cleaners			
D. Butler	7.00 a. m.	5.00 p. m.	
Watchman			
Wm. Carter	7.00 p. m.	5.00 a. m.	
Laborers			

Watt-Meter Readings	Left Hand Meter	Right Hand Meter
Reading to-day, 5 a. m.	5,575,500	5,954,100
Read'g yesterday, 5 a.m.	5,565,000	5,943,100
Difference	10,500	11,000
Total kw hours	21,500	.....

Remarks

POWER STATION LOG, RAPID RAILWAY

afforded for determining the power required per car mile for interurban cars of the kind used on the Rapid Railway. Most of the cars on the Rapid Railway are geared for a maximum speed of about 45 miles per hour, some of them being four-motor equipments, and some two-motor. The four-motor equipments usually reach maximum speed



PASSENGER CAR, RAPID RAILWAY

sooner than the two-motor equipments, although when up to speed they run about the same. It was found that the power required per car-mile for the interurban cars as measured at the low-tension bus-bars at the power house, and which includes, therefore, the losses in step-up and step-down transformers, high-tension lines, rotary converters and direct-current feeders, was about 3 kw-hours. As to the maximum load coming upon the power house when

PASSENGER CAR, RAPID RAILWAY

running interurban cars alone, the following figures represent conditions as they existed part of the time before the Port Huron city lines were operated from this power house.

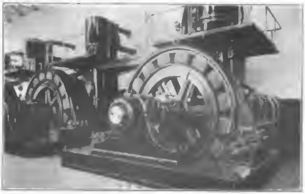
There were in operation cars as follows:

29-ton passenger cars, four-motor equipment..	8
21-ton passenger cars, two-motor equipment..	6
25-ton freight cars, four-motor equipment....	3
Line construction cars......................	2
8-ton city cars in Mt. Clemens...............	2
Total	21

The output for a run of twenty hours was about 14,000 kw-hours, or an average of 700 kw. This represents an average input of 33.3 kw per car in service. Of course, for the interurban passenger cars which are in motion a greater part of the time the input per car would be considerably more than this, as the above list includes the freight cars, line construction cars and two light city cars. Indeed, the power required by the city cars is probably in the neighborhood of 15 kw average, or less than one-half that of an interurban car. With the above list of cars in operation, the maximum evening load, when nearly all the cars would be moving, was about 1384 kw, a maximum of 65.9 kw per car.

Several types of passenger cars are operated by this company, some of which are illustrated herewith. Those now in operation regularly have smoking compartments in the front, and are equipped to run single ended. In these various cars the hot-water heaters are placed in various positions. That preferred by W. O. Wood, general superintendent of the road, who has charge of the operation, is in the front vestibule beside the motorman. When placed in the vestibule it takes up less valuable room than in any other place in the car. The dust and ashes are kept out of the passenger compartment, and the heat is given a better distribution through the car than is possible by placing the

heater in any other location. The motorman's vestibule is likely to be the coldest place in the car, as when running against a cold wind considerable cold air is sure to find its way into the vestibule. It seems but logical, therefore,



GENERATOR, RAPID RAILWAY

that the heater should be placed in the vestibule, so that it cannot only keep the motorman warm, but will radiate the most heat from the pipes in the forward end of the car. In case there is much passenger travel the motorman has much more time to attend to the heater than does the conductor. The argument sometimes advanced that if the heater is placed in the vestibule the motorman will keep the fire too low in order to keep the vestibule from getting too hot is an argument against the type of heater used, and not against

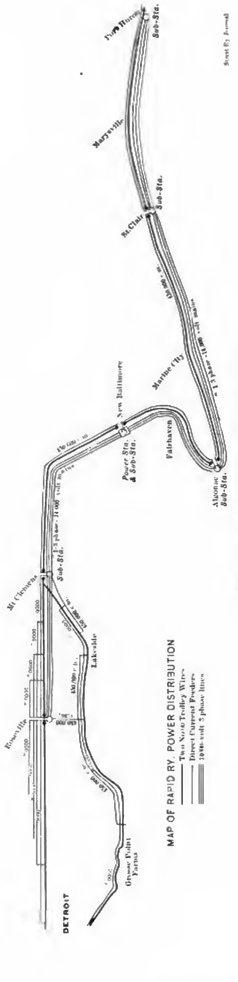
CONSTRUCTION CAR

the practice of placing it in the vestibule. A heater so constructed as to radiate a large amount of heat into its immediate surroundings is not an efficient hot-water car heater.

The mileage of the motor-armature bearings is kept track of closely, and when an armature is run 20,000 miles in a set of bearings it is watched carefully, as it is known to have reached a point where it will not last a great while longer. Kalamazoo trolley wheels are used, from which a life of from 5000 to 10,000 miles is obtained, which is an excellent record for such severe interurban service. The trolley-wheel pressure on the wire is adjusted at about 35 lbs.

A car equipment of four 75-hp motors has proved the most successful, the cars being about 50 ft. over all.

All the mechanical and electrical work on the system, including power station, sub-stations and car equipments, is under the care of A. C. Marshall, chief engineer.



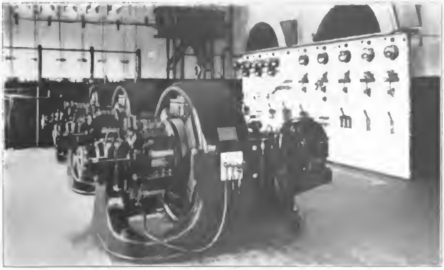
POWER DISTRIBUTION SYSTEM OF RAPID RAILWAY.

The Operation of Electric Interurban Railways

BY W. O. WOOD, GENERAL SUPERINTENDENT RAPID RAILWAY SYSTEM.

The manager of an interurban electric railway must meet many of the problems which are involved in the operation of electric street railway in city and suburban districts, and at the same time be thoroughly conversant with the laws of transportation which have been evolved in the operation of our steam railways. To the steam railroad man, who is accustomed to dealing with large train units and large mileage of track, the operation of an interurban electric railway of 4 miles to 100 miles in length is likely to appear at first a very simple proposition. With the steam railroad superintendent, who has given up steam railroading to engage in the supervision of an interurban electric railway, there is no such illusion, however. He may think upon first assuming his duties that as compared with operating a division of a steam railroad of double the length, operating an electric interurban road will be an easy proposition. The small scale upon which many operations are carried on upon an electric road has a tendency to make the steam road man feel something akin to contempt until he has faced the problems himself. After he has done this he realizes that the great number of small train units and the amount of detail which goes to make up successful operation of an electric interurban road call for an immense amount of care and work on the part of the successful operating superintendent. The same thing holds true all down the line, even to the conductors and motormen. A former steam railroad engineer once applied for work as a motorman upon the system with which the writer is connected. Upon being informed that he must take six weeks as student to learn the road before he could be put regularly in charge of a car, he gave up his application in disgust, with the remark that if he could not learn the whole road in two trips he would eat it. This simply illustrates the feeling among the steam road men above referred to. It was, of course, hard for that engineer to realize that 50 miles of electric interurban road contained far more turnouts and meeting points, sharp curves, possible stops for passengers and points calling for caution than double that length of ordinary steam railroad. It is in the mastering of many details that successful interurban electric railway operation depends, from the motorman and conductor up to the general superintendent. Owing to the great number of train units and the local character of the business of the electric interurban road, the promptness of action required by the operating force of such a road is second only to that of a city street railway, and there is no time for the red tape which characterizes the management of our great steam railway trunk lines. Steam railroads to-day are organized upon the one-man power principle, all matters being referred up from one official to a higher official, until frequently the man least conversant with the local needs and conditions makes the final decision. While of course a perfect organization requires a certain amount of red tape of this kind in order that the system may be operated as a unit under the control of a single head, it is not practicable to carry it to such an extent in the operation of an electric road. The responsibility must be placed to a large extent with the man who is on the scene of action, and he will frequently be called upon to decide, upon short notice, as to the proper course, because there is no time to refer to higher authorities. The men upon the ground must be held responsible for the results, and given responsibility, rather than depended upon as machines for referring all matters to higher officials.

COMBINATION BAGGAGE AND EXPRESS CAR, RAPID RAILWAY



ROSEVILLE SUB-STATION, RAPID RAILWAY

The operation of the Detroit & Port Huron Shore Line Railway, commonly known as the Rapid Railway System, is carried on in many respects like a steam railroad, with the necessary deviations from steam railroad rules of practice and management called for by the conditions. The company operates 107 miles of interurban electric road, and about 16 miles of city street railway in the cities of Port Huron and Mt. Clemens. The distance from Detroit to Port Huron, which is the greatest distance over which

cars are operated, is 73 miles. The line from Detroit to Port Huron is divided into two operating divisions. Motormen and conductors starting from Port Huron, leave their cars at a point about half way to Detroit, changing to cars bound toward Port Huron at meeting points near the division line. The divisioning of the road in this way is believed to be a desirable feature on any electric interurban line of this length. While it is the tendency in steam railway practice to lengthen divisions, it must be remembered first that steam-railroad speeds have been gradually increasing, and second, that the motorman and conductor of an electric car have many more details to think of than the conductor or engineer on a steam railroad. Furthermore, the average conductor and motorman obtainable for service on an electric interurban road have not anywhere near the previous training and experience in the business that engineers and other trainmen on steam roads have had. Trainmen perform their duties best only when they have had such former practice in them that many of their operations become a kind of second nature or mechanical. By working train crews over short divisions on an electric road they are given a better opportunity to learn thoroughly everything pertaining to that division. A man running several times a day over a road comes to know it much better than a man who passes over it only twice a day. The men come to know the regular passengers and the points at which they board and leave the cars. They learn more accurately the exact location of stopping points, the rates of fare, the streets in the numerous towns and villages passed through and the hundreds of little points which go to make up efficient train service. Motormen learn grades, curves and turn-outs, and just where it is possible to make fast time and where it is not safe to do so. Were electric interurban roads all constructed as steam trunk lines, so that it would be possible to make high speeds over a large per cent of the route, regardless of curves and passage through towns, they could operate cars well without changing crews over much longer divisions than at present.

As before intimated, men are required to take from four to six weeks to learn our 107 miles of interurnan road. This does not include operation in the city of Detroit, as the Detroit United Railway Company's crews take our cars at the city limits. The conductor on an interurban car which will seat fifty passengers, and which frequently carries many more on special occasions, must be well educated to his work if he is to perform it with anything like efficiency. Once educated there are many things which come, as said before, a kind of second nature, but for a new man there is an immense amount of detail to remember and to get practice in. If it were possible to have all passengers purchase tickets before boarding the cars and to relieve the conductors of as many duties as possible, as is being done on steam roads, the problem would be very much simplified.

The Rapid Railway system maintains ticket offices at its terminals and in all the principal villages which it passes through, but there are necessarily a large number of places where ticket offices cannot be maintained. Even where there are ticket offices there is little inducement for a passenger to purchase tickets, because, under the conditions, it is impossible for the company to discriminate against cash fares either by charging extra or by an extra charge with a rebate, for the simple reason that so many passengers must necessarily get on at points where tickets cannot be purchased. The collection of cash fares, therefore, puts a great amount of work on a conductor which would not fall to him were it possible to do all business by tickets, as on steam roads, and, furthermore, the conductor must be better trained for his work than if he were simply collecting straight 5-cent fares on city lines.

The average distance traveled per passenger on our interurban lines has been found to be about 12 miles, which goes to show the number of passengers the conductor must deal with on a run of 73 miles. Although, as said before, conductors and motormen on the through cars of the Rapid Railway System only operate over half the length of the road under ordinary conditions, they are required to learn the whole road during the student period, so that in emergencies they can do service on either the northern or southern divisions. The movement of trains is under a modification of the standard code of train rules as adopted by the American Railway Association, with the telephonic train orders given by the despatchers at Mt. Clemens and repeated by both motorman and conductor, who are held equally responsible for their execution. The distances between sidings are so short that it is not desirable to take time to write out an order as it is received, but the danger of accident due to lapse of memory is provided against by not giving an order an unnecessary length of time (seldom more than ten minutes) before it is to be executed. Definite meeting points are given instead of "wait" or "time" orders. Trains running on time move against other trains, as provided in time table, without orders from despatcher. A train sheet and order book shows a record of train movement and train orders that is complete and comprehensive.

The handling of extra traffic on Sundays and holidays is accomplished on the Rapid Railway System in two ways. It may be noted here that the fact that the road reaches a number of pleasure resorts along Lake St. Clair and the St. Clair River makes the amount of pleasure riding greater than it would be on many interurban lines where no such special attractions existed. We have one division called the Shore Line Division which follows the shore of Lake St. Clair and the Detroit River from Mt. Clemens to Detroit which has cars regularly during the week at one-hour intervals. During the summer as a regular thing this service is doubled on Sundays, and since such doubling up of the service is generally known to people who patronize this line regularly it is a more efficient and desirable way of taking care of the extra traffic than running two or three cars upon one-car time as different sections of the same train. This plan of doubling the frequency works well where people who patronize the cars know in advance that the extra service is being given. On our main line, however, which is the short line from Detroit to Mt. Clemens, and runs from Mt. Clemens along the shore to Port Huron, a great deal of the extra traffic comes from strangers, and we have no means of posting these people as to the fact that any extra cars are being run. The most feasible thing then is to run two or more cars upon the time given on our time tables for one car. This, of course, causes some delay at meeting points, because cars must always wait for the different sections of an opposing train. In case two cars are being run on one car's time there will be a delay of one or

two minutes while the second section is arriving at a meeting point. However, this delay is partly made up for by allowing the car ahead to leave some of the local stops for passengers to the following car. On the main or short line between Detroit and Mt. Clemens a half-hour service is regularly maintained. From Mt. Clemens on to Port Huron the cars run at one-hour intervals.

A car leaves Mt. Clemens on the regular time every half hour without regard to whether the cars from Port Huron are on time. That is, if the through car from Port Huron should be delayed by the heavy rush of summer business, a car is started to Detroit from Mt. Clemens upon its time and the car from Port Huron can then run through from Mt. Clemens to Detroit without any stops save for letting off passengers from points north of Mt. Clemens. The through Port Huron car can, therefore, arrive at its destination, Detroit, on time. The suburban business into Port Huron is cared for in a similar manner to that just described, and insures compliance with the timetable.

It might well be the work of the American Street Railway Association, which now numbers among its members so many interurban companies, to appoint a committee of interurban superintendents to codify what ought to be the operating rules for interurban lines. It seems to me that we are getting to a point where there should be some such recognized standards in operating rules and methods. It would mean much to those of us who at present have to contend with totally inexperienced help in times of heavy business.

The Rapid Railway system keeps about eighty motormen and conductors on its regular runs, with from ten to twenty extra men. This brings up an operating point wherein interurban roads are at considerable advantage over city lines, namely, in the small number of extra motormen and conductors required and the relatively large amount of work which it is usually found possible to give these extra men on an interurban road, thereby keeping them well paid and satisfied, where the city road would have difficulty in doing the same thing.

In the maintenance of our track and right of way, which comes under the operating department, the interurban road is divided into sections from 8 miles to 10 miles in length with one foreman and six men for each section. These track men are employed by the company the year around, although, of course, during the frozen period in winter they cannot do much track work. At such times they are put at such other work as needs to be done, walking track, shoveling snow, coal, etc., and thus are kept in readiness for their regular work in the spring. It is considered that better results are obtained by assigning a number of foremen to sections of the above length than by working a large floating gang.

One of the great needs of electric interurban roads is the adoption of standards of permanent construction of roadway and especially of operating methods, that will secure uniformity in practice so far as is consistent with local conditions on what are to be the leading interurban systems of the country. Such a forward step will lay the foundation for the education of employees along established lines and for the development of what has not up to this time existed —a thoroughly experienced interurban railway employee, versed in standard practices and available for immediate service on any line.

Power Distribution and Operating Points on the Detroit, Ypsilanti, Ann Arbor & Jackson Railway

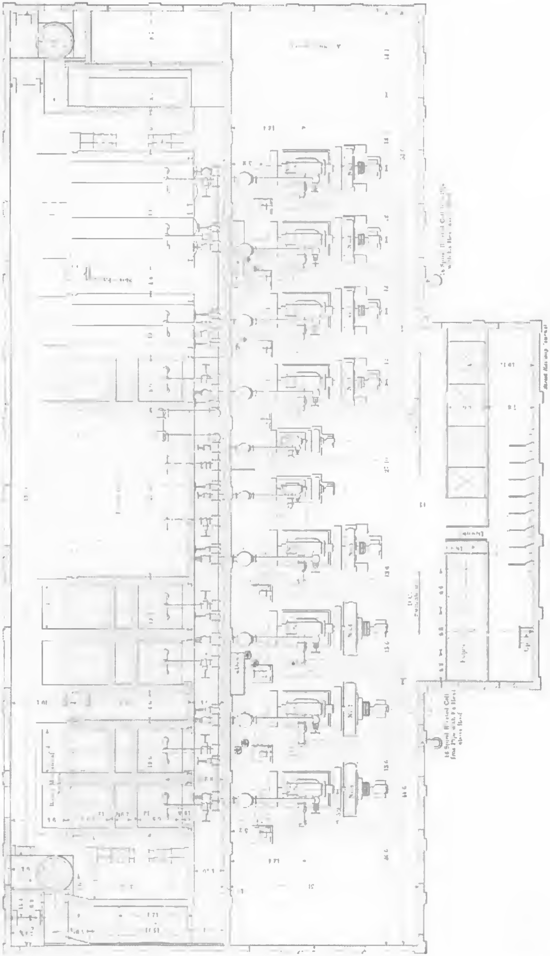
The Detroit, Ypsilanti, Ann Arbor & Jackson Railway operates the longest continuous line of interurban electric road out of Detroit, extending from the Detroit city limits to Jackson, a distance of 76 miles, with a branch to Saline. It was formerly operated by two power houses, but these have recently been combined into one combination alternating and direct-current power station at Ypsilanti. This power station being the most modern of any in the vicinity of Detroit, representing the latest engineering practice of Westinghouse, Church, Kerr & Company, who installed

TRACK AND LINE CONSTRUCTION, DETROIT, YPSILANTI & ANN ARBOR RAILWAY

it, is worthy of more than passing notice. The plan and sectional elevation of this power house are given in the drawings accompanying this article, which show the general arrangement and dimensions.

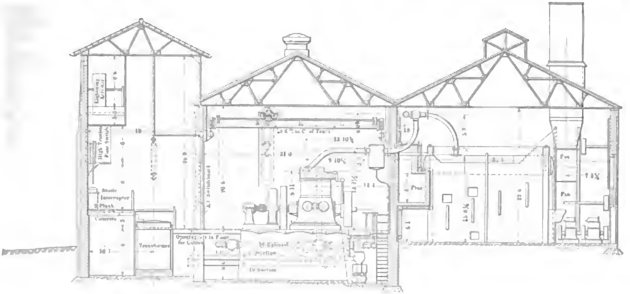
Beginning at the boiler room, there are eight 225-hp Babcock & Wilcox boilers, carrying 160 lbs. steam pressure. These are supplied with feed water by four Worthington outside packed plunger feed pumps. Acording to the usual practice of this engineering company, induced draft is employed furnished by a steam-driven fan, of which a duplicate is kept in reserve. These fans are driven by Westinghouse junior engines. The flue gases pass through Green economizers. The boiler firing is done by Roney mechanical stokers divided in two sections, four boilers on each section. The boilers are piped to a 10-in. main header which is divided into sections between each boiler, with cut-off valves. The connections from the boilers to the engines are made by bends of pipe of long radius.

The main engines, of which there are eight, are all the same size, being Westinghouse high-speed compound con-



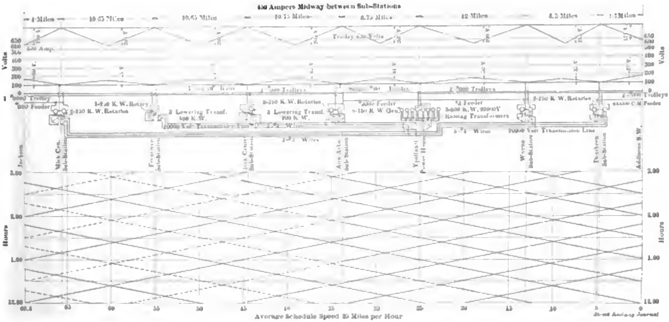
PLAN OF POWER STATION, DETROIT, YPSILANTI, ANN ARBOR & JACKSON RAILWAY

densing 18-in. and 30-in. x 16-in. stroke, running 200 r. p. m. Each engine has one Worthington compound jet condenser. The two engine-driving exciters are Westinghouse compound, 9-in. and 15-in. x 9-in. stroke, running condensing or non-condensing.



CROSS SECTION OF POWER STATION

To five of these engines 250-kw three-phase alternators are connected. These are 390-volt machines operating at the unusual frequency of 29 cycles per second. The remaining three engines have 250-kw double-current generators, giving 650 volts on the direct-current commutator, or 390 volts at the alternating-current collector rings. The



TRAIN SHEET AND POWER DISTRIBUTION

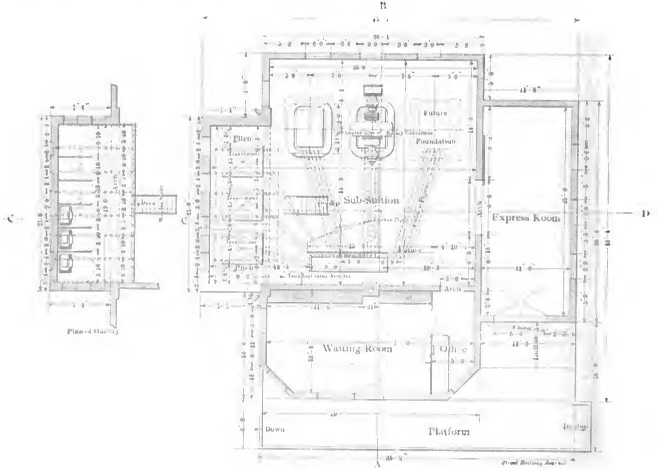
two exciters are 50-kw, 125-volt machines. These are also used to light the offices and shops. All the alternating-current generators are operated in parallel, and there is no provision for other than parallel operation. Coming to the switchboard, there are eight alternating-current generator panels, each of which has a three-pole knife switch for breaking the main generator circuit, a double-pole field switch, the rheostat in the generator field circuit, three alternating-current ammeters, one indicating wattmeter, synchronizing lamps and voltmeter and synchronizing plug receptacles. Generators connect through their three-pole main switches without any further circuit breaking devices, directly to the low-tension alternating-current busbars.

The entire alternating-current output is delivered to one bank of three delta connected step-up transformers. The only automatic circuit breakers in connection with the low-tension switching in the station are in the three legs of the circuit supplying these transformers. Each leg of this main circuit has a switchboard panel, upon which a Westinghouse alternating-current automatic circuit breaker with a time limit is placed. The time limit is put on these breakers, so that in case there is a short circuit at one of the substations the circuit breakers at the sub-stations will open before those at the main station, the idea being that fre-

quently this will save shutting down the whole system by the opening of the circuit breakers in the main power house, where opening the sub-station breakers would do as well. In each leg of the circuit there are also single-pole knife switches of 3000-amp. capacity. The total output is measured by a polyphase induction integrating wattmeter at one end of the low-tension switchboard just described, which contains the generator and transformer panels. There are two voltmeters on brackets at the end of the board. One of these is connected permanently to the bus-bars, the other to any generator which is being prepared for connection to the bus-bars. Along with the voltmeters there is also a Westinghouse synchroscope for use in getting generators in step with the bus-bars before connecting them in. This indicates directly the amount that the generator is out of step, and it is a much more accurate guide than synchronizing with lamps.

The step-up transformers raise the voltage from 390 volts to 21,000 volts. The high-tension leads from the transformers are taken to plug switches, which serve simply to transfer or open connections, and then to static interrupters, from which they pass to the regular Westinghouse long-break combination switch and fuse. The Westinghouse low-equivalent lightning arresters are connected between each leg of the high-tension line and ground. As seen by the plan of the power house accompanying this article, all the high-tension apparatus is in a bay or tower built on one side of the generating room and providing not only a wire tower for the entrance of the high-tension lines, but containing galleries for the high-tension switches and lightning arresters. The high-tension apparatus is therefore isolated to a certain extent from the rest of the plant. This same idea is carried out in the sub-stations, which have towers on a smaller scale for containing the high-tension apparatus.

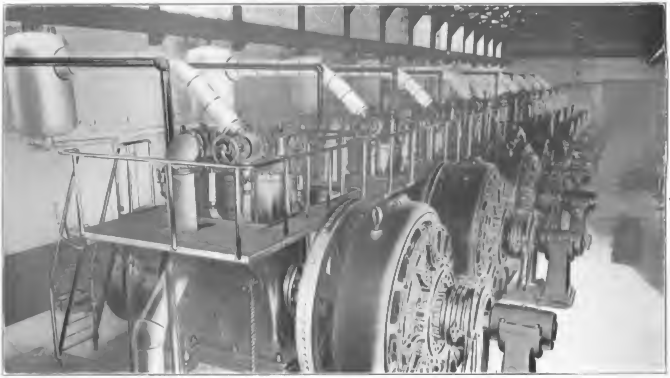
The direct-current terminals of the double-current generators are connected to the ordinary direct-current generator panels and supply lines adjacent to the power house through three direct-current feeder panels. These generator panels have three single-pole main switches—for positive, negative and equalizer. The automatic circuit breaker is on the negative side. The feeder panels have the usual equipment of an ammeter, circuit breaker, and single-pole switch. The direct-current output is also measured by recording wattmeter. A previous diagram illustrates graphically the relative position of the power house and sub-station, and the high-tension lines, giving also the capacity of each sub-station. This diagram, of course, includes only that portion of the line from a point near the Detroit city limits to Jackson. Outside of Detroit the cars are operated by the Detroit United Railway. The distance from Addison's switch to Jackson is 69.8 miles, which is covered at an average speed of 25 miles per hour. The diagram gives the drop to potential midway between sub-stations with 450 amps. flowing between trolley and track. As seen by the train sheet, this represents almost extreme conditions, which would occur in ordinary operation only once every half hour.



SUB-STATION PLAN WITH WAITING AND EXPRESS ROOMS

The regular passenger schedule for the cars is at one-hour intervals for the points west of Ann Arbor, and half-hour intervals for points east of Ann Arbor. The dotted lines on the train sheet indicate the conditions when

The design and equipment of each of the sub-stations being alike, are all practically illustrated in the views herewith. The sub-station buildings are of steel and brick with towers, as mentioned, and each is laid out to contain three 200-kw



INTERIOR OF POWER STATION

SUB-STATION, SHOWING HIGH TENSION APPARATUS IN BAY UNDER TOWER

half-hour service is maintained west of Ann Arbor. For a map showing the route of the road reference can be made to the one which is shown elsewhere in this issue, giving all the interurban roads around Detroit.

transformers and two 250-kw rotary converters with room for one extra rotary converter. There are, of course, switchboard panels for the alternating-current side of the rotaries and direct-current side. There are two feeder

panels at each sub-station, one feeding east and the other west. The trolley lines are sectioned in front of each sub-station.

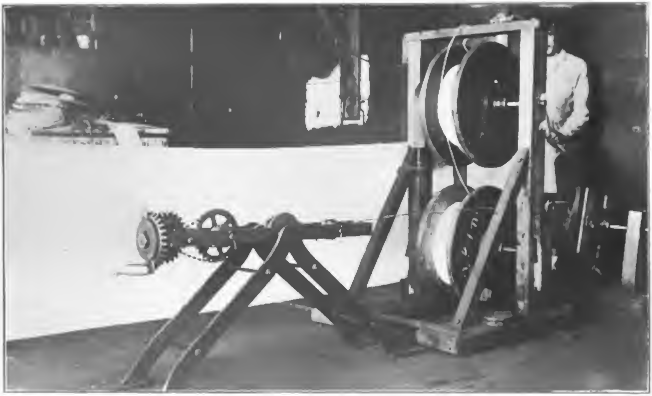
The cars operated regularly are as follows:

Interurban passenger cars	13
Local city cars at Ann Arbor	4
Freight cars	4
Construction car	1
Total	22

On this load five of the 250-kw units are run.

The rolling stock on this road is fairly uniform, although the sizes, both of car bodies and equipment, have been increased as the road grew older. New cars have a seating capacity of sixty people. They contain closets and drinking-water tanks, but no room is taken for hot-water heaters; the heating is by electricity. The heater would take up the seats of three or four persons unless placed in the front vestibule. The motor equipment is four Westinghouse No. 76 motors. The trucks and car bodies were built by the Barney & Smith Car Company, the trucks being master car builders' type. Axles are 5¼ ins. in diameter; wheels, 36 ins. in diameter; wheel tread, 2½ ins., with a bevel at the outer edge to give the outer edge strength, and flanges ⅞ins. deep. These cars take from 150 amps. to 200 amps. running at their maximum speed of about 45 miles per hour. The accelerating current is from 150 amps. to 200 amps., with motors in series, and from 300 amps. to 350 amps. when they are thrown in parallel making ordinary starts. This accelerating current sometimes reaches 450 amps., though not frequently. All the cars on the road are of the same general type, with Barney & Smith car bodies and trucks, Westinghouse motors, Westinghouse straight air brakes, and on the latter cars gearless compressors. The latter have proved a great improvement over the old-style geared compressors, requiring less cost of maintenance, and being much more pleasant from a passenger's standpoint because of the absence of noise from the gears. The cars were formerly equipped with Westinghouse automatic air brakes, but these have been changed to Westinghouse straight air brakes, because of the greater ease and accuracy with which a motorman can regulate exactly the pressure on the brake-shoes with a straight air brake. The first cars built have Baker hot-water heaters. The windows are the ordinary steam-road car type on the new cars, the drop sash having been abandoned on this road.

The company does most of its own repair work in a well-equipped shop at Ypsilanti, which also is the main car house. J. M. Miller is master mechanic. The armature-winding department is able to rewind most of the ordinary types of armatures used on the interurban cars at a cost of about $12 per armature. Instead of selling burned-out field coils for scrap copper, these coils are run through a machine which scrapes off all the old insulation and winds on a layer of tape. This makes the wire as good as new for field-coil winding, and, as the wire is pulled through this machine in the process of winding a new field coil, the expense of the operation is very low. This machine is illustrated herewith. There are no sharp edges in connection with this machine, the wire simply passes over pulleys and past dull edges which take off the insulation. The insulation must be burned, however, before this machine will take it off. Unless the field coil has already been so hot as to carbonize the insulation it must be put in the fire before being put through the machine. Mr. Miller reports an unusual high average for trolley-wheel life for such severe interurban service, namely, about 10,000 miles. A roller-bearing wheel, with side contact spring, is used. The trolley-wheel pressure against the wire is unusually heavy, being about 40 lbs. It is thought that this pressure, to-



MACHINE FOR SCRAPING AND RECOVERING FIELD WIRE

gether with the fact that the trolley has a roller bearing which permits of considerable pressure, is responsible largely for the high average mileage of trolley wheels. The wheel being held firmly against the wire, there is little chance for incipient arcing due to poor contact between wheel and wire, and hence the grooves do not wear rough. To enable so much pressure to be put on the trolley poles without undue strain on the springs of the trolley base, a slight modification has been made in the usual Nuttall trolley base, by which both springs work together to keep the tension on the trolley. In the base as ordinarily used the tension is on one spring at a time only, the other spring being free until the trolley pole is turned over. One of the trolley bases changed so as to give simultaneous tension on both springs is herewith illustrated. All that is necessarry to make this change is to put in a different shaped curved piece for the rods which carry the tension to be hooked into.

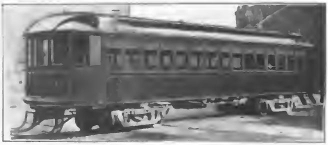
MODIFIED TROLLEY BASE

The plan has been adopted of replacing all broken cast-iron lower gear cases with gear cases made of sheet steel. These are made in the company's shops. The corners are 1-in. angle iron bent to the proper shape. The sides are No. 14 sheet steel. The hangers are bent up from ⅜-in. x ¼-in. bar iron. The sheet steel is riveted to the angle-iron corners at frequent intervals with cold rivets. These cases will hold water and oil, so well is this fitting done. The great advantage found in the sheet-steel case is that when obstructions are struck by the gear case it does not cause as great risk to the car or equipment as when heavy cast-iron gear cases are used. A sheet-steel gear case will come loose or bend before doing any serious damage. A cast-iron case may derail the car.

TWO SUB-STATIONS OF THE DETROIT, YPSILANTI, ANN ARBOR & JACKSON RAILWAY

To maintain the 100 miles of interurban track owned by this company five section gangs are employed with four men in each gang.

The regular schedule calls for cars every half hour east of Ypsilanti and cars every hour west of Ypsilanti. When special traffic is handled from Jackson, the western terminus of the road, cars are run every half hour, the fact that these cars will be run being advertised in the local papers. It is found that this is sufficient to prevent overloading of the regular cars running on the one-hour intervals. Special cars can be chartered when ordered, and the charge is made on the mileage basis.



STANDARD PASSENGER CAR

About seventy conductors and motormen are kept on the pay roll. All runs less than eight hours are termed "extra runs," and the men having them are given chances at the ordinary runs whenever the regular men are off. The road is not operated in divisions, but train crews make the entire run through from Jackson to Detroit and return. Twelve freight offices with regular agents are maintained. This road is under the management of F. E. Merrill, with S. J. Dill, formerly of the Metropolitan Street Railway, of New York, as superintendent. The road is controlled by what is popularly known as the Hawks-Angus syndicate, J. D. Hawks being president; S. F. Angus, vice-president and treasurer, and F. A. Hinchman, secretary and purchasing agent.

The Union Traction Company, of Medina, N. Y., was incorporated Sept. 24, with a capital of $600,000, to operate an electric railroad 50 miles long from Batavia, Genesee County, to the Lake Ontario shore, near Olcott, Niagara County. The directors include: Isidor H. Geballe, Fred L. Downs, Darius Fuller, Samuel Landauer, of Medina; Joseph W. Holmes, of Batavia, and Howard Hendrickson, of Albany.

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With this number, the STREET RAILWAY JOURNAL closes the eighteenth year of its life as a publication. These years have been full of activity, and, as we hope and believe, of usefulness to the entire street railway industry. Our first number was unpretentious and contained only twenty-four pages, but the paper has kept pace with the increase in size and importance of the street railway companies of the country, and this number, which is the largest ever issued by us or by a publisher of any technical paper, contains in the neighborhood of 500 pages. Our special October numbers have been issued for so many years that they are looked upon to a certain extent as a matter of course, not only by our readers, but by the publishers as well, yet few probably, except the publishers, realize the enormous amount of work and expense entailed in the preparation of a number like the present. There is literally no parallel in the way of a publication of this size issued from any of the technical presses abroad, where the October number of the STREET RAILWAY JOURNAL, as well as the paper itself, is looked upon as representative, as well as typical, of the American enterprise and energy back of the industry of which it treats.

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The importance of Detroit as an interurban center and the present interest that is being taken in the construction of electric interurban railways has naturally led to the devotion of much space in this issue to interurban work around Detroit and elsewhere. There are a few features of the city street railway service in Detroit, however, which are sufficiently notable to warrant the calling of special attention to them. The so-called 3-cent fare in Detroit, about which much has been said in various parts of the country in an attempt to prove the soundness of the 3-cent fare idea, has been before taken up in an article giving facts and figures showing the true situation, which is far from what the advocates of the straight 3-cent fare have been wont to represent it. Experience at Detroit has gone not only to show that a 3-cent fare is financially impracticable from the standpoint of the investor in street railway securities, but that it does not appeal strongly to any great portion of the street car patronizing public. A straight nickel fare with good service seems to suit the public best, and is the happy medium which will enable the company to make money and keep its service up to a high standard without making unduly high profits.

In another respect Detroit city street railway service is unique, namely, in the enormous number of cars sent out to carry the traffic during the rush hours mornings and evenings as compared with the number of cars in service during the middle of the day, this increase amounting during the winter to 75 per cent over the midday schedule in the morning and 125 per cent over the midday schedule in the evening. It is doubtful if there is any city in the United States where such figures as to increase in the number of cars in service during the rush hours can be shown. As every practical street railway operator knows, such excellent provision for rush-hour traffic means an enormous number of tripper crews, and the problem of giving these extra men enough work to keep them in the employ of the company is an extremely difficult one, this problem being further increased by the iron-clad agreement which the company has with the employees' union as to hours of service and wages.

This leads up to another notable feature in the street railway situation at Detroit. There is probably no street railway in the country which has such an exacting agreement with the union of its employees, this agreement covering a large number of detail points, as well as some rules under which it would seem at first thought very difficult to operate. The success of the Detroit United Railway Company so far, in dealing with its employees as represented by their union, is undoubtedly due to the fairness of the position taken by the company at all times upon all matters relating to relations between company and employees. The willingness of the company to arbitrate matters which might come under dispute, and even to

allow responsible representatives of its employees to pass judgment upon matters of discipline, should there be any charge of unfairness, has put the company in practically an impregnable position as long as there is any sense of justice and fairness on the part of the employees and the public.

Another point which must be a source of gratification to the company, as it is to all visitors to Detroit, is the regard for appearances as shown by the condition in which its property is kept in various parts of the city, and which is in full keeping with the spirit which seems to be shown everywhere on Detroit's streets. Car houses and car shops are not usually considered great additions to the beauty of a street upon which they are situated, but in Detroit the various foremen vie with each other in keeping the premises under their charge in good condition. Well kept lawns, flowers and vines are found in places around the various car houses where too frequently nothing but dust and gravel are to be seen.

* * *

The student of interurban electric railroading will find much to interest him around Detroit. The electric railways from this city, as shown in the maps which are published in this number, radiate in all directions except to the east, where expansion is prevented by the Detroit River, and reach Port Huron on the north, Toledo and Cleveland on the south and southeast, while they extend to the west as far as the eastern shores of Lake Michigan. In fact, Southern Michigan, owing partly to liberal laws which encourage the transportation of freight, as well as passengers, by electric railways, and partly to its topographical features, which are favorable to railroad construction, is now provided with a system of interurban electric railway transportation which is probably not rivaled by any other territory in this country, and certainly not abroad. In our Detroit article, which occupies the opening pages of this paper, no attempt has been made to describe any of these interurban railways except those which actually enter the city, as the more important lines outside of the city have been made the subjects of extended articles in recent issues of this paper. These roads, moreover, are among the latest in equipment of any in the country, and represent in size of rolling stock and in many other ways the tendency to copy steam-railroad models so far as they are applicable to electric railway conditions. Following the articles descriptive of the Detroit system in this issue will be found a series of contributions on different departments of interurban railroading. The writers are authorities on the topics discussed by them, and their suggestions will be found of great benefit to the designer and builder, as well as the operator. In view of the importance which interurban electric railroading has acquired during the past five years, and particularly during the past year, no excuse seems necessary for devoting so much space to this subject. Following these articles are three on some of the latest interurban roads in New England, the Middle States and the West. The space at our disposal in this issue would prevent us from commenting at length upon these signed articles, if this were necessary, but we feel as if we could not add to the treatment given the topics by the respective authors.

* * *

Passing now from the theory to the realization, we believe that the description of each of the three interurban roads selected for discussion in this issue, i. e., the Boston & Worcester, the Oley Valley and the Aurora, Elgin & Chicago, will be especially interesting, as each represents a distinct advance over any previous line which has been built in the territory through which it operates. Of these, the latter is probably the best known, not only to electric engineers and railway managers, but to the public as well. It is seldom that the inauguration of any single electric railway enterprise marks such an important advance in the art as has that of the Aurora, Elgin & Chicago Railway. Although the attention of our readers has been called to the work of this company numerous times during the past year and a half, and those who have followed the subject in our columns are tolerably familiar with what the road is doing and proposes to do, it will not be out of place at this time to sum up the probable bearing of this new undertaking on the future of the electric railway business. The road is perhaps nothing more than the natural result of the gradual evolution the interurban electric railway has been undergoing for the past five years, but it without doubt, on the whole, represents the highest development the electric interurban railway has yet attained. Indeed, it is a pleasure in this number of the Street Railway Journal, which number by its contents illustrates so fully the magnificent strides made in interurban work, to be able to point to such an excellent example of interurban electric railway engineering and solid financial confidence in the undertaking, as is afforded by the Aurora, Elgin & Chicago Railway. This road marks a considerable advance over previous interurban undertakings in several respects, namely: (1) in the solidity of its track and roadbed, which is equal to that of the best steam trunk lines and which will admit of the low, long, continuous runs at the highest speed known to-day in railroad work; (2) in the high maximum speed for which the equipment is designed, which speed is over 60 miles per hour, and (3) in the fast schedules that are possible, including frequent stops, a schedule speed of 40 miles per hour being obtainable, with stops every 3 miles. It is evident, when these points are considered and fully appreciated, that the electric interurban railway, having gradually evolved from a local service, with a schedule speed of from 10 miles to 15 miles per hour along a country highway, up to the present common interurban schedule of 20 miles to 25 miles per hour on a private right of way, is now to take another decided step in advance in the matter of speed, thereby opening up to itself new fields of usefulness. This will be practically the first electric railway in this country to give a through service between cities 38 miles apart, which will equal or exceed the best speed made by the steam roads covering the same distance. It is worth noting that while the through traffic between such cities as Aurora and Chicago would undoubtedly not be such as to justify the operation of steam trains at half-hour intervals, it has been sufficient even at the time of the opening of this new electric road, to take a majority of the seats in the cars running between Chicago and Aurora at half-hour intervals, even though the schedule of the electric road is not as fast as that ultimately contemplated by the management.

* * *

In other words, the electric road having worked its way up, as a carrier par excellence of short haul local traffic, is beginning to give frequent high-speed through service be-

tween neighboring cities, and with every indication that it will cover this field as thoroughly as it is covering that of shorter hauls. It is the same old story, electric traction lends itself to profitable operation of small train units at frequent intervals, whether at high speed or low speed. Steam does not. The most frequent train service gets the business if it can land the passenger at his destination in anywhere near the same time, and, in fact, experience has proved that a very great increase in speed must be offered a passenger to induce him to wait for infrequent trains. Futhermore, the frequent service creates a habit of riding which makes business, which never exists with infrequent service. It is through this created business that electric interurban roads have been able to exist and thrive.

* * *

So far we have considered mainly the bearing of this new road on future work as a carrier of through business between cities. But the local service is in its way equally remarkable, and likely to have an equally important bearing on future electric railway work. This local service is of a kind that has been much talked of among electric railway engineers in the past few years, but of which, until this road opened, we had no actual examples. It is a kind of magnified elevated railway service, if we may be allowed the expression. That is, the acceleration is very rapid and is carried up to a point where the current must be shut off and the car allowed to drift but a short distance before the brakes must be applied. Although the stations are much farther apart than on a city elevated road, the maximum and resulting schedule speeds have been shoved up correspondingly, so that the general form of the speed diagrams for this local service is the same as on a city elevated road, the essential difference being that the distance between stations is from 2000 ft to 3000 ft. in one case and 3 miles in the other, and the maximum speed 25 miles to 30 miles an hour in one case and 65 miles an hour in the other. Heretofore, electric railway companies operating in the outskirts of our largest cities and acting as feeders to the elevated lines have confined themselves to slow service over suburban highways, leaving suburban communities dependent upon steam suburban service for anything like rapid transportation to the city. The road under discussion, in connection with the Metropolitan Elevated, offers rapid transit to suburban passengers living from five to ten miles beyond the city limits, which will equal, and in some cases exceed, the speed offered by the suburban steam trains, figuring in the time required to reach the downtown office from the railroad depot. From this brief outline, it will be seen that it is certain that if this new undertaking is financially successful (and all the present indications are that it will be) it will mark the beginning of an important new period in electric railway building, both as regards high-speed roads, over considerable distances, and local suburban traffic. Aside from the interest centered in this road, because of the problems which it will solve as regards possible passenger traffic, it is needless to say that it is full of interest to the electric railway engineer from a purely engineering standpoint. The high maximum speed of the cars and the rapid acceleration at the rate of 2 miles per hour per second, at which the cars are brought up to maximum speed and the unusual weight of the motor car equipment per car, are features in themselves enough to arouse interest. To add to all this, it is generally understood that preparations are being made for a series of very extensive tests on this road, with electric cars, at speeds of from 70 miles to 100 miles per hour and over. Electric railway engineers certainly have reason to be grateful to builders of a road on which the track conditions and power supply are so good as to make such tests possible.

* * *

The survey of the interurban situation around such important centers as Detroit, Indianapolis, Cleveland, Dayton and Cincinnati, as well as a consideration of the service already given and faster service contemplated by the Aurora, Elgin & Chicago Railway, leaves no room for doubt but that all places where local traffic is of any volume, it will be taken care of by electric interurban and suburban roads, resulting in the abandonment of everything but through business by the steam roads. This has to a large extent already taken place around the interurban centers mentioned. Of course, there is a possibility that steam railroads will see fit to head off this paralleling movement by the introduction of electricity for handling local traffic. Indeed, from the purely economic standpoint, it would seem that steam roads could add a local electric service cheaper than new electric railways could be built to parallel them. However, steam roads have not seen fit to do this in the past, and it is a question whether they will do it in the future before parallel roads have been built everywhere that they would prove profitable. As we have many times remarked, the opportunity for the steam railroad companies of this country to create a large local traffic by the adoption of a local electric service in addition to their present train service, has been excellent. It is missing the point entirely to argue that the present local or suburban traffic carried by steam trains is not profitable nor sufficient to warrant investment in electrical equipment for local traffic. It is the created business brought into existence by the frequency of service that makes electric interurban roads pay and would make a local and suburban electric service pay on steam roads under proper conditions of population.

* * *

It has been too often considered that steam and electric roads are natural competitors. We have many times maintained that the proper relation of electric and steam roads is for steam roads to follow out the same lines of policy which they have been following for a number of years as regards the better handling of through business, decreasing the number of local stops and increasing the size of train units, leaving to the electric roads the work of carrying the local traffic, both passenger and freight. The electric roads would thus act as feeders to the steam roads, carrying at a profit the class of business which steam roads can carry only at a loss. The efficiency of steam roads as carriers of through business would be increased because they would be relieved of any hampering by local business. This, of course, presupposes that the steam and electric roads act in harmony. It would seem that the natural position of the electric road as a feeder and carrier of local traffic for a steam road would become so apparent in the course of the next few years of operation that the owners of these properties would find some means of getting together, either by traffic agreements, the buying of controlling interests in the electric roads by steam railway companies, or vice versa, or by actual consolidation.

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THE DESIGNING OF STEAM POWER PLANTS

BY WALTER C. KERR

THERE is a great difference between the consideration of power-plant designing and the description of a power-plant design. The latter is concrete and limited to special conditions. It is, therefore, easy to describe, analyze and illustrate. The former is less tangible. In it good practice may be as widely variable as are the conditions to be met. It does not involve a discussion of the merits of apparatus so much as the methods and means of adaptation. There are, however, principles and engineering duties which underlie the whole subject or design quite unrelated to any specific feature.

The main object of this paper is to point out some of the ways and means by which the engineer should find it well to deal first with the general and then with the specific questions involved, also to indicate to the purchaser, manager or securityholder something of the service he may reasonably expect the engineer to render in making determinations and plans underlying large expenditures.

While forming one of a series of articles on the engineering of interurban railways, the principles underlying the designing of steam power plants are scarcely limited to any type of property, the limitations only appearing when specific design is being adapted to the conditions of a given property.

The mental attitude of an engineer in approaching any undertaking has much influence upon the character of his work. It is the well-balanced perception that gives due importance to each factor and enables all of the features to be so corelated as to secure the best results. Harmony and consistency are of the first importance in the conception of general features, and they are equally essential in the design of specific detail to the production of a plant best suited to its purpose.

Altogether too much importance is often attached to the power plant as an end in itself rather than as a means to an end, and when critically reviewed by engineers it is usually so considered. Physically it is more or less a separate construction, and, therefore, by apparent isolation, more readily considered a thing apart from the system it serves, but operatively it is not, and commercially it is not; it has no true cause for distinction as a separate creation; it should not be regarded as competitive with other plants, or a monument to its designer. It is the servant of its system, a sharer of its limitations, and to excel should be consistent throughout with the commercial characteristics of the entire property of which it forms only a part.

Certain interurban properties have had the benefit of a civil engineer's disposition to consider the roadway the road while suffering from inferior power plant and equipment. Another may have profited by a mechanical engineer's excellent power plant while losing traffic on an improperly designed and constructed roadway. Another may have found an electrical engineer's highest type of electric equipment quite inoperative because the other 80 per cent of the property was not in keeping with its excellence. Such anomalies are usually not so much a matter of neglect as they are the natural result of human talent working from a wrong or too limited standpoint, and therefore not simultaneously wielding skill of sufficient diversity. This is sometimes unkindly called ignorance. Power-house design, therefore, is in many instances, and notably in interurban railways, quite inseparable from the general problem of producing the entire property.

Economic commercial adaptation is the very essence of good engineering, and takes precedence over all technical detail, even over engineering standards and conventions, and especially over preconceived desires and ambitions. An engineer's personality and preference must be subordinated to material and commercial requirements, and show chiefly in the methods adopted to secure the required ends. There is ample room for individuality in engineering work after the impersonal elements have been disposed of along cold lines of fact and necessity. It follows that the engineer must not be afraid of his facts, and it requires study to know and interpret the facts and conditions involved in any engineering problem. It has been remarked that there are more mistaken facts than theories.

The best lawyer may be the one who knows the most law or he may be the best court pleader or the most sagacious adviser on difficult legal points, but there can be little doubt that the most useful lawyer is the man with strong business instinct supplemented by legal knowledge and experience. Similarly, while the most successful engineer must needs have engineering skill, he must, in order to achieve real and permanent greatness, have primarily a correct commercial sense of the relation of structures, plants, projects and undertakings to the world at large, financial risks and personal equations, and then be capable of applying his engineering skill to bring forth results. He must not forget that operating cost is not only the coal and labor cost, but involves fixed charges, liabilities, deterioration, and to a certain degree the possible future unsuitability of his work to the then existing conditions.

The first requisite of a power plant is that it shall be so adapted in cost, running quality and sufficiency as to give the highest value and least risk to the securities underlying the entire property which it serves. This raises the question, how far the engineer should enter the commercial and operative field in the interest of his client. He can scarcely go into it too far. It is inconsistent with the profession and the importance of its undertakings to assume that an engineer is to close his eyes and proceed with work which may, through his skill, be rendered technically good engineering, yet by reason of conditions prove bad business.

To have been ordered is no excuse for transgressing good business principles without direct and explicit remonstrance. Mere difference of opinion, sugested or implied, is not the full performance of duty when an engineer with his wide opportunities detects commercial defects in an undertaking entrusted to him for design or construction. If engineers more scrupulously and more boldly exercised this function many properties would not have been constructed and their securities wasted. Whatever prospective opportunity may have led to financing a project, a time arrives when a competent engineer with possession of all the facts, together with knowledge of costs, neces-

sary to proper design and construction, is, or should be, the best commercial adviser. Under circumstances adverse to the project it should be his duty to take the initiative in the protection of capital. This is partly because any man's duty lies toward whatever chance throws across his path regardless of instructions, conventionalities or professional etiquette. The best design for some power plants would be the demonstration of why they should not be built at all.

Certain power plants, especially very large ones, may obviously be designed with comparatively little reference to the system served or to first cost—the problem being practically to produce as large an output as possible per square foot of available area at the lowest operative cost. Again, power plants for certain railway properties must sacrifice ultimate efficiency and other merits to low first cost, simplicity and reliability, their chief mission being to furnish sufficient power to operate a system within fixed charges consistent with traffic obtainable. There must be a well-judged balance maintained between allowable costs and desirable economies, and before this balance is determined the problem too often drifts along the lines of least resistance into the settling of details before disposal of the larger and more important elements.

Power plants must serve present needs, the immediate future, and have due regard for the more distant future. That the future cannot be foreseen is no excuse for not giving due heed to what it will most probably require. Engineering history shows that even much experience seldom leads to placing large enough quantitative values upon future requirements.

While it may be resented by some, it is nevertheless true that too much power-plant design consists only of the selection of apparatus. Some would produce drawings to refute this statement, but inspection will often show that such plans are but little more than the pictorial arrangement of apparatus drawings reduced to the same scale. It is fearlessly stated that many engineers do not know what it means to design a power plant; they merely arrange it on the ground by inspection and selection. There are many plants containing the best apparatus that money can buy, which, on engineering analysis, cannot be regarded as other than operatively bad. They are not operatively designed.

The selection of apparatus and the determination of power-house features with their many details intimately involve methods of subsequent operation. Good judgment must be exercised to weigh between the inefficiency of crudeness and the complication of refinement. In this, as in many other features requiring skilled judgment, it is desired to emphasize the difference between believing that a thing should be done and the practical doing of it. Too often the nice distinctions between one thing and another or a method and its alternative are considered, yet the decisions are finally based on price, delivery, convenience, minor expediency, or even unwarranted notions of the kind that link preventable difficulty with extreme refinement and complication. It is not always easy to be wholly consistent, but a systematic engineering measure applied to apparatus, design and method should carry with it the requisite courage firmly to adopt the measured results.

Those who are fond of analyzing cause and effect could outline a large number of underlying, fundamental requisites for good power-plant design, but two are seldom mentioned which should be ranked first. They are: experience in having actually conducted work of construction as distinct from having told someone else how to do it, and experience in operation after construction. The power-house design of all countries is full of academic work of the learned and guesses of the ignorant. The degree to which many engineers are divorced from responsibility by having no large contract relations noticeably weakens their judgment or fails to strengthen it. This is most conspicuously seen in features which of necessity must be creatively designed and constructed, rather than bought as manufactured product.

Another thing deserving attention is the tendency which has sometimes appeared to specialize unduly. This is, perhaps, less frequent of recent years, with the great improvements in quality and variety of standard apparatus, but it occurs sufficiently often to call forth protest. It is doubtful if in most cases the refined improvements sought by such means do not fall short of their object because of the offsetting cost of the complication usually involved.

By way of simple illustration, a certain pumping plant was very "specially" designed and installed in a way to take advantage of high efficiencies where ordinary centrifugal pumps driven by any small compound engines of standard make would have performed the service more reliably and would have required less fuel for their total operation than could have been bought for the interest charges of the capital differences in the cost of the two plants. Sometimes these things are apparent; again they are not so plainly evident. They exist more often than they are apprehended.

After the property which a power plant must serve has been sufficiently studied to enable the design to be rationally contemplated and the work of design is actually in hand, come the many more or less perplexing decisions which are often hastily made to gain time or contemplated until they become so involved in a multitude of considerations that final solutions are hard to reach. The way is then paved for error. Some more bold than wise gain the temporary admiration of their associates or clients by settling everything "with an axe." It is often the so-called "practical way." In fact, what is needed at just this juncture is hard, careful work and much more of it than is often put on power-plant design. A guess is occasionally a good one, but a series of guesses too rarely succeeds to warrant the method so often adopted in important matters which can be resolved into good engineering decisions by the application of hard work.

Power-plant design involves something more than mere drawings and specifications. It broadly includes ways and means of getting work done, which in turn involves purchasing and providing that all things come together in proper sequence, reasonably on time and in condition for erection. The failures in this art of construction can always be shifted to other shoulders, for the fault is widely distributed through broken promises, imperfect material, inevitable delay, accidents, clerical error, misunderstandings, insufficiency here and there, all of which lined up will show that a fair degree of error spreads over all who have duties or obligations toward the plant. But how about the duty of the engineer in so designing and broadly executing his design in a way to forestall these numerous faults, defects, neglects and the annoying, expensive and merit impairing obstacles. The duty of the engineer is broad and

he cannot wholly shift the responsibility when he does not provide ways and means by which contractors and others will be estopped from error, neglect and failure within reasonable limits. The mere stringency of specifications and the imposing of penalties are inadequate, but the hand and power of a competent engineer, whom no one doubts is an engineer, compels accuracy and fulfillment.

I think it is a fair general criticism upon the engineering of power plants, and more particularly those designed for interurban service, that enough work is not done upon them. They are not susceptible to strokes of genius. They are not chiefly composed of devices designed by the engineer, but rather an assemblage of machines, apparatus and devices regularly manufactured, and hence obtainable. There is too much presumption that things called by the same name are substantially the same in fact, from which follows a looseness in design and specification. It is a fine engineering art to design, select, order, receive, erect and put in operation all of a power plant and have it from start to finish just what was intended. The sooner it is recognized that most plants do not meet expectations in their general performance and that the intentions underlying their design were not quite as accurate as they should have been the sooner will there be more hard work done in getting all things right in the first instance, instead of trying to improve by changes during the progress of construction, or by remodelling after experience in operation. No one can properly build a plant that has not been properly and completely designed. No one can concretely design with hazy or uncertain ideas of what he is designing. If the difficulties met in design are not solved they will usually gain added complications and new limitations as construction progresses.

A complete power plant design is rare. It is never made very quickly. The time for rough and ready methods has passed. The expenditures involved call for the highest skill and the most refined methods of determination. The larger work is being given to those who have equipped for this thoroughness, and those who would succeed must abandon methods in which many of the existing power plants have been thrown together and utilize all of the best-known methods of the art to insure good practice, however much the design of one may differ from that of another.

The engineering developments of the last twenty years have caused power plant design frequently to demand a grade of service beyond the scope of individual effort. Conditions have grown more complex, limitations greater and the necessity of practicing economies more important. Thus the skill of many men and many experiences must often combine to produce results consistent with the best state of all of the arts employed. There are some who fully appreciate this, but more who do not. In it there is food for reflection and an opportunity for any man to take a conservative view of his own personal talents as compared with such service as he might render as one of several engineers of diversified talent co-operating in the design and conduct of extensive work.

When the columns of our engineering press publish the plans of new power plants, with pleasant comments upon them and their designers, it would seem ungracious to dissect them and precipitate critical discussion which might become personal, yet in these columns there have appeared plans of plants in which, by reason of inefficient design of buildings, a large amount of money could have been saved with great improvement to the plants and their housings. In one instance the same cost could have built a better and more suitable building and equipped in addition the entire plant with needed facilities which it lacks. If such facilities were omitted because of expense, it must have been very untrustworthy engineering that could have wasted more than their cost in the inefficient design of the balance. There is a plant in which external fireproof coal storage is provided, and coal and ash handling machinery is installed at large expense, yet the fuel needs to be rehandled by manual labor. It happened also that enough room was wasted within this power house to have held sufficient fuel storage and appliances.

I have known a clever engineer in a few hours of hard work to cut $50,000 out of the cost of a power house design, leaving a stronger and better structure than a less perceptive engineer had created. Hard work pays.

There is scarcely a more important feature for the engineer to keep constantly in mind than first cost—not necessarily the lowest possible first cost, but the warranted cost. This involves judgment, even nice distinction, to secure sufficient quality without waste.

A proper sense of relative cost is also essential to good design, and this can be cultivated by the exercise of care. This sense is not simply the knowledge of costs, as taken from formal estimates, and therefore more or less a matter of exact record even though it is largely acquired by the making and studying of estimates. It is rather the constant accompanying cost sense that should unconsciously accompany skilled design and which leads to no surprises when final estimates are completed.

If there is any notable shortcoming in the engineering design of interurban power plants it is the lack of sufficiency on every hand. It is perhaps found less in foundations, engines and electric generators than elsewhere, but seems ever present in building structures, steam-making appliances and accessories, coal and ash handling, piping, and until very recently in switchboards. In all of the small details of the kind not furnished as articles of manufacture, which are supplied in accordance with the design and specifications, or more often omitted and furnished as found needed, there is a conspicuous lack of sufficiency, which it is the engineer's duty to prevent by fore and not afterthought.

Sufficiency, as broadly used, with reference to a power plant is not easily defined, and while it may be illustrated by specific example it is not the purpose of this writing to attempt the detail of demonstration, but rather to direct engineering consideration by suggestion. Among the power plant features which seem notably to require better engineering than is now usually practiced, are type and sufficiency of power house structures, feed-water purification, feed-water saving, furnace efficiency, steam piping, protective devices for electric circuits and the proper co-relation of all features with each other.

There is no royal road to the elimination of all of the errors and difficulties which beset the path of the engineer, but if he will continually use his best senses and the knowledge of others, who know more than he, and do enough hard work it is probable that he will find a way to do credit to his profession and justice to his clients.

HANDLING FREIGHT AND EXPRESS ON INTERURBAN ELECTRIC RAILWAYS

BY ALBION E. LANG

THE transportation and handling of freight and express by the interurban roads of Northwestern Ohio have presented the same problems and reached about the same degree of development as elsewhere. This feature of electric railway business is generally treated as of secondary importance to the financial success of the roads, hence provision is, or usually has been, made for it only as necessity has actually required.

In practice the term freight is all-embracing, covering all classes and grades of goods and merchandise, perishable and non-perishable, as well as such as are handled by express companies. Freight is usually handled in single cars, and is taken on at stations or sidings, carried to its destination, and unloaded in stations, or in the street, according as means have been provided. In Toledo a central location has been provided, on private grounds, by the city company for the Lake Shore Electric Railway, Toledo & Western Railway, Toledo & Monroe Railway, and Toledo & Maumee Valley Railway, the interurban roads which are now in operation. They enter the city over the tracks of the Toledo Railways & Light Company, having practically a uniform traffic arrangement.

Freight cars run alongside a regular freight house on one side, and a large unloading platform on the other, as shown in the accompanying cut. Six cars can be accommodated at the same time, and room is left for growth. There is ample space for drays to load and unload, the floor of the freight house, as well as the unloading platform, being on a level with the car floor. Cars are run at such hours of the day and night as least to interfere with regular schedules of passenger cars. At present cars back away from the freight station over a Y to reach the proper track for the return trip, but a connection will be made later with tracks on a parallel street, enabling them to be looped in either direction. The freight station faces on Huron Street, and extends through to Superior Street.

UNION INTERURBAN FREIGHT STATION AT TOLEDO

cars switching into the yard from the latter. The property is owned by the city company, and each interurban company is charged a certain rental. There is more than sufficient space available to double the present facilities, both in the way of buildings and platforms. The present freight station is a substantial one-story brick warehouse, the front of which is partitioned off for the office.

The schedules of the several roads are arranged so that the freight cars do not leave the station at the same time. In this way the work is equalized throughout the day, and the tracks are seldom overcrowded. The Lake Shore Electric Railway operates six freight runs, three cars a day each way. The Toledo & Monroe and the Toledo & Maumee Valley have two cars each way apiece, while the Toledo & Western has two runs out of the station each day, but they are double headers, one car for each division.

HEAVY FREIGHT TRAIN ON TOLEDO & WESTERN RAILWAY

FREIGHT TRAIN IN SYLVANIA YARDS OF TOLEDO AND WESTERN RAILWAY

The departure of cars is scheduled as follows:

Toledo & Maumee Valley, 9 a. m., 3 p. m.

Lake Shore Electric, 7:30 a. m., 12 m. and 5:30 p. m.

Toledo & Monroe, 10:40 a. m., 4:40 p. m.

Toledo & Western, 11:45 a. m. and 7:25 p. m., both double headers.

Besides these regular cars extra cars are frequently operated. The Lake Shore Electric sends a special meat car out of Toledo every day, and the Toledo & Western brings a special milk car into the city each morning. Special carload lots are handled at special rates, the Toledo station agent being authorized to give a carload rate over any of the roads. Milk is handled by all the roads at a straight rate of 1½ cents per gallon for any distance. Milk tickets are sold by the general offices and agents of each company. The minimum charge for any article carried is 25 cents.

While the freight traffic of the Toledo interurbans has passed the experimental stage, it can hardly be said to be fully developed, because of the fact that none of the roads has sufficient facilities in the way of cars and power to take care of all the business that could be secured by them were it pushed. Notwithstanding the fact that one interurban, the Toledo, Bowling Green & Southern Traction Company, has not attempted to take any freight business because of lack of power, while the other roads are practically turning down business, through lack of proper facilities, it is claimed that the freight business of the Toledo interurbans already exceeds the express business of the steam lines into Toledo. The reason for the rapidly increasing popularity of this service is the fact that it is practically express service at freight rates. Each road has its own scale of prices divided into classes, charges being made at so much

SPECIAL FREIGHT DELIVERY BY ELECTRIC LOCOMOTIVE

per hundredweight. The class of any article is determined by the regular official freight classification tariff used by all steam roads. The scale of prices for the several roads is shown in the table on this page.

Very little freight or express is carried in combination cars on the lines entering Toledo, but in other sections this is common practice. One agent, with the necessary help, attends to all shipments and receipts at the Toledo headquarters, and is paid by the several roads, in proportion to the tonnage hauled by each. Other expenses, such as telephones, stationery, fuel, etc., are paid in like manner. The freight station is managed by a committee, composed of the general managers of the companies interested. Each year a general manager for the station is elected from the members of this committee, the present incumbent being L. E. Beilstein, general manager of the city company and the Toledo & Maumee Valley Railway. The Toledo & Maumee Valley Company advances such money as is required during the month, and settlements are made each month at a meeting of the managing committee. The city company pays nothing towards the maintenance of the station, but it receives a percentage of the income derived from freight by each road, figured on the mileage handled. The station is in charge of F. W. Fisher, who has had long experience handling freight. He has five assistants in the freight depot, and the car crews aid in loading and unloading.

The business of each road is conducted separately, and there are separate blanks of all kinds, so that although it is a union freight station, it is at the same time practically a station for each road, and is conducted exactly as are the single stations on the several roads. A way bill accompanies each shipment. When freight is received from the consignor a receipt is made in duplicate, one copy

NAME OF SYSTEM AND STATIONS	CLASSES 1	2	3	4	5	6
Lake Shore Electric Ry. Co.						
Genoa	7½	7½	7½	7	..	..
Woodville	7½	7½	7½	7	..	..
Hessville	7½	7½	7½	7	..	..
Gibsonburg	7½	7½	7½	6½	..	..
Tremont	7½	7½	7½	7	..	..
Clyde	9½	9½	9	8	..	..
Bellevue	10½	10½	10	8	..	..
Monroeville	14½	13	12	10	..	..
Norwalk	14½	13	12	10	..	..
Toledo & Western Ry. Co.						
Sylvania	7½	7½	7½	7	5	3½
Riga	10	9	8	7½	5½	4½
Blissfield	11	10	8	7½	5½	4½
Palmyra	12½	11½	9	8	6	5
Adrain	13	12	10	8½	6½	5
Berkey *	11	10	8½	7½	6	5
Metamora	12	11	9	8½	6½	5½
Whiteville	13	12	10	8½	6½	5½
Seward*	13	12	10	8½	6½	5½
Lyons	13	12	10	8½	6½	5½
Densen*	15	12	10	8½	6½	5½
Morenci	15	12	10	8½	6½	5½
Toledo & Monroe Ry.						
Monroe	12	11	8½	7½	5½	4
Erie	11	10	8	7	5	3½
Tol. & Maumee Val. R. R. Co						
Maumee	7½	7½	7	6	5	..
Perrysburg	7½	7½	7	6	4½	..
Waterville	7½	7½	7½	7	5	..

* Prepay station.

FREIGHT TERMINAL YARDS OF THE TOLEDO & WESTERN AT WEST TOLEDO

being given to the consignor and the other kept on file for reference and tracing. When goods are delivered to the consignee a receipt is received in duplicate, a copy going to the consignor. A book of cash receipts and cash disbursements is kept, also a record book of freight bills received. An abstract of freight way bills received and forwarded is sent to the auditor of each road once a month, as well as a monthly balance sheet. There are also blanks for freight over, short or damaged, and for the correction of errors in way bills. Many of the forms used in the freight and express departments of interurban roads are herewith reproduced.

The Dayton & Troy Electric Railway Co.

Abstract of Way-Bills Forwarded.

From .... Office, State of ....

The Dayton & Troy Electric Railway Co.

Statement of Way-Bills Received at .... Office, State of ....

THE DAYTON & TROY ELECTRIC RAILWAY COMPANY.
SETTLEMENT SHEET.

FREIGHT AND EXPRESS RECEIPTS AT .... *STATION*

From .... *190* .... *to* .... *190* .... *inclusive*

DEBITS	Amount.	CREDITS	Amount.
Uncollected bills last report		*Advance charges as per abstract*	
Charges to collect on W. B. rec'd as per statement		*Amt. of uncollected bills as per statement below*	
Amt. of prepaid as per abstract		*Remittances as per statement below*	
Undercharges as per statement		*Amt. of Prepaid beyond*	
Miscellaneous as itemized below		*Deductions as explained on W. B.*	
		Miscellaneous as itemized below	
Balance due Agent		*Balance due company*	
Total		*Total*	

Uncollected Freight Bills to Date.				Remittances of Freight Receipts.			
WAY BILL Date	WAY BILL No.	WAY BILL FROM.	Amount.	WAY BILL Date	WAY BILL No.	Delivered to Messenger	Amount

FREIGHT BILL. No. ......

CONSIGNEE .... STATION ....

To THE DAYTON & TROY ELECTRIC RAILWAY CO., Dr.

Per charges on articles Way-Billed from .... via ....

DATE OF WAY-BILL. 19

NUMBER OF WAY-BILL.

CONSIGNOR.

Original Point of Shipment.

Connecting Line.

No. of Pkgs.	ARTICLES AND MARKS	Weight.	Rate.	Freight	Advances

Received Payment, ... Agent. Date 19

TOTAL TO COLLECT. DRAYAGE.

Original paid Freight Bills should accompany all claims for over charges, loss or damage.

FREIGHT RECEIPT. No. ......

CONSIGNEE .... STATION ....

To THE DAYTON & TROY ELECTRIC RAILWAY CO., Dr.

Per charges on articles Way-Billed from .... via ....

DATE OF WAY-BILL. 19

NUMBER OF WAY-BILL.

CONSIGNOR.

Original Point of Shipment.

Connecting Line.

No. of Pkgs.	ARTICLES AND MARKS	Weight.	Rate.	Freight	Advances

Received the above described property in good condition. .... Consignee. Date 19

TOTAL TO COLLECT. DRAYAGE.

The Dayton & Troy Electric Railway Company.
RECEIPT BOOK.

DATE.	WAY BILL		WAY BILLED FROM	WAY BILLED TO	RECEIPT.

The Dayton & Troy Electric Ry. Co. Via FREIGHT / Via EXPRESS

Freight and Express Department.

Way Bill No. .... 190 ....

Freight Way Bill from .... *to* ....

No. Pkgs.	ARTICLES	Rec'd from	CONSIGNEE.	DESTINATION.	Weight.	Rate Per Cwt.	Advanced Charges	Our Charges	Total to Collect	Amt. Prepaid	[illegible]	Received the property, herein described [illegible]

The Dayton & Troy Electric Ry. Co. Via EXPRESS

Freight and Express Department.

Way Bill No. .... 190 ....

Money Way Bill from .... *to* ....

No. Pkgs.	ARTICLES.	Rec'd from	CONSIGNEE.	DESTINATION.	Value.	Rate Per $100	Advanced Charges	Our Charges	Total to Collect	Amt. Prepaid	[illegible]	[illegible]

FORMS AND HEADINGS ADOPTED BY FREIGHT AND EXPRESS DEPARTMENT OF THE DAYTON & TROY ELECTRIC RAILWAY

The Lake Shore Electric Railway started its freight business in January, 1901. At present its freight cars operate only to Norwalk, but it is expected that in a short time the through business to Sandusky and Cleveland will be opened up. The Toledo & Monroe Railway, 22 miles in length, commenced freight operations in July, 1901. It is being extended to Detroit. The Toledo & Western commenced operations to Sylvania in September, 1901; at present 60 miles of road are in operation, one branch extending to Morenci and the other to Adrian, Mich. The Toledo & Maumee Valley has 21 miles of road, including a branch to Waterville. It commenced to carry freight on March 1, 1902, when the freight station opened for business. It will be seen, therefore, that it is too early to make

TRANSIT RECORD.

Every Messenger, Agent and Transfer Man through whose hands this Way Bill passes must stamp his name and check mark in regular rotation hereon.

MESSENGER.	*Ck. Mk.*
1	
2	
3	
4	
5	
6	

NOTICE.

Every article (either freight or express) must be accompanied by a Way Bill and if received en route or at destination without same it shall be the duty of Agent or Messenger to make an "Over" Way Bill from the marks on the package.

NOTICE TO MESSENGERS.

This W. B. must be delivered to Agent at station named on opposite side. In case the goods are delivered by messenger it shall be his duty to receive consignee's signature on face of Way Bill before turning same over to Agent.

BACK OF FREIGHT AND MONEY WAY BILLS

No.______

The Dayton & Troy Electric Ry. Co.

FREIGHT AND EXPRESS DEPARTMENT.

$______ *Amount of Bill for Collection.*

$______ *Charges for Return of Money.*

$______ *Total Amount to be Returned.*

From______

On______

Date of Shipment______19

C. O. D.

Bill to be Collected on Delivery of Goods.

Goods Way Billed to______

NOTICE TO SHIPPERS.

Goods received by this Company subject to C. O. D. are accepted only under conditions of its Receipt and Instructions to its Agents. If delivery of goods cannot be effected within 30 days, on account of inability to collect the amount due on them, the shipper agrees that the same may be returned to him and that he will pay the charges for transportation both ways, and that liability of this Company for such property while in its possession for the purpose of collection, shall be that of warehouseman only.

NOTICE TO AGENTS.

All employes through whose hands this C. O. D. passes will be held responsible for the same and must adhere to the Company's instructions concerning C. O. D. matter, as given in book of rules.

REMARKS

Counted and Sealed by

AGENT'S MEMO. ON BILLS TO BE COLLECTED

comparisons as to the growth of monthly shipments and receipts of freight on any of the roads, but the following figures for the month of June, 1902, are interesting:

	Receipts in pounds	Shipments in pounds
Lake Shore Electric Railway	226,573	803,644
Toledo & Maumee Valley Railway	56,574	241,570
Toledo & Monroe Railway	232,003	272,755
Toledo & Western Railway	350,712	804,378
Total Toledo Station	865,862	2,122,347

The tonnage received at the electric freight station during the month of July was reported by the management as follows:

	Pounds
Out-bound	2,416,390
In-bound	854,291
Total received and forwarded	3,270,681

These figures do not include the carload shipments which are made over the Toledo & Western from its terminal station in West Toledo, neither do they include similar shipments which have been made over the Lake Shore Electric Railway outside the city limits.

An interesting feature of the statement is that the outgoing shipments are more than double the receipts, and that they are constantly increasing at a much greater rate. At first glance this might be taken to indicate that the enterprising merchants of Toledo have been more prompt to realize the benefits of the new system than the citizens along the several roads, but, as a matter of fact, the contrary seems to be true. The country store keepers, who, in the majority of cases, pay the freight bills, make a point to order goods purchased in the city to be shipped by interurban express. The reason for this is evident. The country merchant steps to his telephone and calls up the Toledo wholesaler, directing that the goods be sent on the next car. It is an everyday occurrence for merchants in Adrian, Mich., or Norwalk, the latter 65 miles from Toledo, to order goods in the forenoon and have them delivered in the afternoon. With sharp connections on the part of the wholesaler it is possible to deliver goods within three hours at any of the towns in this large zone. Some of the good housekeepers in a large city have waited longer for a basket of groceries from the corner store.

The plans for the future point to the development of this utility in new directions. Some of the Toledo wholesalers are agitating the question of laying spurs into their shipping sheds, thereby shortening the time of delivery and saving drayage. The Toledo managers are also seriously considering the purchase of inexpensive box cars to be used as trailers. The idea is to have them built similar in appearance to the present freight cars, and to be drawn by the electric cars, one at a time. Under this plan the several roads could interchange carload shipments. For instance, when the Lake Shore Electric Railway is completed carload shipments could be made from Cleveland to Detroit or to Adrian, Mich.

So much for the interurban lines entering Toledo and the freight and express business of that territory. There are many other sections of the country in which similar de-

velopment may be noted. It will be especially interesting to refer to the efforts that have been made by individual companies, including some that are not favored with the patronage of large cities. The experience of the Cleveland & Eastern Railway in developing the package freight business of the section in which it operates, was very thoroughly described in the STREET RAILWAY JOURNAL of May 31. This road passes through a farming country and has developed a large milk carrying trade.

FREIGHT BILLS PAYABLE ONLY IN BANKABLE FUNDS.

NOTICE.

Freight Office Dayton & Troy Electric RAILWAY CO.

........................190....

....

There has arrived at this Station, consigned to you

from..

the following articles, viz:

....

....

....

....

....

No. Car................**Weight**................

Which are ready for delivery to you on payment of Freight and Charges, $................

Make Checks payable to "Order D. & T. E. R'y. Co."

N. B.—All Freight Bills to be paid before the Goods are removed from the Station.

The contract of this Company, as common carriers, ends upon the arrival of Goods at our freight stations; and if consignees are not then ready there to pay charges and receive the goods, we dispose of them in the best manner we can, and hold them as gratuitous warehousemen for twenty four hours from the time they arrive, subject only to the risks of such warehousemen.

The Company will not be responsible for Damage from ordinary Leakage, Breakage or insufficient Cooperage; and no Damage will be allowed after the Goods leave the Station, unless by consent.

..................................Freight Agent.

☞ RETURN THIS NOTICE.

NOTICE OF FREIGHT AWAITING PAYMENT OF CHARGES

LOCAL POINTS
OF
Dayton & Troy
ELECTRIC RY.

Piqua
Farrington
Eldean
Troy
Cowlesville
Tippecanoe Cy.
Evanston
Ginghamsburg
Vandalia
Chambersburg
Ebenezer
Dayton

........................190....

To..

....

Hereafter and until further notice we especially desire that all goods ordered by freight consigned to points on the D. & T. Ry. be shipped via that line when practical to do so.

....

(OVER)

NOTICE TO SHIPPERS

The Steubenville Traction & Light Company, of Steubenville, Ohio, recently established a freight department, but the volume of business handled is as yet rather small. The management reports, however, that the indications are favorable, as the service is appreciated quite generally. Unlike the Toledo practice, freight is handled on this road in combination cars, and in the principal towns along the line stations have been established, but the company does not as yet maintain delivery wagons. The rates are not so high as the express rates, but are slightly in advance of the steam railroad freight charges. This is permissible, as the service is much superior to that of the steam lines. Blanks used by the large shippers and also the duplex excess tickets, which are carried by the conductors on the line and issued for all small shipments, are reproduced, together with a photograph of one of the combination cars which are operated in this service. These cars are of the following dimensions: Length of body, 30 ft. 9 ins.; length of platform, 4 ft. 5 ins.; length over bumpers, 40 ft. 8 ins.; width over all, 8 ft. 2 ins. The baggage room is the length of four windows, about 11 ft. 6 ins. The passenger compartment is finished in white birch.

The Dayton & Troy Electric Railway Company, of Piqua, Ohio, has developed a very satisfactory system of accounting for freight and express service, which may prove valuable to other lines of a similar character. Way bills are made in duplicate by having every alternate sheet in the pads plain, cheap paper, and using carbon paper between the sheets. There are two styles of way bills—freight and money. Every article transported must be billed whether company business or not. The messenger has a receipt book in which he takes a receipt for every bill delivered. The goods are checked by the bills in practically the same manner as is done by the express companies. When goods are delivered by the messenger before reaching the station he gets the consignee's receipt in the space provided, but when delivered by the agent an expense bill is made. Settlement is made every ten days by the agent on blanks specified as "Abstract Statement" and "Settlement Sheet." Two classes of service have been developed, freight and express, and these are indicated on the way bill. In larger stations the company has its own wagons for express service, but in the smaller places it pays 20 per cent of the charges for delivery to the parcel delivery wagons. It has through billing arrangements with the Southern Ohio Express Company, which operates on the Southern Ohio Traction Company's cars, and its express

FORM TO BE SIGNED BY SHIPPER, COPY SENT TO THE CONSIGNEE AND THE THIRD, SIGNED BY AGENT, KEPT BY SHIPPER AS RECEIPT

DUPLEX FREIGHT TICKET

rates are considerably under those of the old express companies, being calculated on the regular graduated scale. The freight rates are about one cent under those of the steam roads. Two 55-ft. freight cars are employed. One of these makes two round trips every day between Piqua and Dayton. It runs on a schedule and is handled by two men. The company has a freight classification which is identical with the regular railroad classification, and rates are fixed accordingly. Arrangements have been made for way billing freight through on the lines of several of the traction companies which enter Dayton, by a division of the charges and sharing the expense of transfer.

COMBINATION CAR OF STEUBENVILLE TRACTION & LIGHT COMPANY

The Mahoning Valley Railway Company, connecting Youngstown, Warren, Niles, Girard, Lowellville, Struthers, Mineral Ridge and Leavittsburg, Ohio, has developed considerable freight and express business in its territory. At this time it is operating two closed cars, built especially for freight and express service. There are three men on each car, the conductor, motorman and laborer. Freight depots have been located in each city and village through which the line operates; but these stations are planned differently, owing to varying conditions. In Warren, Ohio, space is rented, for instance, in a shoe store, and the shoemaker looks after the freight business. At Niles a depot has been built especially for freight business in connection with the company's power house, and the man who acts as despatcher at that point looks after freight and packages. At Girard, Struthers, Lowellville, Ohio, and New Castle, Pa., the company has buildings of its own, which are used as passenger and freight depots. At Youngstown, Ohio, and at Edenburg, Pa., there are freight rooms in connection with the stations, the despatcher looking after the freight. The company does not maintain delivery wagons, neither does it use combination cars. The policy of the management is to keep the passenger traffic entirely distinct from the freight business, as it believes that otherwise positive damage is done to one, while the development of the other is greatly retarded.

The package freight business of the Cincinnati, Dayton & Toledo Traction Company, formerly the Southern Ohio Traction Company, is conducted by the Southern Express Company. When the Southern Ohio properties were first consolidated the express business was placed in the hands of the Wells-Fargo Express Company on the same basis that it operates on steam roads. The net returns to the traction company were not satisfactory, however, and it was decided to conduct the business itself. The Southern Ohio Express Company is a distinct organization, incorporated with a nominal capital stock of $2,500. The traction company furnishes the cars, crews and power, and receives 10 cents per car-mile for the mileage of the freight cars. At present the company operates two 35-ft. freight cars between Cincinnati and Dayton, making two trips each way per day. Appreciating the possibilities of this business the company adopted at the outset a broad policy, purchasing thirty first-class wagons and teams, sending out numerous solicitors and establishing stations in the leading towns in the territory it intended to occupy. For a time the net loss was quite large, but persistent efforts turned the tide, and this year it is estimated that on the present basis, the net profits of the express company will be about $10,000 for the year. During the last few months the gross receipts have amounted to between $3,000 and $4,000 per month, and it is now making such substantial gains that it will soon be necessary to purchase additional freight cars. The company uses the traction company's passenger and terminal stations in Cincinnati, Hamilton, Middletown, Franklin, Miamisburg and Dayton, paying half the expenses of the maintenance of the station in addition to maintaining its own agent. Under this arrangement the operating expenses amount to about 75 per cent of the gross receipts, leaving a surplus of 25 per cent, which is going toward the reduction of previous losses and for improvements to the service. Of course the traction company derives a good profit under the arrangement.


MILK TRAIN ON CLEVELAND & EASTERN OHIO

As before stated, delivery wagons are maintained in all the leading towns, and in Cincinnati and Dayton the wagons have regular routes, making four trips per day, to over 1500 leading business houses. The business is closely

followed up by solicitors, and country merchants along the line, in ordering from jobbing houses and city merchants, direct that goods shall be shipped by this route.

The company has an arrangement with the Dayton & Xenia, the Dayton & Troy, Dayton & Northern, Dayton, Covington & Piqua, Dayton, Springfield & Urbana, and

SOUTHERN OHIO EXPRESS CAR AT CHAUTAUQUA GROUNDS, BETWEEN FRANKLIN AND MIAMISBURG

Dayton & Western roads, whereby goods are shipped clear through to points on these lines, the receipts being prorated according to the mileage handled. With some of the lines the company has an arrangement whereby their express business is handled in Dayton. In shipping to Springfield goods are sent to Xenia over the Dayton & Xenia, and then to Springfield over the Springfield & Xenia, the reason for this roundabout route being that the last mentioned line is controlled by the same interests as the Cincinnati, Dayton & Toledo. Recently a carload of ponies was

SOUTHERN OHIO EXPRESS CAR AT MIDDLETOWN

shipped through from Cincinnati to Springfield by this route, but no effort is being made to work up this class of through business. By reason of the fact that the various interurban roads entering Dayton maintain independent freight stations, it is necessary to transfer through shipments, and a union freight terminal, which has been talked of for some time, would effect a great saving of time and expense of transfer. At the present time the Western Ohio Railway, which is controlled by the same interests as the Cincinnati, Dayton & Toledo, is conducting a package freight business on a small scale. As soon as this line is completed to Piqua, affording connection with the Dayton & Troy Electric Railway, it is probable the Western Ohio freight business will be handled by the Southern Ohio Express Company, and goods will be shipped through from Cincinnati to Lima and later to Toledo.

The experience of the roads whose methods and equipment have been described may be accepted as fairly representing that of similar systems in other parts of the country. Of course it is well known that the amount of freight and express to be carried by the interurban road, and the profit arising therefrom, cannot be estimated in advance with the same degree of certainty as that of passengers, hence it is not usual, nor would it be wise, to invest great capital to provide for it until circumstances indicate its possibilities.

The Toledo & Western Electric Railway, now entering Toledo, which has been mentioned before in this article, traverses a territory not touched by steam roads, and it is carrying all kinds of freight in single cars and trains, and realizing, it is claimed, a fair profit. But there are few electric roads similarly situated. The value of the ordinary electric road, however, does not depend upon its ability or capacity to carry freight or express. Its value is only enhanced thereby. It should develop the business of carrying freight and express as rapidly as can be done with fair profit, and trust to the future for improved methods for enlarging and improving the same. Right here then is where the builders and operators of interurban roads should exercise the greatest scrutiny and judgment.

The originator or promoter always calculates upon deriving a considerable revenue from the carrying of freight and express, but it appears to me to possess many elements of uncertainty at the present time, where there is steam road competition. Express matter, at express rates, in sufficient volume to demand the full use of a car, or cars, will undoubtedly make an adequate return on the capital invested to provide for it.

The question whether express matter shall be handled by the road itself or entrusted to a company to be owned or controlled by the same ownership, demands careful consideration. In some cities the several interurban roads have formed express companies among their own stockholders, to do business under contract with these roads, thereby separating the liability and securing more efficient management, and at the same time retaining practically all the profits arising therefrom. The wisdom of so doing, however, must depend largely upon local conditions. The time will come when existing companies will be eager to secure contracts with electric roads on terms as favorable, if not better, than they now have with steam roads.

But as to the profit of carrying freight at steam road freight rates there is great doubt, unless cars can be operated in trains and exchanged with intersecting steam or electric roads, as is now done by the steam roads.

If necessity be indeed the mother of invention, we may reasonably expect that the future will provide means and methods of making the freight and express business of the Interurban Electric Railway much more profitable than present conditions seem to indicate.

THE ACCOUNTING DEPARTMENT OF INTERURBAN RAILWAYS

BY W. B. BROCKWAY

THE evolution of cheap transportation for short distances which has occurred during the last half century has been remarkable. The rapid changes from the omnibus of fifty or less years ago through the horse car, the cable system and the steam elevated to the electric system of to-day has made it possible by the rapidity and cleanliness of the latter to link towns and cities together by interurban systems and to fill up the spaces betwen them with houses and factories.

There is one branch of the operation of these systems which has had its problems to solve and its sleepless nights, too, but the public has seen very little of them. Each change of method in operation has caused the accounting department to make its changes accordingly. And while the financial and operating men have been cognizant of the changes, the general public has not marked it, except when, here and there, a company has added another title, that of auditor, to its list of officers. But even to-day the sweeping growth of this recognition can only be gained by comparing the official lists of officers for the recent year of 1895 with the present year. That this recognition is appreciated by the accounting officer goes without saying.

When the first interurban companies were formed they had no precedent to guide—or confuse, as you please—and, as the operating department made its first endeavors of operation along the lines of purely urban companies, the accounting department naturally tried it also. The accounting department worked faithfully along these lines some time, and as late a date as 1897, when the statement was made that "interurban and street railway accounting in the details of the operation are dissimilar, while interurban and steam railway accounts in the same way have more in common," it was received doubtfully. But suddenly, caused somewhat, no doubt, by steam competition, it was recognized that almost the only similarity between urban and interurban roads was electricity as a motive power, and the running over a short mileage of city trackage. Then the pendulum swung to the other extreme, and to-day we have interurban cars operated by train despatchers, substantial station buildings, cattle guards, air brakes, mileage tickets, express, freight and baggage cars, rotary snow plows and numerous other conditions which have made it necessary to have accounting in accordance, and so interurban accounting became a class by itself.

When this change or awakening came there came success and the companies multiplied. It is quite true that the accounting department has kept pace with its new conditions, so that to-day an accountant must approach the requirements of an interurban company in a somewhat different frame of mind than he would one strictly urban.

In planning the system of accounting it must be, of course, governed somewhat by its local conditions, but the prime importance is simplicity; a simple system can always be worked to the final results very much quicker, and the conclusions reached are usually more accurate, because the chances of confusion among the clerical force are lessened. The importance of this prime factor cannot be overdrawn, for the operating department is guided by the records of the accounting department, and wrong plans are easily made, if based upon inaccurate figures.

Another general rule of the accounting department of an interurban line should be, and it easily agrees with the argument for simplicity, to be in a position to furnish upon request operating information seldom asked for. In other words, the accountant should understand the business so well that he will foresee the needs of the operator and be able to assist him promptly. The old criticism that the accounting department "does not produce business" has been broken down, and money is well spent in the accounting department now-a-days if it is not merely a recording medium, but helps by intelligent work to make operating savings.

It is being understood better now than formerly that the reports and records made by conductors and others out on the road should have as little work in them as possible, for the reason that the men from whom the information is required are rarely well equipped by nature or education to grapple anything requiring careful writing or figures. They may be well trained in other directions, but not many of them could hold a place in the office. And so it is well to keep as much as possible of the real work in the office, and the result will be quite satisfactory, for the reason that if little is required from the outside men, that little will be given truthfully, but if much is insisted upon guesswork and hence inaccuracy will permeate much of the office work

The standard classification of construction, equipment and operating expense accounts of the Street Railway Accountants' Association of America is really standard, and with few changes, which it is flexible enough to allow, it is adaptable to the needs of interurban conditions. Its use is earnestly advised for the reasons so well argued since the organization of the association, which have been so publicly spread that there is no need of repeating here.

The great percentage of the passenger income of the company comes, first, from the cash collected on the cars while they are in motion, and second, from the commutation or reduced rate many-ride tickets sold by agents. The first is the more important, not only for the reason that the largest income is from that source, but it is an income coming through the hands of a more or less selected set of agents, conductors, but it comes to the company in various combinations and under conditions trying to the conductor with the operating duties required by his work Therefore, simplicity is again urged in the composition of the ticket.

The forms of the tickets used are as numerous as the roads in operation, and it is an extremely difficult situation to face; for instance, if each station, or fare point, has its set of tickets reading to every other point, each conductor must be supplied with a quantity of each, and he then becomes the custodian of tickets representing a considerable sum of money, which is a serious risk on the part of the

company, or else he should pay for the quantity and remunerate himself when sold, which is quite prohibitive under usual conditions. Again, the system is so easy of manipulation in the conductor's favor that it is not necessary of explanation here. This plan is expensive and cumbersome and is still open to the criticism that if a conductor meets a sudden traffic between points of which his supply of tickets is low, he has a condition to face which is not at all pleasant to him or to the patrons of the line.

Another plan adopted by many companies is the zone plan of making the fare 5 cents between points, at each point of which the conductor has to make a collection of 5 cents, ringing each on a register. The company then has a report from the conductor of the number of rings each day and the money thus called for. This plan is open to objection, as it eliminates the return ticket at a reduced rate, which is very popular with the public; moreover, it is a constant source of annoyance to the passengers, especially on crowded cars running on a rapid schedule, and half fares must also be recorded in a different manner. The plan has its good points, however, for if a conductor passes a passenger during the first zone he is liable to reach him the second, and a passenger can change his mind as to his destination as often as he pleases. To the operating department it is objectionable, for the reason that it makes a traffic statement impossible. This statement will be considered later.

The duplex method of collecting fares is so called because each fare collected has two tickets made simultaneously by the conductor, one half being given to the passenger and the other going to the office to substantiate and check the money turned in by the conductor, the station from and to, etc., being shown by the conductor's punch. The different form these tickets take is multitudinous, some good, some fair, and some wretched, in their operation. I have seen some requiring the conductor to make eight punches for each fare, which is too much work for a large and changing load. One form I have seen in use was designed by a left-handed manager, and the difficulty experienced by the right-handed conductors in handling the ticket can be easily imagined.

Other forms have simply a series of figures representing dollars, dimes and cents, the stations from and to not being considered. Others have the stations from and to perforated in such a manner that the ticket is parted at the proper place, the one section going to the passenger and the other to the office. There are so many forms that they cannot all be explained here, nor their points considered, but all things possible considered, and in view of experience, it seems that if a ticket is used it should be of the duplex style, in some of its phases, for the conductor is then given a pad of tickets at no cost, or rather investment, on his part, and he settles for them in accordance with his reports.

The composition of the ticket is subject to local conditions, that is, the number of fare points, the size of the excursion business, etc., but if the number of stations is not too large it is quite possible so to construct a ticket that the station from, the station to and the amount paid can be shown by one punch mark. If the policy of the company permits round-trip fares it is rather better to make the one-way ticket and the round-trip ticket identical, except to the reading, "good for one round-trip ride, etc.," being substituted for "good for one ride, etc.," and the color of the paper used, white doing very well for the one-way tickets, and red, or some other color distinguishable in uncertain light for the round-trip tickets. At any rate, the form adopted should provide for the definite showing of the beginning and ending of the passenger's ride and the amount paid.

It is not at all necessary, when tickets are used, to add to the work of the conductor the use of a register for each fare collected, as the register then becomes merely a counter of passengers, and that information can be readily found by the beginning and ending numbers of the tickets sold each day. On the other hand, the register can be used for recording the local fares collected in each town en route, but if this is done and the number of local city points is more than one, then no record of fares for use on the traffic sheet can be made without a reading of the totalizer at each point and recording this reading properly on the conductor's report. This adds to the work and possible confusion of the conductor.

There are those who think and substantiate by good arguments that the conductor should have no tickets to use, the different rated fares being recorded within a register which is much more than a counting machine, and further that the conductor should not make up a report of what he has done during the day, but leave that also for the register to tell. In other words, his duty should consist simply of turning in the amount of money collected during the day, the register being opened by an employee of the office, and the amount of money recorded and turned in, compared. As said above, this plan has much to commend it, but it is also subject to the "traffic-statement" argument, and makes the sale of round-trip tickets by the conductor a rather difficult matter. There is no doubt, however, that with some men the desire to do right is governed very much by their opportunities to do wrong, and the methods of reporting fares collected should be safeguarded very carefully.

The commutation many-ride reduced-rate ticket is another problem which needs most careful attention, not only for its proper accounting, but it has been a common experience that rates once reduced are not easily put back to the old condition; hence, a commuter's ticket once put on sale is pretty liable to stick, if not spread to other stations. The common tendency is to overdo the matter, and it soon develops that the conductor has tickets of many sizes and colors to handle and report. The mileage ticket solves much of this problem if the time is given the conductor to detach and mark the stations on the back of the detached strip (for checking and for use on the traffic statement), but the average time consumed in collecting a mileage strip for short hauls and the danger of loss to the conductor by the smallness of the strip and its flexibility make it the subject of much provocation to him and to the office in checking.

It is the writer's opinion that the ticket containing numbered squares for punching by the conductor, one punch for each ride, should never be used; the conductor should always have something to show for every fare, and this will also apply to the annual card pass They contain dangers to the company and to the record of the conductor which make them and their kind a dangerous element which can easily be avoided, and they should be.

The coupon book is good for commutation uses, if colors are used, but wherever possible each coupon should recite the stations included. These tickets are better sold by almost anyone than the conductor, and when sold by agents or in the office they should be subject to a daily report and remittances. It is always preferable that the cover of the book and the agent's report should recite the name of the purchaser, to guard, when it is deemed necessary, against indiscriminate use. The conductors always learn to know their passengers if regular travelers, and it adds a safeguard to a condition which needs all the checks that can be placed about it.

The traffic statement should be prized by the operating department next in importance to the statement of income and disbursements; it occupies the place to an interurban road that the traffic curve does to the urban. It is subject to many ways of handling, but it may be drawn off into squares as follows:

The upper figures in each square show the one-way tickets, and the lower figures, the round trips. Added across the figures give the one-way and round-trip tickets sold from each station, and added down they show the same information to each station. Reference to a particular statement or series of statements gives the operating department information it really needs for its regular or short-distance cars, concessions regarding the reduction of fares, and the many other matters which are governed by the amount of traffic from and to each station. The commutation rides can be easily added in in red ink, which places the manager in as actual touch with his traffic as he is with his operating expenses.

It should be borne in mind that the figures used in the above example are purely fictitious, but should they come out as shown, the manager is at once placed in contact with the fact that something is wrong with his schedule and, all things being equal, he can find the trouble easily, which, when remedied, the statement quickly improves accordingly. Much other information may be added, making the statement still more valuable, and it is all accomplished with but little extra labor when the system is arranged. Even though it should require the extra expense of a cheap clerk to work up, what road would not spend the small amount necessary to get such positive information.

The statement is based upon the tickets (duplex half) turned into the office by the conductor showing the stations, and they are simply assorted after the conductors' reports are checked by the same tickets.

The reports required from the conductor should be simple as possible to make them effective and accurate, but in a general way they should contain the date, car number, trip number, schedule run number, time out, time in, hours and minutes of service claimed, his name and that of his motorman, with space for another, to provide for at least one change of motormen, their badge number, the opening and closing number of his tickets, the total number of each value of ticket regardless of destinations, a lump number of free tickets and a lump number of all kinds of commutation tickets, the total paying passengers carried (to be checked by the difference in his ticket numbers), the total freight or parcel tickets sold (also checked by the numbers reported), and the total cash. Upon the back may be placed the time of passing the different large towns (not small stations), say the two terminals and one point between for verification of accident claims and perhaps a sometime check by schedules, and it is frequently desirable to have the conductor punch the report in one corner as a record of the punch he is using. This information is much easier for him to give than it looks when written out, and it may all be done without taking much

RAPID TRANSIT COMPANY.
Traffic Statement Week ending June 7, 1902.

From \ To	Hometown	Smithwood	Proteus	Brown Farm	Comus	Jackson	Total from
Hometown	Local / 1000	100 / 20	10 / 40	3 / 5	90 / 310	340 / 600	543 / 975
Smithwood	90 / 32		11 / 20	1 / 0	12 / 2	18 / 10	135 / 64
Proteus	110 / 52	4 / 7		0 / 2	1 / 10	4 / 17	119 / 88
Brown Farm	2 / 10	0 / 0	0 / 0		0 / 1	2 / 0	4 / 11
Comus	72 / 100	2 / 0	2 / 1	3 / 2		90 / 140	169 / 243
Jackson	302 / 408	2 / 4	1 / 5	7 / 3	98 / 46	Local / 107	410 / 466
Total to	576 / 602	108 / 31	27 / 66	14 / 12	201 / 369	454 / 767	1380 / 1847

Cars per day . . . . 5 Trips per car per day . . . 9 Trips per day . . . . . . 45 Equals 315 trips for week average 13.76 passengers per trip.	Hometown Local	1000
	Jackson Local	107
	Total Carried	4334

Street Ry. Journal

PROPOSED FORM OF TRAFFIC STATEMENT

time. His duplex tickets being assorted by values for use in his reports regardless of their serial number, become an assistance to the accounting department in checking the report. They have then to be assorted serially in the office to see that none are missing, in which case, should one not be found, he should be required to produce it or pay the highest possible value of the ticket.

The duplex tickets having no actual cash value when issued to the conductor, a simple receipt from him for the pads should be taken and his name written in a book having one hundred numbers printed in a vertical line, his name appearing at the top of the column; then, as the tickets are assorted serially, regardless of the issuing conductor, it is a matter of a few minutes to erase from the record columns the numbers returned each day and an open number quickly shows itself. This book is always a positive check upon the tickets due from a conductor leaving the service. It should be understood that the serial hundreds of the ticket numbers are written at the top of the columns, rather than keeping each conductor's tickets by themselves, as this shows up the possible omission of a whole pad.

The general record of passenger earnings is a serious question, but it seems as though very much labor may be saved and information gained if the time table trips, not runs, be numbered and the record made of what each trip

accomplished in general totals; by this is meant that the whole number of paying passengers, except local city fares, should be shown as a total in passengers and money. It is better to show each local town or city 5-cent limit in its own column; then by showing the number of parcels and its money, in the case of a small road, the whole income by trips is arrived at upon one page. A recapitulation of the day's totals for each column will show the passengers carried and the earnings for each day, and by the use of totals brought forward it is possible immediately to show the results to date.

This brings up the question of whether it is better to require daily reports and daily remittances, or a trip report and a trip remittance. I am of the opinion that a report and remittance for every round trip is better, as it reduces the amount of money carried by the conductor, and makes the checking work of the department easier.

The envelopes in which the deposits are made need not bear anything but the date, the conductor's name and the trip number, and they should be large and strong enough to contain the trip report, the tickets (bound by a rubber band), and the money. In consideration of the frequency of deposit, the number of tickets as evidence and the usual lack of time in which to make the return, it seems that the receiver system, or, in other words, the system of counting and checking before the conductor, is not adaptable to this class of work. In addition, there are reasons overshadowing the satisfaction of the conductor for having as much of the work of this department done in the office as can be arranged. It is always better to give the auditor the actual supervision of the accounting work.

Each day's trip sheets, which, by the way, should be printed on paper, rather than on cards, should be fastened together and filed by months in a package away from the dust, and kept forever. It seems best that they should always be accessible for possible checks by professional accountants, and they frequently form an important basis for the sale of the property.

A copy of each change in schedule should be attached to the page of the earnings-register the day the change occurs, so that an understanding may be had of the precise operation of a trip number.

We now reach in our sketch of the accounting department of interurban railways a new source of income, or shall we call it a by-product? I call it "new" advisedly, because it seems to have been hardly considered or anticipated in the planning of the first companies—that income is from freight, express and mail transportation. The methods adopted in this work have been as remarkable and as changeable between companies as the kinds of tickets used in the passenger business. In other words, we find companies still doing as they did some time ago, when the first farmer asked them to take a barrel of apples to town for him, as he couldn't go along, saying Mr. Jones, the grocer, would meet it at the office. It is easily within memory when the first request of this kind occurred how the conductor took the barrel, but he didn't know what to charge, and if he could guess he didn't know how properly to report it to the company.

There are many roads to-day which charge 10 cents a package—at owner's risk—regardless of the size or weight, which have made little or no provision for the proper report to the office of such income, and which have no method of package identification; no record of transportation, nor all the other checks, records, tariffs and reports used by all the rest. And here again appears the comparison with steam railroad practice, for by the changed methods some of the companies have closely reached the basis of steam railroad accounting with the difference coming from another power of movement and the extremely local character of the business.

It also develops a difficulty that is quite real and positive to the accounting department, for, unlike the passenger part of the business, it seems that the more the freight business grows, the more there is needed a complete record of the consignor, consignee, commodity, rate, weight, car number and the other information long ago adopted by the steam roads, so that in an article of this kind which aims to cover the general subject it is quite out of the question to give suggestions to fit the conditions, except in the most general way. However, it may be accepted that where the freight and express business is small with cash collections at point of shipment a very simple system of accounting is most desirable, something, for instance, in the nature of a duplex tag bearing the address, and into which may be punched by the conductor such general information as box, barrel, bag, etc., with the places from and to and the amount paid. One-half of the tag should go to the office with the conductor's money and report, and the other should be attached to the freight, to be detached at delivery, to bear the receipt of the consignee upon its back and to be returned to the office for safekeeping and proof of delivery as against claims of loss, etc. These tags should be numbered, and the non-appearance of any particular one should be inquired into and explained. In this, as in the handling of tickets, those spoiled should be returned to the office, instead of making an attempt to correct them, as this latter course is always liable to, and usually does, result in arguments and unpleasantness between the patron and the company. Enough unpleasantness is sure to arise anyway, so it is better to forestall all that is possible.

But in the case of larger business, where, for instance, freight cars are run on a regular schedule, a more complete system becomes necessary, especially when regular agents and stations are maintained along the line. Then there opens up the need of positive record, for the traffic has now become "freight," as distinguished from "light package" business, and frequently "carload" shipments are made, making a difference in the tariff, as compared with "less than carload."

A positive schedule of rates for differing commodities now is a necessity for the governance of agents and conductors, and the accounting department should add to its duties a rate checking desk, upon which must go the records of all business for checking, the same as the conductors' reports of passenger traffic are checked by the money counters.

It seems, in the face of a large business, which frequently crowds the passenger business for the supremacy as the largest producer of gross income, and to the frequency of "collect" shipments, together with the necessity of "returned empty" shipments as applied to milk cans, beer kegs, etc., that there should be applied the system of regular way bills copied in duplicate in the forwarding agent's book, one tissue copy going to the general office

and the way bill to the conductor, and thence to the receiving agent, each making a record to show the proper handling in his hands, and all eventuating in a "freight receipt" and "freight received" notice to consignee at the destination. All this brings into use the system of abstracts made daily, weekly or monthly by the forwarding, and also by the receiving agent, showing the date of shipment, way-bill number, commodity, weight, rate, amount paid and amount to be collected.

The amount collect on the abstract of the forwarding agent should agree with the amount paid on that of the receiving agent's abstract, plus the undelivered freight still on hand. It, of course, appears that an abstract should be made for each station to and from.

Then comes the filing of way bills at the receiving station, the checking in upon the way bill of freight received, the "over, short and damaged" report of received freight, and the numerous other conditions of money and traffic which soon call for the work of a traveling auditor who makes periodical and unexpected examinations for the assistance, not only of the accounting department, but of the operating as well, for an agent who cannot fill the requirements of the accounting department can rarely be a help to the operation.

This enlargement of business calls for a like expansion of the accounting department, for records must now be kept that were unnecessary a few years ago, and the abstracts from the agents must be checked by the way bills' tissue copy, as sent in daily, so that a recapitulation of them may form an accurate basis of record as the income from freight business. Of course, it is still necessary for the conductor to be able to receive package freight along the line, and a simple method must be provided, as first suggested, for him to use, as he is not in a position to carry out the detail required of an agent, but as his business is usually, or can be made to be, cash, his duplex ticket or tag takes the place of a way bill and his report takes the place of the regular abstract.

It is also common to make connections with steam railroads with through rates and tickets for freight and passengers, and sometimes this reaches the need of through cars. It seems uncommon that the electric line should receive the liberal differential which is customary when a large steam road delivers to, or receives from, a smaller one, but such as it is, it is another phase of the work of the accounting department of the electric line which calls for its abstracts to and from the steam line, the same as from its agents, and the monthly settlement is made much in the same way. But where there is only a transfer delivery it is similar to its own handling of its own local business.

Unless the interurban company has more than one line or route the record of freight income should be shown by stations, so that the importance of a freight point may be gained. It is quite feasible to make a traffic statement, somewhat similar to that of the passenger business, when the general volume reaches a point of importance. When it does, the details can be worked up in about the same way; the figures may also show the tons and the dollars, from which statement comes the unit of the "ton-mile," which is the unsatisfactory and misinforming, but "standard," adopted by the steam railroads.

It is advisable that regular freight records should be kept of the material hauled for the company, that is, the supplies sent from the city to the barns or shops, or from barn to barn, as it adds an element of responsibility to the handling of the material that is desirable.

Car mileage records are so important that provision should be made for their proper keeping with as much care as those for the handling of traffic. Even though the comparison of earnings on the car-mile basis has passed from some of its usefulness since the introduction of the car-hour basis of comparison, it is still the proper basis for use in many of the operation features, and these records should be worked up very carefully and promptly. This is easily done from the trip sheets of the conductors. Mileage from this source is better than from the schedule, and the daily statement of car-miles run by each car, including the freight and work cars, should be in the hands of the proper officials promptly each day, as well as recorded in the accounting department.

The daily statement of passenger business, and if possible to include freight, should be rushed through the office with all the speed possible, so that the operating department shall know within as few hours' delay as consistent with accuracy what were the results of the day previous. This statement should include the day's earnings compared with the same day of the week the previous year, the car-miles operated for each class of car also compared. The earnings for the accumulated monthly period (based on the day of the month) also compared, the number of each class of passenger, that is, cash, commutation, and free, also compared, and the weather compared. It is well understood that comparisons with a previous year are always valuable, as they bring up causes and effects quickly for explanation and remedy.

The monthly statement of income and disbursements and other information is an important document, to which should be applied all the energy and ability of the accounting department. The statement of earnings should be in such detail that the totals may be easily understood and the statement of expenses should cover all the requirements of the operating department based upon the classification of the Street Railway Accountants' Association of America, with such additions as the needs of the operation may require. It seems better that this statement should have all possible comparisons, as for instance, this year with last, and period with period, with such basic comparisons as per car-mile, per car-hour, per cent of total and the other percentages usually needed, together with the per cent of increase or decrease. While it sometimes is not considered necessary to show the percentages of each item, it still should be given for the sub totals and grand totals. The condensed balance sheet should also have the comparisons with the previous year because it gives a quick understanding of conditions quite vital to the welfare of the company.

Statements in general divisions of cash received and disbursed are desired usually as a part of this statement, and, in fact, the statement can be expanded to an extent and reduced to a point desired by the president, but it should be considered that while the present management may want but little, some future arrangement may call for quantities of back information which are more easily obtained if complied in the form of a monthly report and thus being preserved for future as well as present use. That reasoning should also apply to the whole system of

accounting, for it seems to the writer that no system should ever be planned nor operated without due consideration of the probable needs of future managements. Statements and reports should always be preserved and filed for the use of others, because changes occur and the accounting department is the one called upon to supply information. The golden rule is not a bad one to apply here, because conditions change so completely that we frequently get both points of view, viz.: as the originator of systems and the searcher after information in someone else's system.

Material and Supplies.—What accountant doesn't regret to think of this problem of interurban accounting? Of all the purely accounting propositions it is usually the most provoking. But it cannot be said that it is the accounting alone which makes it difficult to handle, but the conditions which surround the other end of it. That is, the storehouse is usually at the barn, a busy place in charge of a busy man who does not always appreciate the importance of the information asked from him. Or else the statements are put in such shape that he finds himself in the position of the conductor referred to; he gets confused and guesses with the results we know so well. Therefore, the remedy applied to the other troubles, simplicity, will help in this. The best results will be obtained if but two reports are required, one made out upon the receipt of material, showing date, quantity and material from which the bills for supplies may be checked (don't send the bills to him, but keep them in the office), and another for each lot of material issued. These latter should be numbered for office checking and show the date, quantity and material, followed by a few columns with such simple headings as "Repairs to Cars," "Repairs to Motors," etc., in which he puts a simple check mark. Send both of these statements to the office each day, that is, not one for each day, but one for each time the storeroom is unlocked, and then do the compiling in the office under the eyes of the auditor. Don't ask the foreman to do the office work. If greater accuracy is desired, the office should keep a card or other record of the material for charging and crediting, but the supplies usually carried by a company of this kind seldom call for such records. Not that I do not believe in them, because I do most thoroughly where the quantity of the material warrants the expense. The report of each receipt and issue is much better than a daily or weekly summary and when sent to the office daily the foreman is relieved of further worry. The office should check the report numbers to guard against loss in mail or neglect to send in.

The pay rolls for conductors and motormen may be easily made from the conductors' reports daily, and the barn, shop, line and track men may be reported by the foremen daily giving name, usual occupation, rate of pay, and in small columns with proper headings the hours worked in each classification may be entered. From these statements will be made not only the pay rolls themselves, but the distribution of operating and other expense as applying to labor will be gathered. It goes without saying that legal receipts should be taken and that the payments should not be in the hands of the foremen, but preferably by someone from the office. Some point on the line is usually best for the paymaster to go to pay all trainmen passing that point; if this point can be located at a barn, so much the better for safety and gathering together most of the men. The way of reaching the others can be easily decided, but it seems best to have but one man to pay the whole road, because he soon knows all the men, which is always more or less desirable.

The operating expenses are more satisfactorily kept in a record with enough columns to provide for the whole classification. If treated a little differently it may be used as the whole record of accounts payable. At any rate, the totals of these columns added to the same columns of the material and supply statement, the pay rolls and various journal entries applying will be the material from which the operating expense statement may be gathered. If progression totals are used the total for any period can be quickly obtained. Certainly there are other ways of handling the matter, but the above is always satisfactory and quick in its working, and the whole subject is always gathered at a glance.

The company's mail from station to station, to and from the office, barns, etc., has caused many arguments and delays by the failure to deliver, and the other excuses so well known. It seems best, therefore, that certain cars should carry a box into which may be placed at the different points the mail for the office. These cars are known to pass at certain times, and they should be expected to carry to the office all mail to the time of leaving. The box should be locked with the key only at the office, and with a slit or other opening for the insertion of the mail. They pass the office often, and as the runs bring them around the clerk can open and empty them in a moment. The mail to the other points may be handled in small padlocked bags with a tag directing the destination. Each agent and foreman having a key, he is sure to get all of the mail sent and get it on time, because the bags are just too large for a pocket and just heavy enough not to blow away. On regular passenger cars the motorman can better handle the mail than the conductor because he has less to bother him, and the passengers do not have access to the bags.

It seems unnecessary to say that the punches used by the conductors should be recorded in the auditor's office and the record kept so complete that tickets and other punchable matters may be promptly and accurately identified.

The right of way and other deeds and contracts may not be filed with the auditor, but when they are a splendid way to record them is by numbers in boxes and a book kept with a page for each one with its record of dates, cost and other information. The page number should be the same as the file number. Partial payments of contracts may also be shown on the proper page in the record, for quick reference.

The subject of interurban accounting is so very broad to-day that a short article cannot contain a story of it, nor is one writer in a position to cover it all. However, enough has been said to show how different it is from that of purely urban companies and to demonstrate how really needful simplicity is. It is well worth sincere study to those engaged in it, but there should be kept in mind that steam railroad principles cannot govern it in its entirety, although the practices are similar. Originality is best and improvement is of the age, but keep thoroughly in mind that system—if simple—is the lubrication of the business machinery.

INTERURBAN ELECTRIC RAILWAY CAR EQUIPMENTS

BY W. B. POTTER

THE character of what might be termed the individuality of the traffic, whether for business or pleasure, is so greatly diverse in its nature that in each case the best method of serving presents an independent problem in itself. Even more specifically the schedule, modes of operation and equipment depend upon existing conditions, and are determined in essential features by the amount of travel, distribution of the loads throughout the day, the natural characteristics of the country and location of the residential districts. In most cases a compromise has to be effected between the predominating influences affecting operation on the one hand, from whatever cause they may arise, and what may be considered best engineering on the other, leaving unessential details to the choice and fancy of the individual operator.

It may, however, be of interest to discuss some of the general conditions met with in determining the equipment for various types of service, describing in every case only the apparatus which has passed the experimental stage and is established in character. There are three classifications under which interurban roads, that is, roads which operate both inside and outside of the cities, may naturally be subdivided.

1. Roads approximating steam railroading conditions, operating heavy trains over private rights of way in the city and country, starting from a point in the city and stopping only at predetermined points along the route.

2. Roads operating lighter single cars on public highways in the country and running over city tracks through cities encountered on the route, making stops wherever the passenger desires to enter or leave the car.

3. Roads in general combining the two former classes operating single cars or light trains over private rights of way in the country and entering the city over surface lines.

A desirable feature of an interurban service is the ability to maintain a fast schedule, and this is determined by the character of the roadbed as affecting the acceleration and maximum speed, particularly the latter.

When the length of run is less than a mile the acceleration becomes the determining factor in the schedule speed and is the more important the shorter the run. The maximum speed becomes important only when the length of run exceeds 1 mile or 2 miles. In the usual mixed city and interurban service, the stops will vary from 10 to the mile in the city to 1 in 5 miles and over in the interurban portion, averaging 4 stops per mile in the city, 2 in the suburbs, and from 1 to 1½ stops in 2 miles in the country. The average length of the run over the whole route will approximate between ½ mile in length and 1 mile. It is thus seen that a proper acceleration is of considerable importance in securing a fast schedule.

In combining runs of such widely different lengths as characterize this class of service, the average run with its characteristics may be taken to represent the whole route. This has been determined from an extensive investigation employing a number of motors of different sizes and makes, and assuming the same weight of car, operating conditions, number, length and sequence of runs, even where the length of various runs varies as high as 20 to 1, the average run giving characteristics which vary but a few per cent from the average of the integrated characteristics over the whole route. Thus the average run serves as a convenient method of determining the motor equipment, gearing, and secondarily, the power consumption. All values so reckoned are on the safe side, as the schedule speed is slightly less and the losses in the motor and the power consumption slightly greater than the average values integrated over the whole route.

Where the length of run in the city becomes a considerable percentage of the total length of round trip, the schedule speed is greatly affected by the time required to get into and out of the cities, as the speed is usually limited by sharp curves and blocking city cars. To reduce the time on the city portion it may be more profitable to follow the less frequented rather than the main business streets.

Both the safety of the passengers and maintenance of the schedule demand, as a first essential of the roadbed, that it be double-tracked throughout and as straight as possible, to minimize the dangers arising from the high speeds and the short headway between cars. Nearly all disastrous accidents can be credited to a single-track road or to the motorman's not being able to see well ahead.

As curves affect speed of the car and comfort of the passengers they should be of as large radius as possible and with compounded approaches. As affecting the speed the limit may be generally assumed as the square root of the radius of curvature in feet, that is, the running speed would be limited to about 10 miles per hour on a curve of 100 ft. radius, 32 miles on a 1000 ft. and 50 miles on a curve of 2500 ft.

Curves also introduce loss of power, a curve of 143 ft. or 40 degs. being equal to a grade of 1 per cent, and they are, further, the principal cause of flange wear and truck maintenance.

Grades of moderate amount or length are of less importance, as they do not limit the speed nor cause discomfort to the passenger. Over rolling country, where the cars may freely coast down the grades, returning ultimately to the same datum level, the average schedule, heating of the motors and power consumption do not materially differ from the same characteristics determined over the same distance on the level.

A point not ordinarily appreciated is that if the stops are always made at the top of the down grade, so that the acceleration of the grade is added to the acceleration of the motors, it is possible to make a faster schedule with less motor heating, energy consumption, over a rolling profile,

than over the same distance on a level with the same number of stops. The down grades add to the acceleration and the up grades assist the braking.

This principle has been utilized to an effective degree in the profile layout of the Central London Underground Railway.

For further illustration of these principles may be cited the familiar "switchback" railway of our pleasure parks.

The worst possible combination results where the stops are made at the bottom of the grade, and for this reason such location of stops should be avoided.

Each per cent of the up grade requires 20 lbs. per ton tractive effort, and the effect of grades upon the schedule is thus greater in proportion, as the normal rate of acceleration is slower.

If trailers are hauled, as in the case of the locomotive, or the grades unusually steep and long, the grades become of serious importance in determining the motor capacity, gear ratio and minimum weight on drivers.

In a general way the preferable maximum speed will be found to be the least that will ensure the schedule.

The selection of the proper gear ratio for a given motor requires careful consideration, and it should be determined only after a full study of all the conditions.

As it is often desirable to determine from a simple test the performance of the motors for a given service, the recommendation of the A. I. E. E., on the testing of railway motors, as adopted at the nineteenth annual meeting, may be followed to advantage.

For the determination of the average run it is necessary to know the desired schedule speed, length of round trip, number of stops per round trip, the average length of stops, including layovers, the weight of loaded car and the average voltage over the route. The most difficult to determine and the most important is the average total number of stops per round trip, as this fixes the length of the average run.

Slow downs from curves and other causes where the power is thrown off and the brakes are applied, have the same effect as, and are equivalent to, fractions of a stop, with values dependent upon the amount of reduction in speed. As such slow downs affect the schedules they should be reckoned accordingly in the total number of stops per round trip. Since ordinary grades are not important in affecting the characteristics of the motor equipment, only the longer and the steeper ones need be considered.

An equipped car may thus be conveniently tested by running it forward and backward upon a level track, over the average length of run, accelerating at the proper current and maintaining the average schedule until the motors reach their maximum temperature, which will be in from eight to twelve hours. The temperatures so obtained will closely approximate what would be obtained in practice.

Higher rates of acceleration, with an ample reserve to provide for contingencies in handling variations in schedule, grades and safe guarding against the abuse of the motors, demand a proper proportioning of the weights on the driving axles to give the necessary available tractive effort. Under ordinary conditions of track the coefficient of friction may be taken from 15 per cent to 18 per cent of the weight on drivers, which permits a gross accelerating power of from 300 lbs. to 360 lbs. per ton when all axles are equipped with motors—200 lbs. per ton or 2 miles per hour per second is a reasonable maximum for comfortable acceleration.

To ensure comfort to passengers at high rates of acceleration it is essential that the control be so handled as to first start the car at a low rate, then increasing to the acceleration desired. That is, the speed curve should be concave at the beginning instead of the straight line of full acceleration, on the same principle that the straight line of braking is concaved at the end, due to easing of the brakes on the final stop.

For the equipment of double-truck cars four motors will be found generally desirable. If the grades exceed 5 per cent, the rate of acceleration exceed 1.75 miles per hour per second, or snow abound to any extent, four motors per car will be found essential to a reliable service.

Two-motor equipments may be expected to have an advantage in requiring less attention and maintenance, and a slightly higher efficiency, but, other things being equal, four motors of the same total horse-power rating will perform the same schedule with the same weight of train with less temperature rise or perform a faster schedule for the same temperature rise, since the total radiating surface of the four motors is greater. This difference, however, is not enough to reduce the cost of the four-motor equipment below the two-motor when making the same schedule with the same weight of train for the same temperature, and thus, when feasible, the two-motor equipment is the cheaper.

Even where conditions would permit the use of two motors, it may be their dimensions for the necessary capacity will be such as to exceed the allowable space, in which case four motors must necessarily be used.

Fortunately, the time is rapidly passing when a purchaser, having bought a motor, feels that he can use it regardless of car weight or gear ratio, although the refinement of application and difficulties of design are not yet fully appreciated. It may be safely said that no other piece of electrical apparatus is subject to so close limitation in dimension or adaptation to its work while being called upon to withstand severer service and abuse.

The greater the number of stops, as in city service, the time the motor is operating at full voltage and speed is but a small per cent of the total time. Hence its average core losses are low and the copper losses high. Where the length of run gives a large percentage of free running at full voltage, the percentage of accelerating current and copper loss is low and the core loss high.

Since the disposition of material determines the losses in the motor, which in turn limits its capacity for service, the service to be performed influences the distribution of the material.

Railway motor capacity may be expressed as the product of turns of copper and magnetic flux, city work permitting low turns and high flux, and long-distance work, high turns and low flux. It is evident that the motor cannot be economically designed to best suit both kinds of service at the same time, and where both classes are combined as is usually the case, a compromise is required.

Within the past few years the mechanical design of railway motors has been greatly improved and standardized,

and the split frame and box-frame motors are now recognized types.

The limitations imposed by the gage, wheel base and space between car body and track are always troublesome, and with bogie trucks become serious when the motors are larger than 125 hp.

A 6-ft. wheel base has apparently, for no sufficient reason, been generally adopted for bogie trucks, and allowing a 6½-in. axle and a 12-in. bolster, there is little space left for the motor. Steam railroad practice, both with regard to locomotives and cars, contains many instances of relatively longer wheel base, even allowing for the larger curves.

In electric service, as the gage is fixed, and the wheel diameter is in many cases limited by required height of car body to 33 ins., it is especially desirable that the wheel base be 7 ft. instead of 6 ft. This will provide for a 200-hp motor, large axles and an ample bolster. Where still larger motors are required, the only solution is to increase the diameter of the wheels and to further lengthen the wheel base.

For the handling of trains the electric locomotive is a natural outgrowth of the motor car and trailer. For the handling of through steam trains at terminals or the movement of freight cars the electric locomotive on electrically-equipped freight car is specially suited. For all general passenger work the equipment of each car in the train as a unit possesses many advantages.

Where each car is equipped with its own motive power, it is possible to make the capacity of the train suit the condition of traffic, whether light or heavy, and maintain the same schedule with any length or weight of train. The safe handling of such a train requires the operator to have a full and immediate control over it at all times, and be capable of accelerating it smoothly.

Safety and reliability are the prime requisites, and simplicity of design an essential to a successful method of control. This has been secured to a marked degree by the electromagnetic system, as operated on the Manhattan Elevated, where each car is equipped with its motor control operated from a master controller on the leading car.

On single cars and locomotives the electromagnetic control offers great advantages in the handling of heavy currents by the reduction of operating controller to a small size of very easy manipulation.

The disposition of the apparatus and method of wiring the car are worthy of special study. The utmost precaution should be taken to prevent any possible arc setting fire to the car or its continuance by arcing to grounded metal. The smaller conductors supplying the heat and light circuits and the cables controlling the electromagnetic switches can, with safety, be run through iron pipe or armored ducts, for should a ground or short circuit occur in these wires their protecting fuses are of such small capacity that they will blow, without danger of fusing the metal armor.

It does not seem advisable to run the main cables and motor circuits through metal ducts, for should a ground or semi-short circuit occur the main fuse or circuit breaker, having considerable capacity, might permit sufficient current to flow to fuse the pipe, although not enough to blow the protecting device. A non-inflammable conduit of asbestos compound is a sufficient protection against fire from a possible arc, and being an insulator would not tend to maintain the arc.

All parts of the under-car flooring in vicinity of the switches and resistances should be protected with substantial sheet asbestos compound, all metal parts of the car framing being especially well protected. All motor controlling apparatus should be beneath the car floor, and while protection should be provided against snow and wheel wash it should be installed with reference to convenient inspection.

For the protection of the smaller circuits, the enclosed type of fuse has been efficient and satisfactory.

For the main circuit the circuit breaker has an advantage on single cars, as it can be quickly reset. It has the disadvantage of requiring careful inspection and being more liable to get out of order than a fuse.

Where cars are operated in trains with several cars equipped the fuse appears to be preferable. The blowing of a fuse on one car does not cripple the train, as the other cars remain operative and the blown fuse can be replaced at leisure. A most effective form of fuse is one of copper ribbon provided with a magnetic blow-out.

For protection against lightning every car operated from overhead feeder lines should be equipped with some form of arrester. Arresters with spark gap, high-resistance ground, magnetic blow-out and a kicking coil, give excellent results. They should preferably be located under the car and connected just inside the main cut-out switch.

The simple trolley has developed a surprising capacity under the increased duty it has been forced to perform; 200 amps. at 60 miles per hour, 400 amps. at 30 miles per hour, and 800 amps. at 10 miles per hour, from a single trolley wheel may be found in practice. It is true, the wheels wear rapidly, but the wonder is they work at all. With a smooth trolley wire and a pressure of 35 lbs. to 40 lbs. the wheels run with very little arcing.

Where the conditions will permit, the third rail is in every way better suited to heavy or high-speed service. Recent investigations indicate the desirability of using a third-rail shoe held in contact with the third rail by a spring, rather than depending on gravity alone. The interruption of the current due to jumping of the third-rail shoe at the joints or elsewhere is apparently conducive to motor flashing. The purpose of the spring is to keep the shoe in more positive contact with the third rail.

The modern electric car in all its appointments and construction has probably received more study and has reached a higher development than any other vehicle moving on land. A coach without outward evidence of power, but carrying on its trucks a silent force capable of hauling backward a puffing locomotive or of running forward at 100 miles per hour speaks eloquently for the future of electric traction.

TRUCKS FOR INTERURBAN SERVICE

BY C. F. UEBELACKER

THE recent extensive development of interurban projects and the consequent increase in speeds of electric cars is necessitating radical changes in the design of double trucks.

Ideas of suitable construction are swinging around in a circle. The early double trucks were all of the long wheel-base type. Then for some time the single truck was developed to keep pace with the demand for longer and heavier cars until it reached its limit on the 20-ft. closed car. The effort to reduce operating expense by increasing the size of car next brought out the maximum-traction type, and later the "short wheel-base" type was introduced to accommodate the narrow car bodies generally in vogue, and at the same time secure the steadiness of motion contributed by swinging bolsters which the increasing speeds in the suburbs rendered imperative.

The interurban roads have now exceeded the safe speed at which the short wheel-base trucks could be operated, and the standard design has again swung back to the long wheel-base.

There is a strong tendency among most of the builders at present to follow a design which is a mixture of the diamond frame freight truck and the equalizing bar passenger-coach types in use on steam roads. This truck combines the cheapest form of all forged frame, and the easy riding features insured by the combination of elliptic and spiral springs in supporting the load, which, together with the fact that the forging work upon it is all light and capable of being shaped in formers, accounts for its popularity with both builders and operators.

The features necessary to meet requirements of high-speed service are many of them difficult to combine in the same machine. The policyof picking up and dropping passengers at every road crossing necessitates steps sufficiently low to be easy of access from the level of the ground. At the same time, in order to cut down the length of each stop, the steps must be as few as possible. The result is that while a few have adopted the steam-road design of car with platforms level with the car floor, and the consequent double or triple steps, the bulk of the interurban roads are still using a form of body which is practically an enlarged horse car, in which one step is formed by dropping the level of the platform below that of the car floor. The space occupied by the heavy knees required to support these platforms, and the consequent limiting of the length or wheel-base, is one of the most serious obstacles in the way of the design of a simple and efficient high-speed truck for interurban work.

Probably the greatest factor in the popularity of the electric railway work when compared to the steam road for interurban service is its ability to deliver passengers at or near their destination. This involves the operation through city streets of the same cars which must make schedule speeds of from 20 miles to 30 miles per hour outside the town limits. Most city franchises were obtained and tracks laid before the interurban propositions became a prominent feature in electric railroading. As a result, the space provided between tracks in cities is seldom so wide but that it must be taken into account when determining the width of cars. This restriction of width is a more serious matter in open cars than closed cars, on account of the space occupied by the run-boards. The long wheel base being necessary for the high speeds, the ends of the trucks swing well out into the run-boards when rounding curves, making it necessary to cut them away to provide clearance.

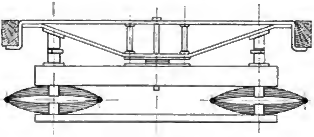


FIG. 1.—M. C. B. ARRANGEMENT OF BOLSTER SPRINGS

These clearance spaces, no matter how carefully covered or boxed in, are always fruitful sources of accidents to passengers boarding or leaving the cars. The only remedy so far devised is to drop the ends of the trucks outside the yokes so far that they can swing under the run-boards. Such a design means either a cast-steel or solid forged side frame, and, as cast-steel has been known to fail in service, it is not an entirely desirable material upon which to depend at high speeds.

This shortening of the truck crowds the spring space under the bolster by reducing its width, crowds the motor

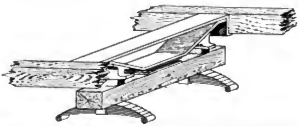


FIG. 2.—LONGITUDINAL ARRANGEMENT OF BOLSTER SPRINGS

supports close against the transoms, making them inconvenient of access, brings the spring plank in the way of the lower half of the motor case when swung down, and, most of all, crowds the space which should be occupied by a brake rigging applying shoes between the wheels so that it becomes either complicated and indirect or wholly impossible.

Assuming for the time that the swinging bolster is an essential feature in the design of any high-speed truck, the obvious and simple method of flexibly supporting the bolster from the frames of the truck is that which the past forty years' experience has made universal in steam passenger practice, and which is shown diagramatically in Fig. 1.

The two principal variations from this plan, both of which have the advantage of allowing a narrower bolster and consequently shorter wheel-base, are shown in diagram

in Figs. 2 and 3, and Figs. 4, 5 and 6 are illustrations of trucks embodying the plans shown in Figs. 1, 2 and 3, respectively.

Consider now briefly the function and action of a spring. A 33-in. wheel rolling along the track, Fig. 7, at 20 miles

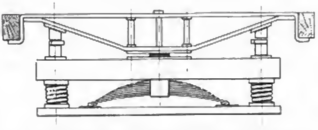


FIG. 3.—ARRANGEMENT OF BOLSTER SPRINGS FOR NARROW BOLSTER

per hour meets a rigid obstruction ¼ in. high. The wheel must then rise ¼ in. in the time taken by the center of the axle to traverse 2.8 ins., namely, about 1-100 part of a second. The result, uncushioned, would be a very sharp shock, and the function of the spring system is to enable the car supported by it to take a longer time in making the rise of ¼ in., which the wheel has to make in 1-100 of a second. Consider again a straight steel bar held securely at one end, *a*, and free at the other, *b*, Fig. 8. If this bar is bent by pulling on the free end, *b*, and then released, it will vibrate, and the greater the distance, *a*, *b*, the slower will be the vibration. Apply this same idea to the elliptic spring, which is a combination of such bars held rigidly at the bands and free to move at the ends, the longer the spring (the number and size of leaves being the same), the more slowly will it respond to a shock, or, in other words, the softer will it be. The same holds true with spirals, namely, the longer the bar from which the spiral is coiled, the softer the spring, the cross section of the bar, of course, remaining constant.

The extent to which softness of riding can be obtained by thus lengthening the springs is limited by the amount of

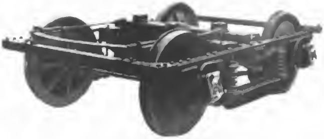


FIG. 4.—ST. LOUIS TRUCK

spring play which is practical to allow. Present practice is from 3 ins. to 4 ins. maximum movement of springs. Steam practice would allow one-half of this for the compression of springs by the dead weight of the car body and load, leaving the other half to take up the shock and jar encountered in running. With the present excellent standard of track construction on interurban roads, this allowance of 50 per cent of the total spring motion for riding should certainly be ample, although a few years ago street railway practice was to allow for this from 60 per cent to 70 per cent of the total spring movement, with the result that riding was noticeably easier when the car was loaded than when it was light.

Refer again to Fig. 8. This shows also that each size of spring has, like a pendulum, a certain "period" or time of oscillation, which is a function of the dimensions of the spring and the load carried. A further investigation into the mechanics of the subject, which it is unnecessary to go into in detail, demonstrates that with a given spring and

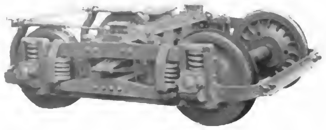


FIG. 5.—BRILL NO. 27 TRUCK

load, the period of this oscillation is independent of its amplitude. Again it is evident that oscillation, once established by a shock or jar, will continue until damped by the friction of the moving parts. Suppose now a moving car is subjected to a series of jars recurring at stated intervals, such as a wheel imperfectly centered on the axle, a flat spot, or the rail joints themselves; it is evident that as the speed increased, were the car carried on a single set of springs of uniform dimensions, a point might be reached where the successive jolts would fall in step with the period of oscillation of the springs, and thus tend to increase the amplitude of this oscillation before the damping effect of friction has had time to stop it. It is not necessary that such periodic jolts should follow each other with a rapidity equal to the periodicity of the springs, but only that they should fall in step with this periodicity, one impulse to, say, every three or four periods. This effect is at times noticeable as a kind of dancing or bobbing of the car body at certain speeds, especially with trucks that depend too largely on spiral springs. It should be counteracted in designing by placing two or more sets of springs between the car body and wheels, the periodicity of the sets being to each other as 5 is to 7, or some other similar proportion whose least common multiple is large in comparison to its factors.

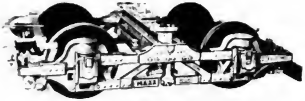


FIG 6.—PECKHAM 14A XX TRUCK

As pointed out above, a loaded spring started oscillating, continues to do so until damped by friction. With the spiral spring this friction must come from the rubbing together of working parts of the truck, and consequently entails wear and lost motion. With the elliptic, the friction for damping is furnished by the movement of the leaves over each other, and consequently lasts as long as the spring itself. The elliptic also, with its greater weight of material for a given carrying capacity, has a slower period of oscillation. The combination of this rapid damping and slower period has led to the almost universal practice of placing the elliptic, the softest riding member of the spring system, next to the car body, or immediately under the bolster. The limited space available in the side frames and

over the journal boxes has made the use of spiral springs for equalizers and yoke springs equally universal.

In the so-called M. C. B. type the yoke springs are generally omitted, and where used their function is not that of furnishing a third set of springs for the support of the car body, but of preventing the tilting of the truck frames by the pull and thrust of the shoes when brakes are applied. The arrangement of this type, as seen in Fig. 4, is as follows: The weight on the bolster is transferred to a spring plank through a set of elliptic springs. The spring plank is hung from two transoms by links, allowing it to swing across the truck from two transoms which serve the double purpose of supporting the links and furnishing a pair of guides between which the bolster is free to move vertically and laterally. These transoms are rigidly secured at each end to the side frames, which again serve a double purpose in transferring the weight from the transoms to the equalizer springs, and furnishing a frame for keeping the journal boxes in line. In other words, the side frames are subjected as trusses loaded at the center, to vertical strains due to the weight carried by the truck; also to a bending moment due to the horizontal thrust of the boxes on the jaws when the car is starting or stopping. Fig. 9 shows in outline the two types of M. C. B. frame commonly used. They are loaded at the points *b*, *b*, with the weight of the body transferred to them by the transoms. They are relieved of this weight at the points *a*, *a*, where the equalizer springs are applied. Both designs present for the carrying of the vertical load a simple truss, and in so far both designs are mechanically correct. Against the thrust of the journals at the points *c*, *c*, on the yokes in starting or stopping, however, type *B* offers only the resistance to bending of the bars at the points *c*, *c*, and *d*, *d*, while in form *A* the bottom *d* of each yoke is tied to the top *c* of the other, and the bars constituting the frame are subjected to tensile and compressive strains only. It is evident from the above that the form of frame shown as *B* in Fig. 9 is not suitable for the high accelerations and quick stops which are the rule in interurban work.

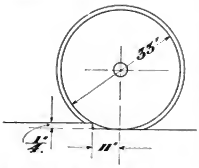


FIG. 7.—LIFT OF WHEEL MOUNTING OBSTRUCTION

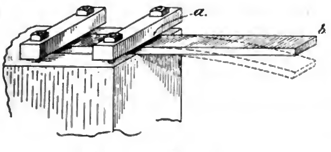


FIG. 8.—VIBRATING STEEL BAR

It was assumed above for the purpose of argument, that the swinging bolster was an essential feature in the design of a successful high-speed truck. It is not likely that any one in the present time will question the assumption; still it is desirable to examine the principles of its action. Fig. 10 shows usual swing motion and the principles demonstrated from it will apply to all others. The bolster, confined in the direction of locomotion between the transoms, is supported on the spring plank, and with it free to move laterally. Lateral movement is permitted the spring plank by the swing of the links *d*, *d*, which support it, pivoted to the transoms at *a*, *a*, and to the spring plank at *b*, *b*.

It is the function of this swinging support to accomplish the same result in the horizontal plane that the springs do in the vertical, namely, to enable the body to conform to the irregularities and curvatures of the track more gradually than do the wheels and truck frame.

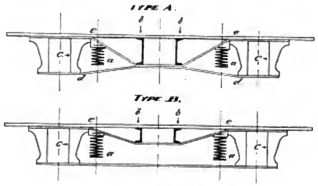


FIG. 9.—TYPES OF M. C. B. FRAMES

From inspection of Fig. 10 it is evident that the swinging mechanism is practically a double pendulum, and will conform to its law, or the greater the length *a*, *b*, of the links, the slower will it swing. Again it is evident that when the bolster swings either way from the central position, it, together with the car body it carries, is actually raised, and when the force required to raise the body equals the force which swings it from its central position, the lateral movement will stop. If the links are made very short a very short lateral movement is required to raise the body sufficiently to offset the force tending to push it sideways, and the swinging motion becomes quick and jerky. If the links are very long the correspondingly long lateral movement results in the bolster striking the side frames, unless excessive space is allowed at the ends for clearance.

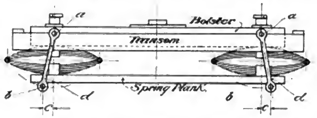


FIG. 10.—M. C. B. ARRANGEMENT OF LINKS AND SPRING PLANK

To obtain at the same time the advantage of the slow swing of the long link and the short travel of the short one the plan shown in Fig. 10 is used of spreading the links further apart at the bottom than at the top. The advantages of this arrangement are double. First, as the pin *b* of the link on the end toward which the swing takes place will rise farther for a given lateral displacement than that of the link at the other end will fall. Second, shorter lateral displacement is necessary to raise the car far enough to

counter-balance the displacing force, and this is accomplished without the quick, jerky motion that results from the use of short links. Third, the link toward which the swing takes place raises its side of the car, and thus tends to keep the floor of the car at right angles to the direction of the force which is felt by the passengers, and which is

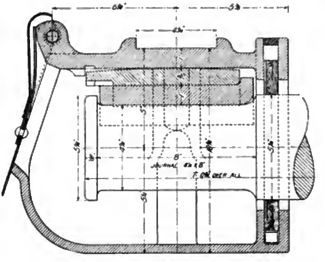


FIG. 11.—M. C. B. JOURNAL BOX

the result of gravity and the force producing the lateral movement. In other words, the effect is the same as elevating the outside rail of the track. It might be noted in passing that this last advantage was overlooked in some of the earlier designs, and the links were spread wider at the top than at the bottom, thus tending to increase the outward tilting of the car body, instead of diminishing it.

Practically, the swing motion has worked down to links about 15 ins. long between pins and spread about 4 ins. wider apart at the bottom than at the top.

Many builders provide cushioning springs at the ends of the bolsters to prevent their striking hard against the side frame, but, with the present good practice prevailing in interurban-truck construction, this would seem to be unnecessary, if 3 ins. or more of swing are allowed the bolster at each end.

Journal-box design is rapidly narrowing down to the form which has given the best results in steam practice, and has been embodied in the Master Car Builders' standard box, Fig. 11. The merits of this design would have un-

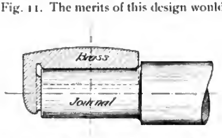


FIG. 12.—JOURNAL WITH PROVISION FOR TAKING UP THRUST ONE WAY ONLY

doubtedly been recognized earlier but for the fact that the small diameters of axles which were current practice would not allow sufficient difference in diameter between the body of the axle and the journal to provide enough surface on the button to properly take care of the end thrust. A common specification used to be 4-in. axle and 3½-in. journal, which left only a ¼-in. shoulder.

The main essentials of a journal are: First, sufficient surface to take the load at not to exceed 300 lbs. per square inch; second, ample thrust surface; third and foremost, provision for bringing into contact with the lubricant the *whole* of the wearing surface of the journal each revolution.

The box shown in Fig. 11 provides for the automatic alignment of the brass and journal by means of the circular form of the top of the wedge. This feature is quite essential, as the brass and journal are accurately fitted to each other, while the box inside and out is usually a rough casting.

The form of the journal also is such that the packing can readily be forced up so as to wipe and lubricate not only the

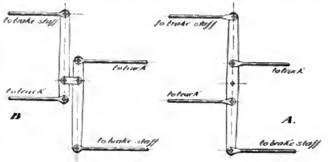


FIG. 13.—EQUALIZING AND PLAIN SWAY BARS

journal proper, but the end thrust surfaces as well. The design also provides thrust surfaces at each end of each journal, with the result that all end motion is taken up on both side frames instead of pressing against one only and tending to spread them apart. Fig. 12 shows a form of journal in which this last point was neglected, and which demonstrates by the excessive wear on the inner ribs of yoke and box the necessity for ample provision for end thrust.

The design of brake rigging for interurban trucks is much complicated by the large space occupied by the heavy motors in use. While air is now almost universally applied, all roads expect to install and occasionally use the hand brakes. To go in detail into the theory of the proportioning of brake rigging would occupy more space than would be appropriate here. A very able discussion of this subject by R. A. Parke can be found in proceedings of the New York Railroad Club for Nov. 18, 1897.

Any brake rigging should provide for the equalization of

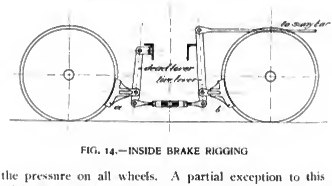


FIG. 14.—INSIDE BRAKE RIGGING

the pressure on all wheels. A partial exception to this might be made in the case of the sway-bar in the hand rigging when placed on cars in conjunction with air or other power brakes for use in case of their failure only. The usual plain sway-bar, Fig. 13A, is so much simpler than the double or equalizer bar, Fig. 13B, and works with so much less friction that it is not advisable to incur the extra com-

plication for a brake which is to be used in emergencies only. The rigging of each truck should, however, be provided with "dead" or equalizing levers, as shown in Fig. 14, to increase the leverage on the shoe *A* enough to compensate for the direct pull on the head of the live lever transmitted to the shoe *B*.

For successful operation, the hand-brake rigging, and to a less extent any power brake, must be very direct in its action in all parts. The fewer the parts and joints that go into its make-up the less will be the lost motion and spring or stretch, and consequently the less will be the number of turns necessary on the brake staff to apply the shoes to the

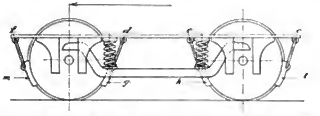


FIG. 15.—REACTIONS OF INSIDE AND OUTSIDE BRAKE RIGGING

wheels. The application of the shoes between the wheels instead of outside shortens up and reduces the number of parts in the brake rigging, and for this reason, and others, generally proves the most satisfactory brake arrangement. The inside brake is convenient also in that the tops of the levers are well away from parts of the car body liable to interfere. The greatest advantage of the inside brake, however, is the reduced tendency toward tipping the truck frame when brakes are applied. This can be best illustrated from Fig. 15. If the shoes between the wheels, as shown at *a* and *b*, be applied while the truck is running in the direction indicated by the arrow, shoe *a* will press up and shoe *b* will pull down, each on its link, thus establishing a couple with a lever arm *d c* tending to raise the end *f* and lower the end *e* of the truck frame. This couple is resisted by the equalizer springs *g h* or the yoke springs, if the design of the truck includes them. If, on the other hand, the shoes are applied at *l* and *m* outside of the wheels, the shoe *l* will thrust up, while *m* pulls down, establishing a couple tending to tilt the truck frame having a lever arm of *f*, *e*, which is quite three times as long as *d*, *c*. If the brakes are applied sharply right up to the time the car comes to a standstill the spring *g* will be, when the car stops, more compressed than the spring *h*. The spring *g* will then recoil, raising end of the frame. This will in turn raise the shoe *m* and cause the wheel with which it is in contact to revolve backward, causing an unpleasant jerk of the car body in an unexpected direction, which is apt to throw passengers who have already risen from their seats before the car comes to a full stop.

When the shoes are applied between the wheels the greatly reduced leverage which they have on the springs *g* and *h*, together with the damping effect of the gears and friction of the motor armatures, so reduces this effect that it is not particularly noticeable.

There can be no question but that in the anxiety to follow the longer experience of steam-road mechanics the advantage of placing springs directly over the journals has been overlooked along with some other features of the strictly street railway truck which are still valuable in the higher-speed service. The design from which the M. C. B. has been copied was intended and used in steam practice strictly as a trailer truck. It is well suited for the moderate braking and acceleration of steam service, but not for extreme limits to which these are carried in electric work. The high ends also of the M. C. B. type are inconvenient to combine with low-hung car bodies, and especially with open-car run-boards.

There are several minor points in design that have never yet been thoroughly worked out. The strains and wear imposed on the bolster and transoms in transmitting to the body the pull of the motors or brakes has never been fully provided for. It is essential for smooth riding that the bolster should be a fairly close fit between the transoms, as otherwise it will tilt between them and bind and jar, yet there has never been any serious attempt made to provide for taking up the wear which occurs at this point. It is important for ease of running and even safety at high speeds, as well as avoiding undue wear, that the axles should be accurately parallel; yet they depend for their alignment on boxes which are inside and out rough castings without any adjustment for the correction of this alignment to compensate for their irregularity. It is necessary for the smooth working of the brakes, and to avoid undue wear and chattering that the connections between the brake-shoes and truck frame should have practically no lost motion, yet very few trucks have any provision for taking up this lost motion as wear takes place.

The tendency toward more machine work and accurate fitting has been very evident in the past few years, and has not yet reached its limit. Truck manufacture, but not necessarily design, is following the same course as locomotive manufacture, and the future high-speed motor truck will be a carefully finished product of the machine shop, instead of the assemblage of rough bolts, castings and forgings from which it has gradually evolved.

The earlier experiments with steel-tired wheels in city service were so uniformly unsuccessful that they have not been tried in the later interurban trucks. It is a question whether in conditions so nearly approximating steam service they would not prove more efficient than the cast-iron. Aside from the question of efficiency, the steel wheel obviates one of the most prominent dangers of higher speed, namely, that of broken flanges. In city service, where the rail is mostly flush with a hard packed or paved roadway, and the speed seldom exceeds 20 miles per hour, a broken flange is seldom more than a matter of annoyance or delay traffic. In interurban service, however, where cars are running over fills and trestles at much higher speeds, broken flanges have been the occasion of several serious accidents. The wheel of the motor truck also has an additional strain imposed upon it, as compared with that of the trail truck, by the uncushioned weight of the motor. That this is an appreciable factor is plainly demonstrated by the failure of the smaller diameter axles, which forced us by successive steps from the 3¾ ins. of the early days to the 5 ins. of to-day. These and several other advantages inherent in the steel wheel should insure it another trial under the new conditions of interurban service.

TESTS OF INTERURBAN CARS OF UNION TRACTION COMPANY OF INDIANA

BY CLARENCE RENSHAW

NOTWITHSTANDING the rapid development of interurban electric railways and the large mileage now in operation, there has been but little reliable data available on the general performance and requirements of cars in such service. In order to secure data of this sort for use in recommending equipments for similar railway service, a series of tests on cars of the Union Traction Company, of Indiana, was made recently by the Westinghouse Electric & Manufacturing Company, under the direction of the writer. These car tests formed a part of a general test of the power system of the Union Traction Company by students of Purdue University, under the direction of Professor W. E. Goldsborough, and through his kindness a number of students acted as observers.

The system of the Union Traction Company is a typical example of the most advanced type of interurban railway, completely equipped with modern apparatus. A map of the lines and the power system and an article on operating features were published in the STREET RAILWAY JOURNAL for December, 1901. In brief, the company operates about 100 miles of interurban line, connecting the cities of Indianapolis, Anderson, Muncie, Elwood, Alexandria and Marion, as well as from 50 to 60 miles of local street railways in the cities named. The power station at Anderson contains three 1000-kw Westinghouse alternating-current generators, direct connected to Rice & Sargent cross-compound engines, and there are eight rotary converter sub-stations, to which power is transmitted at 16,000 volts. Service at one-hour intervals is given on each of the interurban lines, and in addition to this "limited," or through cars, are run at reasonable intervals on several of them. Fifteen interurban cars are required for the ordinary schedule.

The operation of this system has been so successful that the company is now building 125 miles of new line, which will nearly double the present mileage. Contracts have been already let to the Westinghouse Company for new apparatus for this line similar to that which is now in use. This apparatus includes two generators, twelve rotary converters, a number of raising and lowering transformers, switchboards, lightning protection and fifteen 4-motor equipments of 75-hp motors. Power for the new line will be transmitted at 32,000 volts.

The tests were made on the line between Muncie and Indianapolis, which also passes through Anderson and through nine intermediate towns. The population of Indianapolis is 160,000, and of Muncie and Anderson about 20,000 each. The intermediate towns have populations of from 150 to 1500 each. The line is 56.55 miles long, and contains many curves and grades. The maximum grades are 3 per cent, but these are short. Most of the grades are less than 2 per cent. Power is supplied by five sub-stations, located respectively at Muncie, Daleville, Anderson (power station), Ingalls and Lawrence.

The cars have 40-ft. bodies and are 52 ft. 6 ins. long over the bumpers. Their height is 9 ft. 6 ins. from bottom of sill to top of roof. At the front end there is a baggage compartment 8 ft. long. This is provided with folding seats and is used also as a smoking compartment. The main part of the car has eleven seats on each side, and will accommodate forty-four people.

These cars are each equipped with two Westinghouse No. 50-C (150 hp) motors, and one L-2 controller. They are operated by overhead trolley. The characteristics of the motors are shown in Fig. 1. Both motors are

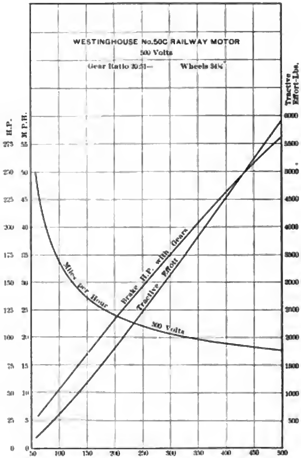


FIG. 1

mounted on the forward truck by means of the Baldwin-Westinghouse method of spring suspension. The gearing consists of a 20-tooth pinion and a 51-tooth gear, and the wheels are nominally 36 ins. in diameter. On car No. 252, however, which was used in the tests, the wheels had worn to a diameter of 34¼ ins. The weight of this car complete, but without passengers, was 63,100 lbs., divided approximately as follows:

	Pounds
Car body, including heater and brake equipment	34,065
Motor truck	9,565
Trail truck	6,670
Electrical equipment	12,800
Total	63,100

Sixty-four per cent of this weight was on the driving wheels.

In addition to the cars just described, the company has a few smaller cars of the same general construction. These cars are about 12 ft. shorter than the others, and are not as high. They are equipped with four Westinghouse No. 56 (60 hp) motors and K-14 controller. Tests were made also on one of these cars, No. 237, which weighed 51,560 lbs.; 13,500 lbs. of this was electrical equipment. Both styles of cars are equipped with Christensen brakes.

In addition to the ordinary local service between Muncie and Indianapolis, in which the cars stop regularly at each of the several towns and make numerous other flag stops, "limited" or through cars, which stop for passengers at Anderson only, are run at intervals. In these tests a detailed record was taken of the entire performance of each test car during a complete round trip (113 miles), carrying passengers in regular service and running first as a local and then as a limited car. In making these tests one side of the baggage or smoking compartment of the car was shut off from the public by means of a heavy canvas curtain, and the instruments and observers were located there. Fig. 2 shows the instruments in car No. 252.

FIG 2.—INSTRUMENTS ON CAR NO 252

Besides an ammeter and a voltmeter for measuring the current and line voltage, a car wattmeter was connected in the main circuit of the car for measuring the total power consumption, a voltmeter was placed across the terminals of the forward motor inside of the starting resistance, for measuring the exact voltage on the motor at all times, and an instrument for measuring the square root of mean square current was connected in the circuit of the same motor.

This latter instrument consisted of a car wattmeter, in which the usual 12,000-ohm resistance in series with the shunt circuit had been replaced by a lesser resistance suitable for the purpose and the instrument especially calibrated. This wattmeter was connected so as to measure the energy (in watt hours) lost in the field windings of the motor. Knowing the time during which a given total loss in watt hours occurred in the field windings, the average loss in watts could be readily calculated, and from this and the resistance of the field windings the average square of the current and its square root were easily determined. The resistance of the field windings was taken at intervals and an average value used.

This method of measuring a quantity which it is so necessary to know in all cases where the capacity of a motor for the service it is performing is in question, is believed to be new and to have been used for the first time in these tests. The method is a convenient and accurate one, and saves entirely the lengthy calculations which would be necessary in order to find the square root of mean square from the current readings.

For measuring the speed of the car a small magneto generator, such as is ordinarily used for sparking gas engines, was mounted on the trail truck, belted to the axle and connected with a 15-volt voltmeter in the baggage compartment. The generator gave a pressure of 10 volts at normal speed, and a careful calibration showed that it had a straight line relation between voltage and speed. The pulleys were so arranged that a speed of 5 miles per hour gave a pressure of 1 volt. Fig. 3 shows this machine in place on car No. 252.

Since all the conditions of speed, current and voltage change very rapidly when a car is starting, it was essential to obtain readings at short intervals during such times. When a car has attained a reasonable speed, however, these quantities are fairly uniform, and longer intervals between readings would suffice. To avoid taking an unnecessarily large number of readings it was decided not to take them at regular intervals, as would naturally be done, but to suit the intervals to the conditions. Under the direction of an observer, located beside the motorman, readings were taken at intervals of 5 seconds, when the car was starting or stopping, but at other times the interval was extended to 10, 15 or 20 seconds, and a record kept of the actual time in each case. Even with this method of taking observations, about 12,000 instrument readings were taken on each round trip. A crew of seven men was required for conducting each test, and to complete the series required about two weeks work.

FIG. 3.—SPEED INDICATOR ON CAR NO. 252

The transmission line follows the track during most of the distance, and the poles are spaced at uniform distances of 100 ft. Each fifth pole is numbered, and a record of the locations of the car during each run was kept by noting the time of passing each of these numbered poles.

The results of the tests have been plotted in a series of curves, of which Figs. 4 to 6, inclusive, are samples, and they form the most complete data on the operation of interurban cars within the knowledge of the writer. Figs.

4 to 6 give a record of the speed, current, line voltage and power consumption for car No. 252 from Indianapolis to Muncie in local service. All of the curves are plotted with reference to the time in seconds as abscissæ, and the profile and alignment have also been located approximately on the same basis. Every fiftieth pole number has been marked on the curves, and these give reference marks 5000 ft. apart, by means of which distances may be estimated. A few of the results may now be noted.

SPEEDS

In local service the running time between Muncie and Indianapolis is two and a half hours, giving a schedule speed of 22.6 m. p. h. The run shown by Figs. 4, 5 and 6, however, was an unusually heavy trip; the car was delayed by frequent stops at sidings, and was 23 minutes late. In making this run 37 minutes is required for covering 6.5 miles in the cities of Indianapolis, Anderson and Muncie, where the speed must be limited, so that the schedule over the remaining 50 miles is 26.6 m. p. h.

In the cities here mentioned the schedule speed is from 10 m. p. h. to 13 m. p. h. The cars are rarely run with the controller beyond the series position, and it is usually on the first or second notch, giving from 100 volts to 200 volts on the motors.

In limited service the cars, with exactly the same equipment and gearing, make the entire run in two hours—a schedule of 28.3 m. p. h.—while outside of the cities their average speed is 35.3 m. p. h.

With a line voltage of 500 or more the cars maintain uniform speeds of from 40 m. p. h. to 45 m. p. h. over the light rolling grades, of which the road is largely composed. On slight down grades speeds in the neighborhood of 50 m. p. h. are common, and on one particular part of the road a speed of 60 m. p. h. is sometimes reached.

It will be noted at once from Figs. 4, 5 and 6 that the cars are handled in a manner very similar to steam trains. The starts are slow, from 35 seconds to 50 seconds being ordinarily required to reach a speed of 25 m. p. h., and the power is kept on until the last moment before braking. This method of operating, although it causes a greater average power consumption than would be the case with more rapid acceleration and a corresponding amount of coasting, is almost a necessity on a road of this character. Rapid acceleration is not practicable on account of the large feeder capacity which would be needed to maintain the voltage when one or more cars were starting at a distance from the sub-stations.

When making flag stops, moreover, coasting is difficult. About 750 ft. is usually required for a service stop from the ordinary speed of 40 m. p. h. to 45 m. p. h., and the motorman could not see a passenger at a much greater distance than this.

It will be seen from Figs 4. 5 and 6 that the cars in starting took a maximum current of from 200 amps. to 250 amps., with the motors in series, and from 250 amps. to 330 amps. or 340 amps. in multiple.

When running at uniform speeds of from 40 m. p. h. to 45 m. p. h. over the slightly rolling grades—there are no levels to speak of—the car required repeatedly from 140 amps. to 150 amps. This corresponds to a train resistance of a trifle less than 20 lbs. per ton.

STOPS

The total number of stops outside of the cities of Anderson, Muncie and Indianapolis varies, as a rule, on different trips, from about 30 to 35, occasionally reaching 45. This makes the average run about 1.6 miles. One stop is made at each of the several towns, and from two to three stops between towns.

Some of these stops are merely slow downs to a speed of 5 m. p. h. to 6 m. p. h., and they vary from this up to an actual standstill of 25 seconds or 30 seconds. The average duration calculated from a large number of stops was 10 seconds. This, of course, refers to passenger stops, and does not include accidental delays on sidings.

The effect of stops on the schedule speed is shown very clearly by the difference in the running time of the cars in limited and local service. In the latter the cars make about thirty more stops than in the former, and their running time is just thirty minutes longer. Thus, although the average duration of the actual stop is only ten seconds, the entire time lost by slowing down, stopping and getting up to speed again is very closely one minute for each stop.

POWER CONSUMPTION

The power consumption shown by the wattmeter readings varied on six different trips in local service from 2.24 kw-hours to 2.78 kw-hours per car mile (66.7 to 81 watt-hours per ton mile) from Muncie to Indianapolis, and from 2.62 kw-hours to 3.12 kw-hours per car mile (77 watt-hours to 89.5 watt-hours per ton mile) for the return trip. The average for the six round trips was 2.62 kw-hours per car-mile, or 76.6 watt-hours per ton-mile.

In limited service the consumption of power was 2.1 kw-hours per car mile (58.7 watt-hours per ton mile) from Muncie to Indianapolis, and 2.31 kw-hours (71.6 watt-hours) on the return. The average for the round trip in limited service is thus 15 per cent less than for the locals, which is entirely due to the omission of stops.

The effect of stops on the power consumption may be shown by the following comparison.

In making the run from Indianapolis to Muncie on three different occasions, the number of stops outside of the cities of Anderson, Muncie and Indianapolis, together with the respective power consumptions, were as follows:

Run No.	Service	Stops	Watt-hours Per Ton Mile	Time
1	Limited	4	71.6	2 hrs.
2	Local	31	83.3	2 hrs. 36 min.
3	Local	44	89.5	2 hrs. 53 min.

The handling of the cars in the three cities was closely the same in each case. It will be seen that the power consumption in run No. 3 was almost exactly equal to that in run No. 1, plus 27/40 of the difference between the consumption of run No. 1 and run No. 3. That is, the excess power required when making the stops was almost exactly proportional to the number of stops, and was ⅔ of 1 per cent for each.

SQUARE ROOT OF MEAN SQUARE CURRENT

The heating current, or the square root of mean square current per motor, as measured by the special wattmeter, already described, varied in four different round trips in local service from about 87 amps. to 99 amps., averaging 94 amps. for the four trips. This means that the heating effect of the varying currents used by the motors in making the runs was equivalent to that which would be pro-

duced by uniform currents equal to the foregoing figures, applied to each motor continuously for the same length of time in each case, as was required to make the trip. For the trip in limited service this quantity averaged 83 amps., that is, 12 per cent less than the average for local service. This, of course, is due to the omission of frequent starting currents. The above currents are well within the continuous capacity of the motors, and show that the equipments are of the proper size for the work.

It is often supposed that the running of interurban cars at very slow speeds in the cities and towns through which they pass is easier on the motors than the regular high-speed runs in the open country. This idea is erroneous. It will be seen from the curves that the square root of mean square current, while running through the city of Indianapolis at an average speed of about 10 m. p. h. was not materially different from the average value for the entire trip (over which the schedule was 19.6 m. p. h. in this case), and taking the average value for four round trips the heating current per motor was 7 per cent greater for the portion of the run in the city of Indianapolis than for the run as a whole.

AVERAGE VOLTAGE

The average line voltage for the trip shown in Figs. 4, 5 and 6 was 454 volts. In computing this only those voltage readings which were taken while the car was using current were considered, since an average which included the no-load readings would be misleading.

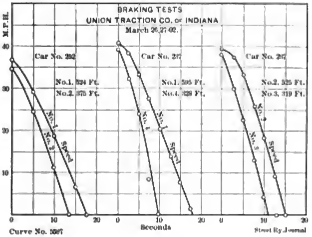


FIG. 7

In considering the question of motor capacity the average voltage at the terminals of the motors must be taken into account as well as the square root of mean square current, since the iron loss depends on this. In computing this average all readings (including zero readings as well as others) must be included, and the average result based on the entire time of the run. Owing to the fact that the motors were sometimes in series, sometimes on resistance and sometimes, as in braking or when at rest, with no voltage at all, the average voltage at the terminals of the motors for the run shown by Figs. 4, 5 and 6 was only 237.

BRAKING

The braking curves obtained in the service tests show a retardation varying from about 1.1 miles to 2 miles per hour per second. The rate of retardation, after the brakes were set, for twenty-five different stops, averaged 1.6 miles per hour per second.

Fig. 7 shows the results of some special tests in which the retardation is much more rapid than the foregoing. These were emergency stops, and were much too rapid for use in ordinary service.

TESTS WITH 4-MOTOR CAR

In the tests with the 4-motor car the results were all of the same general character as here attained. With this car the acceleration was somewhat faster and the starting currents consequently greater than with car No. 252. This was apparently due rather to the handling of the controller than to any essential difference in the cars. On a basis of the empty weights, this car had 9.3 nominal horse-power per ton, while car No. 252 had a little over 9.5. On a basis of the same tractive effort, i. e., 20 lbs. per ton, car No. 237 should have attained an ultimate speed of 47 m. p. h. on a straight, level track with 500 volts, while car No. 252 should only have reached 44 m. p. h., so that the gear reduction on the latter car was somewhat greater than on the former. This fact should tend to make car No. 237 less economical of power than No. 252. The maximum speed of this car and its current consumption under uniform conditions were almost exactly the same as with car No. 252. On account of the lighter weight, however, the train resistance calculated on this basis was 24½ lbs., instead of 20 lbs. per ton. This increase was partly accounted for by the fact that the car had been equipped only about a week before the tests, and was still somewhat stiff.

The average power consumption of the 4-motor car in limited service was 72.8 watt-hours per ton-mile, or 11.2 per cent greater than that for the 2-motor car. In local service the average power for two round trips was 85.4 watt-hours per ton mile, which was 11 per cent greater than the average of six trips with car No. 252. A considerable part of this difference in power consumption, however, was due no doubt to the stiffness of the car, and the difference in gearing, although, even with all conditions exactly alike, it is probable that the power consumption per ton mile of the 4-motor equipment would have been somewhat greater than that of the 2-motor equipment. A discussion of this matter, however, is beyond the scope of this paper.

CONCLUSION

It has not been the object of this article or of the tests to bring out any specific conclusions, but rather to present the general operating conditions of a most successful interurban railway in a form which it is hoped will make them useful to engineers and railway managers. A number of the results, however, are of particular interest. The figures on train resistance, obtained by direct measurement of the power required by two different styles of cars at uniform speeds of from 40 m. p. h. to 45 m. p. h., should add something to the recent discussion on this subject. The average results in regard to acceleration, braking, number and duration of stops and so on, furnish useful data as to the proper values to use in making theoretical calculations, and the schedule speeds and power consumption are concrete examples of modern practice.

The writer is indebted to the officials of the Union Traction Company, and especially to A. S. Richey, electrical engineer; Charles A. Baldwin, superintendent of transportation, and John Matson, master mechanic, for their hearty co-operation; to Messrs. Dostal, Zapp, Peticolas, Hollingsworth, Dinsmore and other students of Purdue University, and to B. B. Abry, of the Westinghouse Company, for general assistance in preparing for and carrying out the tests.

SUBURBAN TRAFFIC CONDITIONS OF LONDON, ENGLAND

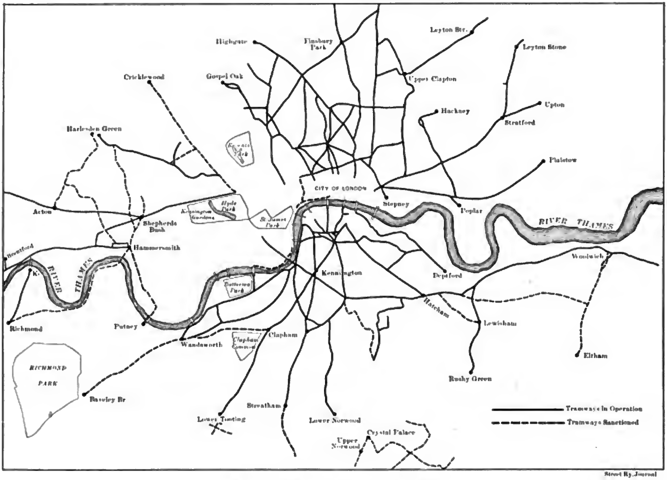
BY PHILIP DAWSON

IN the last convention issue of the STREET RAILWAY JOURNAL there was a series of articles by Messrs. Ford, Vreeland, Starrett, Pearson and others, in which the subject of the rapid transit facilities in Greater New York was most ably handled. It may, perhaps, interest the readers of the STREET RAILWAY JOURNAL if some of the conditions that obtain in and around London are brought before them more clearly than has hitherto been done.

The following figures show the population and the area of London and Greater London:

	Area Square Miles.	Population		
		1881	1891	1901
County of London...	117.87	3,834,194	4,232,118	4,803,010
Greater London	692.84	4,766,661	5,633,806	6,600,000

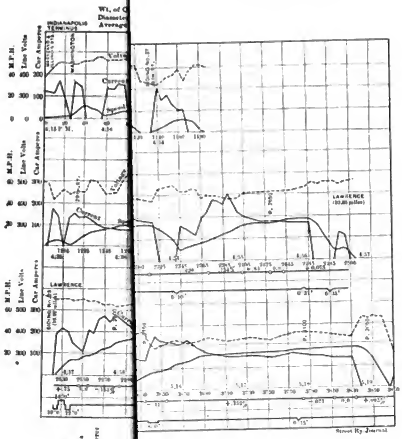
The want of rapid transit facilities has been long felt and is well known to the American visitor in London, who up till recently had generally either to use a cab or a 'bus to be taken from one part of London to the other. It is especially noticeable in the center portion of London; the existing 'buses are neither convenient nor economical in time, and, owing to the conditions that obtain, tramways or street railways will never be tolerated in the center of London, and consequently other methods had to be resorted to. The solution, which has so far been most successful, and which was introduced by the late Mr. Greathead, is the tube system of railways, constructed at such a depth (from 50 ft. to 100 ft.) underneath the existing roads as not to interfere in any way with existing buildings, sewers, and such like.



MAP SHOWING TRAMWAYS IN LONDON

There should be no difficulty in getting near the center of the city without being deposited within it, since there exists a network of railways which, provided proper methods of traction are used, should, in conjunction with the tramways which are now being equipped by the London County Council, completely satisfy all requirements.

To show the excellent system of railway lines which came into London, as well as the system of tramways, which is now being electrically equipped by the London County Council, and the tube franchises which have already been granted, the three maps which accompany this article



data which was specially tak[illegible] some of the busy portions in London between 8 a. m. and 8 p. m. by independent witnesses appointed by the metropolitan police, and they may

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which is now being electrically equipped by the London County Council, and the tube franchises which have already been granted, the three maps which accompany this article

have been reproduced. A series of diagrams showing the area covered by each of the various railway systems entering London have been added. When electric traction has been introduced (as undoubtedly it will be within the next few years) these will give "the hub of the universe" one of the best rapid transit systems the world has ever seen.

Table I. gives the various existing tube tramways and railway and omnibus lines which exist at the present moment, and shows the passengers carried, as well as the mileage run and the mileage operated. According to British usage, the mileage operated is not given in miles of single track, as is generally done in America, but in miles of route operated, this in some cases being double, and in others single track. With railways it is sometimes quadruple and more. From this table it will be seen that last year the total number of passengers conveyed by omnibus, steam railway, tube or tramway was nearly 900,000,000,

TABLE I.—EXISTING TRAMWAY, OMNIBUS AND UNDERGROUND RAILWAY LINES IN LONDON, TRAFFIC TRAIN MILES AND MILES OF ROUTE.

	Passengers Carried in 1901	Train Miles Run	Miles of Routes
Central London Railway	41,188,389	1,243,730	6⅓
City & South London Railway	12,896,678	939,666	6⅝
East Ham Urban District Council Electric Trams	*3,663,422	245,047	4⅛
Waterloo & City Railway	†4,324,594	... .	1⅝
London United Trams	40,000,000	....	‡6
Harrow Road & Paddington Tramways Co.	2,706,367	299,363	3
Highgate Hill Tramway Co.	1,122,855	91,255	7-10
London County Council—Southern System	118,281,320	10,399,058	24⅛
Northern System	160,801,393	16,514,353	62¼
London, Deptford & Greenwich	8,205,285	754,314	6
London Southern Tramway Co.	6,454,657	654,522	5¼
South Eastern Metropolitan Tramways Co.	3,252,330	263,020	2⅛
South London Tramways Co., Ltd	17,392,115	1,666,049	13
Woolwich & S. E. London Tramways Co., Ltd	4,353,821	446,031	7⅔
London General Omnibus Co.	202,024,222	32,288,606	....
London Omnibus & Carriage Co.	....	....	....
London Road Co.	67,909,537	....	....
Railways & Metropolitan Omnibus Co.	2,281,053	214,816	....
Metropolitan Railway	88,000,000	2,295,640	64
Metropolitan District	40,444,073	1,380,996	18¼
North London Railway	49,500,000	2,187,391	12‡
Metropolitan Dist. & City Exten.	1,399,043	218,166	2
East London Railway	7,072,492	322,252	6⅛
London, Tilbury & Southend	15,774,822	1,293,175	79

* For six months. † Exclusive of season ticket holders. ‡ Operates over 100 miles of route. § One mile of single, double or triple track, etc., counted as one mile only.

not including the passengers carried by the suburban lines of our great railways, such as the Northwestern, Great Northern, Midland, Great Eastern, Southeastern & Chatham, London, Brighton & South Coast, Southwestern & Great Western. It is impossible to get accurately the number of passengers carried by these, but it must be considerable, as it will be seen by a glance at the railway map (next page) published by the Clearing House of London, which accompanies this article, as well as a series of diagrams showing the suburban ground covered by the various steam railway companies whose termini are in London.

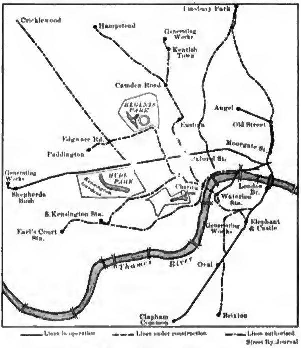
The accompanying Table II. has been constructed from data which was specially taken at some of the busy portions in London between 8 a. m. and 8 p. m. by independent witnesses appointed by the metropolitan police, and they may serve to give some idea of the traffic that exists at some of the chief points which has to be catered for.

TABLE II.—AVERAGE NUMBER OF VEHICLES AND PEDESTRIANS PASSING DIFFERENT POINTS IN LONDON BETWEEN 8 A. M. AND 8 P. M.

	Vehicles	Pedestrians
Marble Arch	10,974	21,080
Oxford Circus	12,331	54,100
Holborn Bars	14,301	59,455
Knightsbridge	18,874	,7,036
Piccadilly Circus	12,551	52,930
Strand	11,997	56,927

Already the competition of electric tramways is being very seriously felt by the railways, and the same process will probably be gone through in this country as was experienced in America. This is clearly demonstrated by the speeches made at the annual meetings of most of our big railway companies. The following extracts in this connection may be of interest:

"With regard to the decrease in numbers—in first-class and second-class passengers—the reason is that the short-



MAP SHOWING TUBE RAILWAYS IN LONDON

distance passengers have decreased in London, Birkenhead and Bristol, and this is chiefly, if not entirely, due to the competition of electric trams. You will find, of course, that the result is that we have been carrying more passengers for longer distances, and that has increased the receipts per passenger. The competition of electric trams, of course, is one which we have been watching very carefully. I do not think that there is any doubt that electric trams, for short distances especially, are taking away a certain amount of traffic."—Earl Cawdor, at the Great Western Railway meeting, Feb. 15, 1902.

"With regard to the passenger and parcel traffic, I think I have said that the receipts are down £14,000, and this I consider a very disappointing account. And this is mainly due to the strike of the fishermen at Grimsby. Apart from this, the loss chiefly arose from the competition of electric trams in Yorkshire. We have had a decrease there of 507,000 passengers; short-distance passengers, it is true,

but, nevertheless, a serious loss."—The Rt. Hon. W. J. Jackson, M. P., at the Great Northern Railway meeting, Feb. 14, 1902.

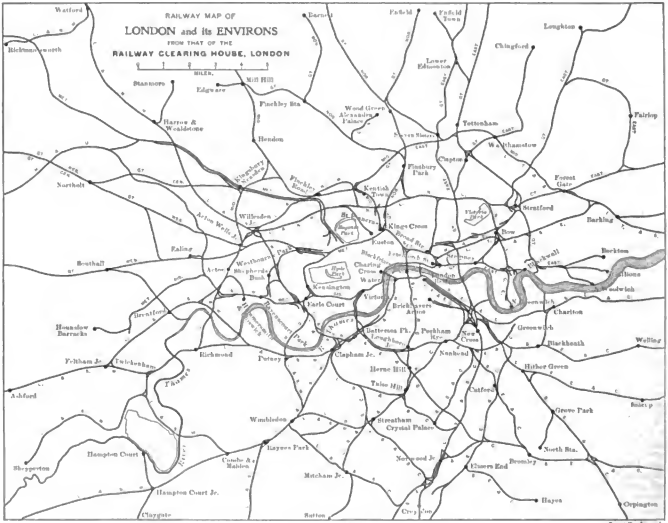
"Proceeding, the chairman had something to say with reference to the competition which has recently sprung up in the shape of extended and improved tram services. Here he thought the railway people had a real grievance. These tramways, whether electrical or otherwise, were constructed upon roads made and maintained out of the rates, and when it was found that these roads were used, in some cases almost monopolized by these tram undertakings, it was surely only reasonable to expect that they should contribute to the rates, that the railway companies might be relieved of some of the burdens which pressed so heavily upon them."—Alexander Henderson, M. P., at the Great Central Railway meeting, Feb. 12, 1902.

"He still, however, felt the same apprehension as to the future that he expressed when last addressing the shareholders. He felt that the pace was too hot to last, and they had the danger before them of the competition and opening of tramways in the district, and which, if they were authorized and made, must necessarily compete with their railway."—R. L. G. Vassall, at the Taff Vale Railway meeting, Feb. 11, 1902.

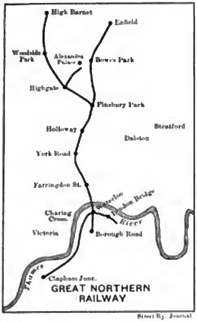
"The directors had not lost sight of the new conditions that had to be faced by railway companies. These conditions were increased obligations, and last, though not least, the construction by the public bodies, at the cost of the rates, of tramways and electric railways, which would compete with existing lines."—Lord Claud Hamilton, at the Great Eastern Railway meeting, Jan. 28, 1902.

"When I addressed you on this subject a year ago, I mentioned that it was the first time we had had to record a decrease in the number of passengers carried, which I attributed to the loss of suburban traffic by reason of tramway competition, and to which I referred at our last meeting. With a view to ascertaining how we have been affected during the past half year by reason of this competition, I have had the figures carefully taken out, and can with certainty say that we have lost 620,000 passengers and £6,053 in receipts; not so much as I should have expected. We must also remember that in some districts where the tramways are non-competitive they act as feeders to our line."—Sir G. Armytage, at the Lancashire & Yorkshire Railway meeting, Feb. 5, 1902.

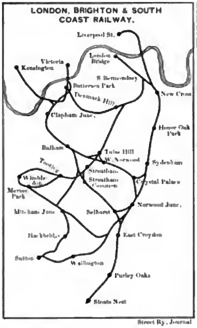
"There are, no doubt, many cases giving great anxiety to those who have the responsibility from day to day of carrying on this enterprise. There is the effect upon these companies—all railway companies, and especially a company like ours, with a dense population—of competition on the public roads by people who are not subject to taxation, who pay nothing for rights of way—rights of way to



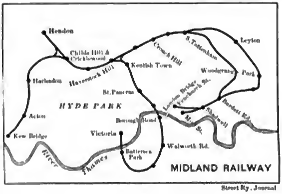
MAP SHOWING STEAM RAILWAYS TERMINATING IN LONDON



GREAT NORTHERN RAILWAY

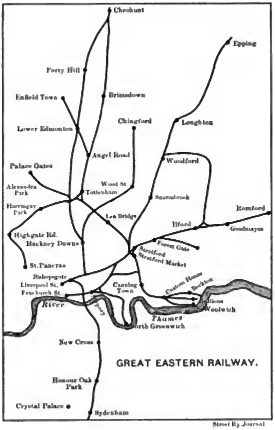


LONDON, BRIGHTON & SOUTH COAST RAILWAY.



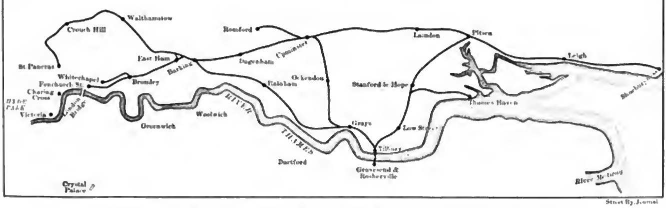
MIDLAND RAILWAY

NORTH LONDON RAILWAY.



GREAT EASTERN RAILWAY.

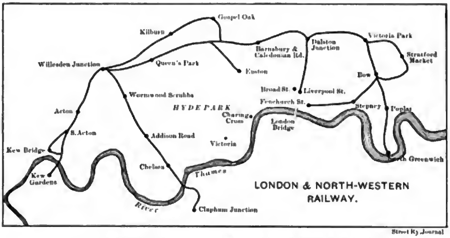
LONDON, TILBURY & SOUTHEND RAILWAY.



MAPS SHOWING THE CITY TERMINALS OF A NUMBER OF THE STEAM RAILROADS IN LONDON

which you in every parish, on every road, are enormous contributors. You are actually now being used by county councils, road authorities and private adventurers, running upon the roads which you largely maintain free of cost to them, as a means of competition against yourselves."—J. Staats Forbes, at the London, Chatham & Dover Railway meeting, Feb. 3, 1902.

"We are, as nearly all railway companies are, more or less feeling the effects of electric tramway competition in the suburban districts, not only of London, but of other large towns. With the advance which has been made in electric traction such competition was inevitable. But such competition ought fairly to be limited to crowded dis-



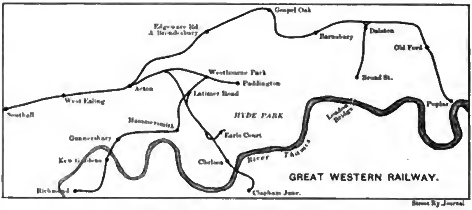
CITY TERMINAL OF LONDON & NORTHWESTERN RAILWAY

tricts, and it would not be reasonable to allow it to extend beyond the immediate suburbs, or it would become a most improper and unfair competition. The districts beyond the immediate suburbs have been built up by the railways, which have spent millions to provide transit accommodation for the public, and which have provided their own roads, while the rates they have paid have largely built up the funds by which the highways, of which tramway companies ask for free use, have been made."—The Hon. W. Campbell, at the London & Southwestern Railway meeting, Feb. 6, 1902.

"It was hardly fair to the present companies, who had expended millions of money on making their roads, that they should have to face competition from electric railways and tramways running along the public thoroughfares."—Lord Cottesloe, at the London, Brighton & South Coast meeting, Jan. 29, 1902.

The figures (see table on next page) in this connection are also of interest, showing that the competition of electric tramways is a very serious thing for the railway companies.

The railway traffic receipts between all places was reduced from £2,985 in 1900 to £1,785 in 1901. The number of season ticket holders was reduced from forty-one to thirty-five. Half-hour trains are run on the railways, while



CITY TERMINAL OF GREAT WESTERN RAILWAY

there is a 9¼-minute car service on the electric tramway which has caused this reduction in the railway receipts. The total light railway traffics from April 6, 1901, to April 5, 1902, was 1,985,769, while from April 6, 1901, to Dec. 31, 1901, it was only 1,558,676.

Between Hartlepool and West Hartlepool the Northeastern Railway states that its traffic has decreased by about 36 per cent. The distance is 2 miles. The competing electric tramways carried 1,960,122 passengers for year ended Dec. 31, 1901, but this is on the whole system.

Between North Shields and Monkseaton the traffic on the steam railway has decreased 58 per cent during 1901, while from March 18 to Dec. 31, the

CITY TERMINAL OF LONDON & SOUTHWESTERN RAILWAY

electric tramway system carried 1,515,511 passengers.

Between Stockton and Middlesbrough, a distance of 6

POOLE & DISTRICT LIGHT RAILWAYS
(Opened April 6, 1900.)

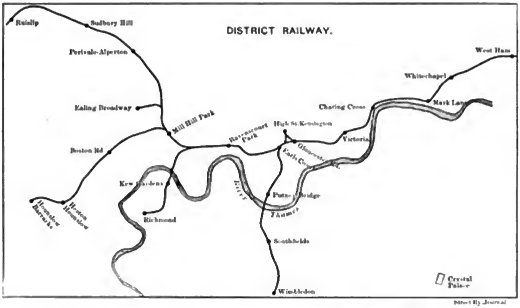
	Passengers Carried	
	1900	1901
Poole & Parkstone..........	135,292	63,482
Poole & Branksome	55,592	26,816
Branksome & Parkstone.........	24,917	15,611
Parkstone & Bournemouth....	140 992	105,793
	359,793	211,702

miles, the railway bookings have decreased by 21 per cent, and between Middlesbrough and Newport, 90 per cent. The Middlesbrough, Stockton-on-Tees and Thornaby Electric Tramways, which also serve these localities, have a total length of 9 miles 4½ furlongs. The number of passengers carried by this tramway was: July 16, 1898, to Dec. 31, 1898, 3,759,605; Jan. 1, 1899, to Dec. 31, 1899, 8,307,322, and Jan. 1, 1900, to Dec. 31, 1900, 8,782,970.

The Northeastern Railway Company has realized what is happening, and has decided to electrify the loop which connects the Newcastle Central station with Tynemouth. The total miles of route covered by this line will be 36 miles.

The present position is in some respects very similar to the conditions that obtained when some routes were first introduced into London; thus in 1845, owing to the difficulties of getting from the railway termini into London, nineteen bills were presented to Parliament for railways in the metropolis. A line which now forms part of the Inner Circle was promoted in 1854 to connect the northern termini. The bill was successful, but it was difficult to get capital for such a novel undertaking, and the line was only actually commenced six years later, and was not open until 1863. The opening of this line was soon followed by the construction of the District Railway from Westminster to Kensington, which was opened in 1868, and extensions were built after that till the Inner Circle was finally completed in 1884. There is no doubt that those who undertook to build the Inner Circle were true pioneers, and that it was a very heroic effort on their part. The cost of construction was in some parts terrific, amounting in some cases to £1,000,000 per mile, and in places, owing to shallow tunnels adopted, whole streets had to be reconstructed. These underground railways were at first intended to be worked by hot-water locomotives, and they were, in fact, the pioneers of the shallow tunnel which has of late been so successfully adopted in America.

The problem of rapid transit in London may be divided into two great sections; (1) the methods of inter-communication between the various portions of London, that is to say, giving facilities for getting about in London itself from place to place; (2) the facilities for getting in and out of London from the suburbs and increasing the radius, as far as distance is concerned, without increasing the time taken in the journey, this time being practically a limited quantity.



MAP OF CITY TRANSPORTATION SYSTEM OF THE (UNDERGROUND) DISTRICT RAILWAY

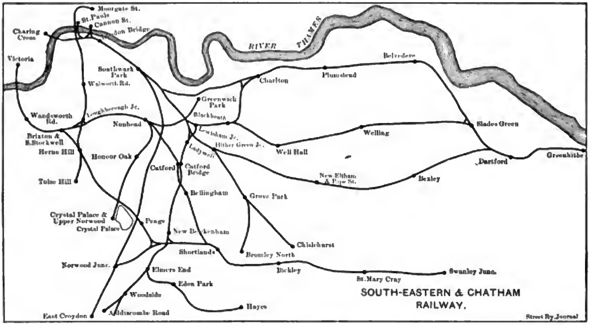
The first requirement is being more or less solved by the Metropolitan and District Railways and by the Yerkes and Morgan interests, as well as by the Central London, the City & South London, the Great Northern & City, the tube lines, and by the London County Council Tramways, and the shallow tunnels which this body proposes to construct to connect the tramway termini on the north and south sides of the river through the heart of London. This problem is comparatively easy of solution, and we are within sight of a very complete rapid transit system as far as getting about from one part of London to the other.

But the second problem is by far the most important, and nothing definite has yet been done toward its solution. So far, the main line railways, particularly those of which diagrams accompany this article, have been the means of conveying the business man to and from his work every day. The present methods of transportation are very obsolete, and the railway companies will have to wake up to existing circumstances and be prepared to spend additional capital and transform their suburban services into electric ones, unless they are willing to discontinue handling suburban traffic entirely and hand the same over to some separate organization.

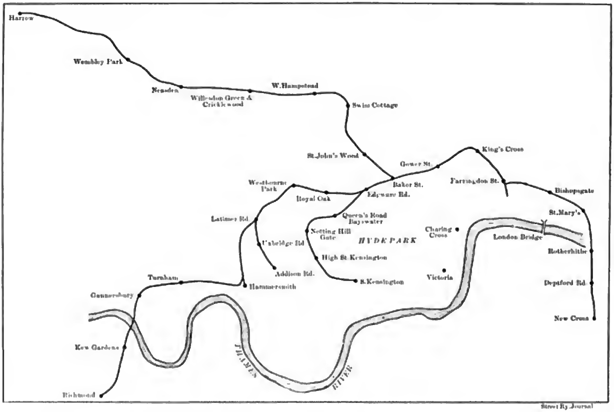
The greatest difficulty in the way of the railway companies moving is a financial one. The conversion from steam to electric traction will undoubtedly be very costly, and will involve the scrapping of a large amount of rolling stock, locomotives, signals and other material, in addition to calling for a heavy capital expenditure to pay for new rolling stock and electrical equipment. Even if our railway companies were not very heavily handicapped by their

enormous capitalization, the step would be one so serious as only to be taken when absolutely forced to do so. That this is the case has been proved in America, where only quite recently the main line railways have considered discontinuing the use of steam for operating their local trains into the city by electricity. It is only after such an accident as that which happened recently that the New York Central and the other lines which come into this station have been forced to decide on electrification.

Some idea of the enormous burden which our railway companies have to bear may be gained by the following figures, taken from the Board of Trade returns, and applying up to the end of the year 1900. At the time the capitalization of the railways of the United Kingdom was £1,176,001,890. The annual gross receipts were £104,801,858, the ratio of operating expenses to receipts 62 per cent and the average interest on the paid-up capital 3.41 per cent. The total miles of route open were 21,855, of which 12,162 had two or more tracks, and 9693 were single track, and the total number of passengers carried, exclusive of season ticket holders, was nearly one passenger per pound sterling of capitalization. Adding the number of season



CITY TERMINAL OF THE SOUTHEASTERN & CHATHAM RAILWAY



MAP OF CITY TRANSPORTATION SYSTEM OF THE (UNDERGROUND) METROPOLITAN RAILWAY AND CONNECTIONS

ticket holders, which was, approximately, 1,600,000, and adding a fair average of journeys for this, would probably bring the total number of passengers carried on the railways of the United Kingdom to 1,500,000,000,000 per annum.

Notwithstanding this fact, the railway companies, when they want to, could raise money easily, and they should not hesitate to inaugurate the conversion to electric traction of the suburban portion of their systems. As already shown, our railway companies realize that they are undergoing a steady and substantial decrease in their suburban traffic, owing to the competition of electric tubes and tramways. The same thing has happened in America. In order to compete with electric tramways, steam railways will have to do a great deal more than simply operate their trains electrically, they will have to change the whole system of operation of their suburban traffic, which will have to be entirely separated from their main-line trains.

TABLE IV.—RUNNING TIME OF SUBURBAN TRAINS ON THE LONDON, BRIGHTON & SOUTH COAST RAILWAY

Miles	Name of Station	Time Taken to do Distance as per Time Table in Minutes	Average Speed Mile per Hour
	London Bridge to—		
2¼	New Cross	6	27½
7	Brockley	4	15
7	Honor Oak Park	5	12
¾	Forest Hill	4	11¼
7	Sydenham	3	20
1	Crystal Palace	10	6
¾	Gipsy Hill	4	11¼
1	West Norwood	3	20
1¾	Streatham Hill	4	26¼
1	Balham	3	20
¾	Wandsworth Common	3	15
1¼	Clapham Junction	4	18¾
1½	Battersea Park	4	22½
½	Grosvenor Road	2	15
½	Victoria	5	6

Total distance, 16½ miles; total time taken, 55 minutes; average speed for whole distance, 18 miles per hour; average distance between stations, 1.1 miles.

TABLE V.—METROPOLITAN BOROUGHS

Borough	Acres Excluding Water	Population	Persons per Acre
Stepney	1,691	298,600	177
Bethnal Green	743	129,680	174
Hackney	3,250	219,272	67
Shoreditch	642	118,637	185
Spitalfields	87.5	27,969	319
St. George's North	114.0	40,976	279
Mile End, New Town	146.6	28,718	251

TABLE VI.—INCREASE OF POPULATION BETWEEN 1871 AND 1901
(Extract from Census Returns.)

Acres	District	1871	1881	1891	1901	Increase Each 10 Years		
						1881	1891	1901
18,786	West Ham Division	99,142	200,752	365,134	580,306	102%	*15	58%
1,072	Stratford	......	......	38,612	44,825	....	....	16
1,949	Blaistow	......	......	58,090	90,920	....	....	56
1,866	Canning Town	......	......	54,750	70,666	....	....	29
806	Forest Gate	......	......	58,511	60,807	....	....	18
3,208	East Ham	......	......	32,713	96,070	....	....	198
7,951	Total	67,928	189,513	237,616	363,278	105	70	52
1,787	Wanstead	......	......	7,042	9,198	....	....	30
681	South Leyton	......	......	38,232	50,458	....	....	32
1,963	North Leyton	......	......	24,874	48,441	....	....	94
4,431	Total	15,913	32,400	70,148	108,097	101	116	54
6,504	Walthamstow	15,301	28,830	57,870	106,981	89	98	80
....	Romford	......	......	......	......	....	....	..
8,498	Ilford	5,947	7,645	10,913	41,240	28	42	277
3,808	Barking Town	6,576	9,155	14,302	21,547	39	56	50
12,299	Total	12,523	16,800	25,214	62,787	34	50	149

A great deal has recently been heard of operating main-line trains electrically; thus in this country Mr. Langdon, the late president of the Institution of Electrical Engineers, Messrs. Mordey, Jenkins, Swinburne and others have dilated on the subject. In Germany experiments at Zossen have been carried out, and in Switzerland Messrs. Brown and Boveri have equipped a main-line railway, the Burgdorf-Thun. Messrs. Ganz have equipped the Valtelina line, which, up to date, is not yet completely operated electrically. The Mediterranean Thomson-Houston Company has built a line from Milan to Gallarate, which has

TABLE VII.—POPULATION OF METROPOLITAN BOROUGHS

Name	Area in Square Miles	Population	Population per Acre in 1896
Battersea	3½	In 1855, 14,000 1871, 107,262 1891, 150,558	94
Bermondsey	2 2-5	1841, 68,701 1881, 134,632 1891, 136,660	97
Bethnal Green	1⅚	1871, 120,104 1881, 126,961 1891, 129,132	171
Camberwell	7	1861, 71,488 1881, 186,593 1891, 235,344	57
Chelsea	650 (acres)	1851, 56,185 1891, 96,253	148
Deptford	2½	1891, 107,273	68
Finsbury	588 (acres)	1891, 109,961	192
Fulham	2⅔	1850, 10,000 1881, 42,900 1891, 91,639	61
Greenwich	6	1891, 84,429	22
Hackney	5¼	1861, 70,000 1896, 213,044	80
Hammersmith	3½	1800, 5,600 1881, 71,939 1891, 97,239 1896, 104,199	50
Hampstead	3½	1851, 12,000 1881, 45,452 1896, 75,449	38
Holborn	409 (acres)	....	165
Islington	4¾	1801, 10,212 1891, 319,143 1896, 336,764	110
Kensington	3½	1861, 70,108 1881, 163,151 1896, 170,465	148
Lambeth	6¾	1851, 138,000 1891, 275,000 1896, 295,033	74
Lewisham	11	1896, 99,962	14
Paddington	2	1871, 96,813 1896, 124,506	98
St. Pancras	4	1881, 236,363 1891, 234,375 1896, 240,764	102
Poplar	3½	1896, 21,898	110
Marylebone	2⅓	1896, 141,188	130
Southwark	1¼	1881, 195,164 1896, 206,582	187
Stepney	2¼	1891, 285,225 1896, 295,547	170
Stoke Newington	...	....	52
Wandsworth	14½	1891, 156,912 1896, 187,264	20
Westminster	4	1861, 257,232 1896, 193,465	107
Woolwich	13	1891, 98,966 1896, 106,477	14
Penge	1 1-5	1896, 21,308	...
Shoreditch	1	1861, 129,364 1896, 122,358	190
City of London	670 (acres)	1901, 31,108	...

already been described in the STREET RAILWAY JOURNAL, but the conditions that obtain in these instances are totally different from those met with in Great Britain.

The British railways, particularly in London, by electrifying their suburban lines, will be able greatly to increase the average speed; this will, of course, probably entail separate tracks for handling this traffic and separate terminal stations with loops such as have been already adopted at the terminal station at Boston, Mass., and at the terminal of the electric street railway on the New York side of the Brooklyn Bridge and at some of the termini of the Metropolitan Underground Electric Railway of Paris.

TABLE VIII.—INCREASE OF PRESENT POPULATION OVER:

	1871	1881	1891	1871	1881	1891
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Stratford, Plaistow, Canning Town, Forest Gate, East Ham	434	160	52			
Wanstead						
South Leyton, North Leyton	585	233	54			
Walthamstow	613	278	89			
Stratford to Walthamstow (together)				485	189	58
Ilford	593	439	277			
Barking Town	227	135	50	401	273	149

TABLE IX.—EXTRACT FROM CENSUS RETURNS, 1901, SHOWING CONGESTION OF POPULATION

Rooms. No.	Occupiers No.	Metropolitan Boroughs of: Bethnal Green, Tenements	Bethnal Green, Occupiers	Hackney, Tenements	Hackney, Occupiers	Shoreditch, Tenements	Shoreditch, Occupiers	Stepney, Tenements	Stepney, Occupiers
1	3	1,110	3,330	679	2,037	1,318	3,954	2,879	8,637
1	4	594	2,376	292	1,168	678	2,712	1,734	6,936
1	5	208	1,040	71	355	216	1,080	824	4,120
1	6	85	510	18	108	73	438	309	1,854
1	7	33	231	7	49	12	84	131	917
1	8 to 12	12	115	2	18	8	67	51	438
2	6	684	4,104	356	2,136	694	4,164	1,798	10,788
2	7	383	2,681	154	1,078	280	1,960	1,126	7,882
2	8	173	1,384	57	456	155	1,240	577	4,616
2	9	55	495	14	126	48	432	278	2,502
2	10 to 12	27	278	11	114	25	266	149	1,564
3	9	211	1,899	100	900	175	1,575	511	4,599
3	10	82	820	37	370	64	640	278	2,780
3	11	33	363	10	110	21	231	231	2,541
3	12	16	192	6	72	9	108	68	816
4	12	35	420	18	216	27	324	127	1,524
Total in less than 5 rooms and 3 per room		3,741	20,336	1,832	9,313	3,804	19,275	10,952	62,504
Total tenements		28,200		48,794		27,081		61,118	
5 rooms and less		23,732	84%	39,099	80%	22,940	84%	49,182	80%
2 rooms each		7,264	25	7,211	14	7,509	27	15,090	25
1 room each		5,378	19	4,327	9	6,706	24	13,292	21

By the adoption of electric traction, railways will be able to run trains in accordance with the requirements of the traffic, and to increase greatly their average speed.

The accompanying Table IV., taken from one of the time tables of our railways—the London, Brighton & South Coast Railway—for which the writer is acting as consulting engineer, may be of interest.

From this will be seen what improvements may be expected by the introduction of electric traction It must, therefore, be pointed out that as regards the two last stations, Grosvenor Road and Victoria, all tickets are collected at the former, and that between Grosvenor Road and Victoria there are only two tracks available for ingoing as well as out-going traffic, and that there are between 350 to 400 trains, according to the season of the year, going in and out every day. To obviate the delays due to this "bottle neck," the company is at the present moment spending over £1,000,000 to widen the approaches to the bridge over the Thames, which leads into Victoria station.

An idea of the urgent necessity of improving methods of rapid transit may be gained from the following figures, showing the increase in population in some of the suburban districts of London within the last few years, and the terrible state of overcrowding that obtains in certain of them. The only method of getting over this trouble is to give increased facilities for getting in and out of London and getting long distances in a shorter time, so as to enable the working and the poorer classes to have increased accommodation at a reduced rent.

TABLE X.—EXTRACT FROM CENSUS RETURNS, 1901

District	Acres	Population	Persons Per Acre
LONDON			
Bethnel Green, S.W*	300	65,926	219.7
Whitechapel *	378	78,624	208.0
Stepney*	314	63,689	202.8
Hoxton Shoreditch*	343	62,461	182.1
Haggerston *	305	55.437	181.7
St. George's (Tower Hamlets)*	286	51,071	178.5
Bethnal Green, N.E*	455	63,786	140.2
Mile End *	363	48,348	133.2
Limehouse*	423	55,996	132.3
Bow and Bromley	1,001	91,081	90.9
Hackney, Central	822	67,612	82.2
Hackney, South	1,541	101,350	65.7
Poplar	1,332	78,430	58.8
Hackney, North	1,574	84,253	53.5
ESSEX			
South Leyton	631	50,458	80.0
Forest Gate	806	60,897	75.5
Plaistow	1,249	90,920	72.8
Stratford	1,072	44,825	41 8
East Ham	3,268	95,970	29.4
North Leyton	1,963	48,441	24.6
Walthamstow	6,504	108,931	16 7
Wanstead	1,737	9,198	5.3
Ilford	8,496	41,240	4.8
Chigwell	13,975	17,653	1.2
Waltham Abbey	11,017	6,547	.6
Epping	17,101	6,595	.4
Harlow	17,041	6,211	.4
MIDDLESEX, N.E.			
Tottenham Division	4,638	136,702	29.4
Hornsey "	2,875	72,056	25.0
Edmonton "	7,491	61,892	8.2
Enfield "	12,601	42,738	3.4
Chestnut "	8,479	12,288	1.4
MIDDLESEX, W. and N. W.			
Brentford Division	20,980	178,849	8.5
Hendon "	33,569	167,307	5.0
Barnet "	25,767	58,970	2.3
Uxbridge "	26,858	39,003	1.4
Staines (part)	24,331	33,861	1.4
KENT			
Bromley Division	40,978	85,755	2.1
Dartford "	52,316	96,046	1.8
SURREY			
Richmond Division	5,009	49,4.9	9.9
Croydon "	32,540	194,425	6.0
Kingston "	24,551	137,563	5.6
Carshalton "	12,228	32,997	2.7
Epsom "	13,074	17,429	1.3

* Have a total population of 545,338, covering 4.94 square miles.

A large amount of evidence was given before Lord Windsor's committee of the House of Lords during the discussion on tube railways as to the great delays which were encountered owing to the congestion of traffic on the existing railways. Thus, to get from Highgate to the city, a distance of under 5 miles, an hour had to be allowed, and it took sometimes as long as 45 minutes to get from

Wood Green to Moorgate Street station. A glance at the map of the London railways will show what this means.

The service which has to be improved is not so much what we might call the metropolitan one, served by the tubes and tramways and the District and Metropolitan Railways, but what might justly be called an interurban service which is required to connect the outlying districts around London, which are alreadv in steam railway communication with London by means of an improved and accelerated electric service. This, however, owing to the expensive procedure of procuring Parliamentary bills and to the oposition which independent undertakings, seeking experienced gained and from the conditions that obtain near the metropolis, it seems evident that within a radius of, say from 25 to 35 miles, all the traffic on the railways should be handled electrically with the exception of the main-line long-distance trains.

One great advantage which would be obtained would be to avoid to a large extent the serious delays which are met with, particularly on the southern railway systems, where the main-line trains are generally punctual till they get within 10 or 15 miles of London, after which they are constantly delayed by suburban trains in front of them. By the increase in the average traveling speed of the sub-

MAP OF LONDON BY BOROUGHS, SHOWING POPULATION PER ACRE

franchises to do this class of work, would necessarily offer, can only be performed if the railway companies themselves realize their duty and seriously put their hand to the plow and effect a change rationally and not piecemeal, as, unfortunately, seems to be quite probable. What is required is an interurban service between the towns which surround London, such as Tilbury, Chelmsford, Brentford, Romford, Epping Forest, Waltham Abbey, St. Albans, Watford, Richmond, Rickmansworth, Uxbridge, Staines, Woking, Guildford, Dorking, Leatherhead, Epsom, Reigate, Sevenoaks, Maidstone, Chatham and Gravesend, and stations somewhere near the center of London from which the traffic could be distributed to the various parts of the metropolis by means of interconnected service of tramways, shallow tunnel tramways or tubes, and the existing District and Metropolitan system. In other words, from urban trains which would result from electrification, owing to the more rapid acceleration possible and to the introduction of modern methods and up-to-date rolling stock, whereby the stops at stations would be greatly reduced, the serious delays of main-line trains would be considerably reduced. Furthermore, by absolutely separating the long-distance and the suburban traffic at the terminal stations, the general public would greatly benefit.

By means of multiple-unit trains considerable time would be saved even at terminal stations, as the shunting of locomotives at present required could be done away with. As an example of what electric traction renders possible, the Central London and the District Railway, as it now exists operated by steam, may be compared. On the former the average time of stoppages at stations does not much exceed 10 seconds, whereas on the latter it is over 50 seconds.

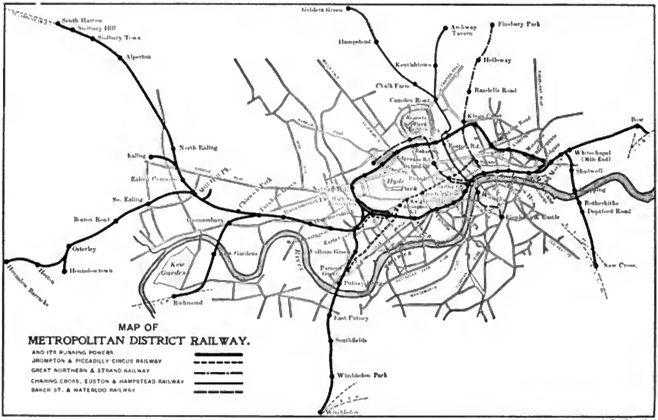
This is not due to the handling of smaller traffic, in the first case, as the trains of both systems have practically the same capacity, and the Central London Railway, as a matter of fact, at the present moment carries nearly double the number of passengers that are carried by the District Railway.

In considering the position of tube railways and tramways in London as compared to what has been done in America, the item of the average fare received must not be lost sight of. In this connection some figures as regards the average receipts actually obtained on London lines may be of interest.

The average receipt on the District Railway per passenger carried is 1.49d., and on the North London 1.34d. The average fares on the London Tramways system per passenger carried work out at 1.08d.; on the omnibus lines, 1.3d., and on the East London Railway, 1.47d., from which it will be seen that, as far as metropolitan travel is concerned in London, it is not safe to reckon on an average fare of more than 1½d. per passenger carried. A few figures taken from Mr. Dredge's excellent article in a recent issue of Traction and Transmission which apply to some main-line railways for the year 1900 are interesting for the sake of comparison. Thus, on the London & Southwestern the average fare was 6.7d.; on the London, Brighton & South Coast, 7.13d.; on the Southeastern & Chatham, 7.41d., and on the Great Eastern, 4.59d. These lines have been particularly chosen, as they handle a very heavy suburban traffic. The Great Eastern is the one which has to lay itself open as much as any to catering for the suburban resident, and over a large area it has adopted the fixed-rate system, especially for workmen's trains.

The great problem which will have to be solved is how to carry persons cheaply and rapidly distances of from 15 to 30 miles between their homes and their places of business. At the present moment the railway companies with termini in London are attempting to do it, but with very moderate success, and with very grave inconvenience to the passengers. The want of terminal facilities and the enormous price of the land necessary to afford extra accommodation, the complexity of ownership and running powers held by various railway companies over each other's lines, and that great enemy of all railway traffic in London during the winter months—London fog—have to be reckoned with, and all these points make the problem an exceedingly difficult one to solve. Owing to the present poor rapid transit facilities only very few business men can manage to live more than 6 miles or 7 miles out of London, and for this short journey very often an hour is required, and a large amount of time has thus to be wasted by people who can ill afford it, and whose hours of business attendance are absolutely fixed.

Besides this suburban traffic, there is another traffic which is not sufficiently considered in Great Britain, and that is the so-called pleasure traffic, which has been cultivated to so large an extent by electric railways in the United States. There are a large number of places in the neighborhood of London, such as the Crystal Palace, the Alexandra Palace, Kew Gardens, Richmond, Hampton Court and many other places which, if proper facilities were granted and a good train service maintained, could be greatly developed to the advantage of their shareholders, as well as to the benefit of the railway companies. The supply of greater traveling facilities with higher speeds would change the map of London very rapidly, and would greatly increase the value of the surrounding property.



MAP OF METROPOLITAN DISTRICT RAILWAY AND RUNNING POWERS

From a careful study of the conditions that obtain in London, and bearing in mind the difficulties and the expenses which have to be faced, both as regards preliminary Parlimentary expenses and the cost of construction, etc., it is hardly likely that many new systems will be constructed to connect the various portions of London with its various suburbs. A study of the official railway map published by the Railway Clearing House, of London, which accompanies this article, and a glance at the diagram showing the district served by the various railway companies who enter London, will convince anyone that the areas served by these lines are amply sufficient to meet the wants of the worker in the metropolis for years to come, provided, of course, that they are utilized to the fullest extent and proper systems of tramways installed which will enable an easy concentration to be effected.

Owing to the limits of speed imposed on electric tramways it is not likely that these will compete with railways for distances exceeding 5 miles. It will be some time before the London County Council will complete its system of electric tramways, of which a general idea can be obtained by looking at the tramway map of London which accompanies this article, but each consecutive year will see the scheme nearer completion. Most probably we shall soon see the London County Council Tramways connected with other electric tramways now being constructed at Gravesend, Chatham, Croydon, Sutton, not to speak of the enterprising London United Tramways, whose network, as shown by the map, connects a large number of residential towns and districts situated at the west side of London. The railway companies must act quickly if they wish to prevent the business population satisfying themselves by settling on a tramway route.

That tramway competition, instead of being disastrous, can really benefit railways, has been proved in the United States, as in Chicago and the Greater New York, where by the electrification of the suburban lines and of the lines running out into the neighboring country it has been found that the tramways carry their district passengers from their offices into the trains and deliver them at the other ends from the suburban stations to their homes. In other cases it has been found possible to run a through traffic. It is certain that under the existing conditions railway companies find it impossible to handle their suburban traffic better than they do at present. Are they prepared to sit still and let other concerns arise who will commence by taking their suburban traffic from them, and will eventually end by absorbing a large portion of the other traffic as well, as has been demonstrated over and over again, both in Europe and America? The table which has been prepared for this article, with the diagramatic map of London, shows how densely populated London is, and an inspection of the former will show the rapid growth of population. This means that there will continue to be an increasing demand upon the railway companies from the suburban population, and it is an ascertained fac: that there is an everswelling traffic on the main lines. If the railway companies do not act or decide on some radical remedy shortly their service and receipts cannot improve, but must deteriorate.

In this discussion there must be no mistake about the meaning of the word suburban, which is merely relative, as the distance of the London suburbs from the center will increase as traveling facilities increase. The result will probably be that the railway companies will concentrate their energies on cultivating the distant districts which at the present moment lie beyond the suburbs. By this means they can open up a new residential area which would become a source of profit to the railway companies, not only by supplying them with new traffic, but also by increasing the value of the land thus developed.

The whole question, therefore, as has already been stated, is complicated, owing to the very heavy capitalization of the existing tramways, underground railways, tube lines and suburban lines owned by the other railway companies. Some idea of what this burden is will be gained from the statement that, neglecting the capital invested in omnibuses, over £100,000,000 is at the present moment invested in what might be called the rapid transit service of London—an amount nearly equal to the capital invested in Greater New York. From this it will be seen that the present traffic will have to be enormously increased if anything like a fair interest is to be paid on the capital already involved. This is another reason for supposing that the suburban lines in London will have to be electrified at no distant date. The results of this will be extremely interesting, as it will make London far ahead of any other town in the world. It is already the pioneer city of tubes, and when the various tubes now under construction, or for which franchises have already been granted, are working, the methods of intercommunication of London itself will be exceptionally good. It may possibly be of interest to American readers to give them some idea of the actual approximate cost of tubes per yard of single tunnel: in some cases, under special conditions, the cost may be far greater than that given:

Diameter.	Cost per Yard.		
11 ft. 6 in.	£37	0	0
12 ft.	40	5	0
12 ft. 6 in.	42	10	0
13 ft.	44	10	0
13 ft. 6 in.	47	15	0
21 ft.	140	10	0

The diameter of tubes at present varies from 10 ft. 2 ins. internal diameter (City & South London Railway), 11 ft. 8 ins. (Central London), 12 ft., as proposed (Mr. Yerkes'), and 13 ft. 6 ins., as proposed by the Morgan interests.

It is unnecessary in this article to discuss the various engineering details which will have to be considered by those steam roads who eventually decide to go in for electrification. It is no longer necessary now to demonstrate the feasibility of running the heaviest trains economically electrically.

It seems probable that by a proper combination or community of interests, if such can be arranged between the tramways, whether owned by company or municipality, and between the tube and main-line railways, that electricity may be utilized to improve the situation of all of them. Thus tramways and tubes in London would serve to distribute inside the city and to concentrate at the various exchange stations from which the suburban lines start. These having their own right of way can run at high speed between the centers of the population and deposit passengers there, where they would be distributed by surface tramways. The results would probably be eventually that the railways would be duplicated by tramways along their whole route, but if properly managed this should not be to the disadvantage of either, as the tramway would take the short distance and the railway the long-distance traffic.

CARS FOR HIGH-SPEED INTERURBAN SERVICE

THE interurban of the present day, with its exceptionally high speed, has developed many entirely new conditions. Those which involve the operation of passenger cars are both novel and trying. It is too early to say what the final type will be; possibly many entirely new designs will be found necessary. The question of what is the best type for the interurban car, with its high speed, frequent stops and its combination of city and suburban service, is one which has been put to every car builder, as well as nearly every electric railway company, in the country. Neither the steam railroad car, nor the enlarged electric car of street railways, is entirely suitable for the service.

In view of the importance of this subject, a study of some of the recent interurban cars as used by the latest electric interurban railways in the country has been thought to be of interest.

Figs. 1-4 illustrate the standard cars of the Canton & Akron Railway Company. Two cars are illustrated, as the company intends to operate trains of two cars each. One of the cars is a straight passenger coach, and the other a combination car, having the novel feature of three compartments. Figs. 1, 2 and 3 show plans, elevation, seating arrangement and details of floor framing, while Fig. 4 shows the interior of the car illustrated in Fig. 1.

Referring to Fig. 1, it will be seen that the leading car is intended to run on a loop in one direction only; that it has a cow-catcher; is mounted on double trucks, and has a "steam roof" and a round-end vestibule. It is 58 ft. over all and is intended for a speed of 60 miles per hour. The passenger coach will seat seventy-two persons. Its interior arrangement, as shown in Fig. 4, indicates the finish to be of unusual elegance, the decorations being of the Empire style. The baggage racks are made nearly continuous, and the number of lamps is greater than is usually provided, even in steam coaches. The seats are walk-over, high rolled back, covered with plush. The interior finish is mahogany, decorated with inlaid marquetry. The high backs are a feature highly appreciated by passengers.

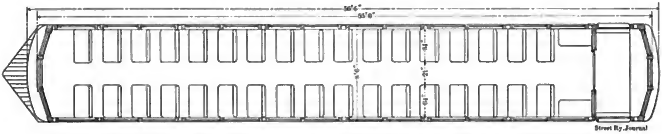


FIG. 1.—PLAN OF ORDINARY PASSENGER CAR, CANTON & AKRON RAILWAY

Of the seating arrangement, see Fig. 1, little can be said beyond noting that it is plain, straightforward and sensible for a coach of the kind. The question arises, however, whether, if the cars are to be run in trains, it would not have been advisable to put an end door into the vestibules in such a way as to make passage from one car to another possible. This would have given the occupants of the passenger coach access to the smoking compartment of the car shown in Fig. 2.

This engraving shows a car with the unusual feature of three compartments—baggage, smoking and passenger. The baggage doors are carried so far forward that they do not interfere in any way with the side truss of the car. This remains intact from bolster to bolster.

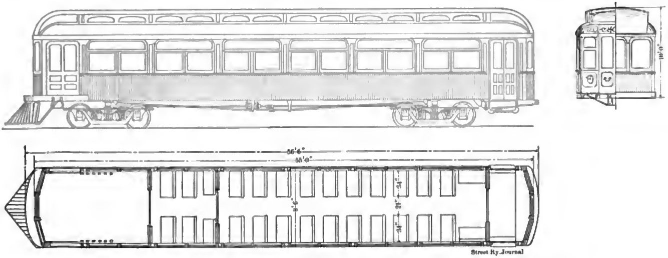


FIG. 2.—PLAN AND SIDE ELEVATION OF BAGGAGE AND PASSENGER CAR, CANTON & AKRON RAILWAY

The floor framing of these cars, see Fig. 3, is of unusual interest, as it shows a decided step toward a complete metal floor frame. There are six sills, all of them strengthened with channel-irons. The two intermediates have not only a channel-iron on one side, but are plated on the outside as

well. The side-sills have a channel and bar on the inside, which in turn has a filler of wood. All the sills are of yellow pine, extending in a single length from end-sill to end-sill. The corner posts are of oak and the intermediates of

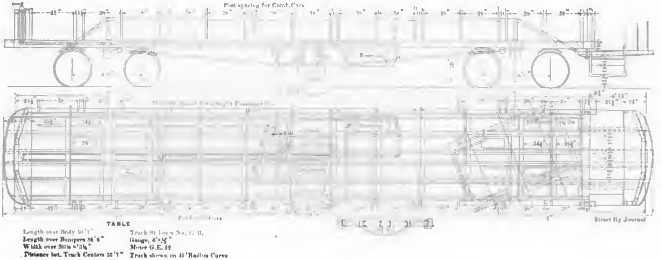


FIG. 3.—FLOOR FRAMING OF CANTON & AKRON CARS

ash. These are spaced in such a way as to bring the windows in pairs with a double post between them. The single posts are made in two pieces with the tie-rods running in the center. The sides of the car are built in a manner which is becoming generally popular, with inside sheathing laid horizontally, and this in turn covered by narrow fatched stuff put on vertically.

FIG. 4.—INTERIOR OF CANTON & AKRON CAR

Owing to the great length of this car, which is 35 ft. 7 ins. between the bolsters, unusual care was taken in the trussing, as will be seen by the upper portion of Fig. 3. The truss-rods are carried by deep saddles on the needle-beams. The upper, or window, truss is not only well secured by a large plate iron washer, but has what is uncommon, a good anchorage on a special metal post. It may be noted here that in a large part of the cars where a window truss is used it is of no possible value. In many cases its only supports at the points where the greatest strain comes upon it are a couple of insignificant wood screws and a shoulder of wood no thicker than itself.

These cars, which were built by the St. Louis Car Company, are mounted on the St. Louis Car Company's No. 23-B high-speed motor trucks. They have a 6-ft. wheel-base, 6-in. axles and 33-in. steel tired wheels. The equipment consists of four General Electric No. 52 (75-hp) motors, with multiple-unit control. The weight of the car body, motor and trucks complete and ready for operation is 67,000 lbs. This is about the same as that of a steam coach having an equal seating capacity.

The exterior view, Fig. 5, and the plans and elevations, Figs. 6 and 7, show an entirely different type of interurban car used by the Cleveland & Eastern Railway Company. The body is short, being but 45 ft. 11 ins. over the buffers, and the trucks are spaced but little more than 21 ft. between centers. The car itself is divided into passenger and smoking compartments. The forward vestibule, however, might be considered a compartment by itself, since it provides not only for the motorman, but for the hot-water heating apparatus. At the opposite end there is a separate compartment for the toilet room. Provision is made for seating forty-six passengers. The general features of construction present but few novelties, but the floor frame in Fig. 7 is worth careful study. Here diagonal braces are introduced. All the sills are strengthened with metal. The side-sills have a channel-bar sandwiched in them. The intermediates are plated, while the center-sills are composed of I-beams, a filler with a steel plate on the outside of them. The arrangement of the platform and platform timbers is unusual, as will be seen by a study of the plan. The end-sill is practically plated all over, having an angle-iron on one edge, and the ends of the sills or the angle-pieces from them covering its inner surface. Straps for the platform

FIG. 5.—HIGH-SPEED INTERURBAN CAR, CLEVELAND & EASTERN RAILWAY

timber bolts protect its top. With the exception of the side-sills, the construction of this floor frame is almost entirely iron, as the wooden pieces employed serve as fillers rather than as sills.

To meet the requirements of a high-speed interurban car for a mild, uniform climate, like that of California, the car illustrated in Fig. 8 is very popular, and should be included in any article on interurban-car construction. This car, as

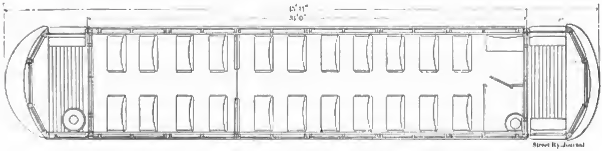


FIG. 6.—PLAN OF CAR SHOWN IN FIG. 5

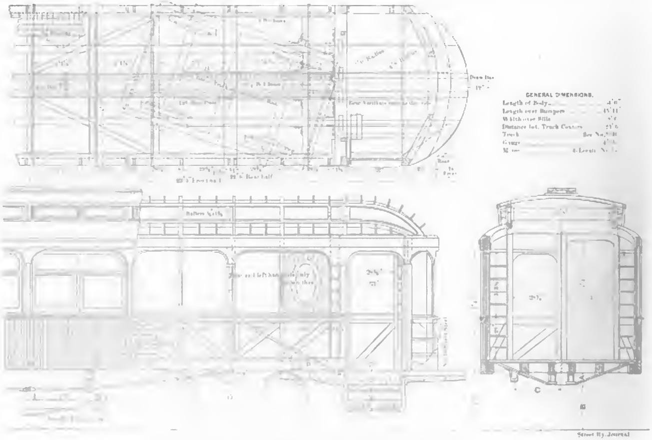


FIG. 7.—FLOOR FRAMING OF CAR SHOWN IN FIG. 5

well as that illustrated in Fig. 7, was built by the St. Louis Car Company, and is a material modification from the type originally known as the California type. The ends are open in the usual style, but the entrances are from steps at

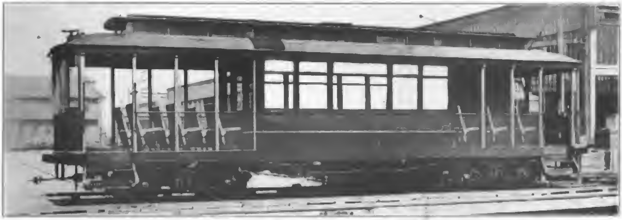


FIG. 8.—HIGH-SPEED INTERURBAN CAR OF THE CALIFORNIA TYPE

the corners, instead of from a running-board. Another novel feature for a high-speed interurban car is the use of longitudinal seats in the closed part. Peculiar conditions may render this necessary, but for long runs the longitudinal seat is not altogether desirable. Cars of this class are particularly adapted to the Pacific Coast, where practice has shown that the riders at all seasons of the year usually divide themselves equally between the open and the closed compartments. These cars are 37 ft. long and weigh complete 40,000 lbs. each.

The palace-car, or sleeper, design shown in Fig. 9 may at first sight seem inappropriate in this connection, but with the introduction of great electric systems extending over hundreds of miles, the parlor car and the sleeper will undoubtedly become necessities, and this car may be taken as one of the first answers to the question, what shall be the

FIG. 9.—PARLOR AND SLEEPING CAR OF THE UNION TRACTION COMPANY, OF INDIANA

form and style of the high-speed electric sleeping car. This car has been illustrated before in these pages, but is included in this article owing to the interest attaching to it in connection with interurban service. It was built by the St. Louis Car Company for the Union Traction Company, of Anderson, Ind. Its extreme length is 50 ft. The entrance is in the center of the car, which divides it into two compartments. One of these has desks, library, smoking and observation room. The other compartment on the other side of the entrance comprises a drawing room, sleeping compartment with upper and lower berths, bath room, dressing room and kitchen. The interior is richly decorated. The only possible objectionable feature in the design is the central door, which destroys the continuity of the side of the car, but adds greatly to its convenience. This, however, is a mere detail of the design. End entrances could be provided without difficulty and without changing the interior arrangement in any essential. The car weighs complete 60,000 lbs.

FIG. 10.—HIGH-SPEED COMBINATION CAR FOR FORT WAYNE & SOUTHWESTERN TRACTION COMPANY

Figs. 10 and 11 show another car, which has been illustrated in these pages, but, as it is the standard of one of the latest interurban roads in Indiana, and as it is of a type of which its builders, the John Stephenson Company, have sold a number, it deserves special study. It is not of unusual size, measuring only 43 ft. 6 ins. over the dashers. The design, however, has been adapted to much longer coaches, and can be built of any desired length. What is known as the Pullman window is employed, with a steam hood and a

round-end vestibule. This particular car is intended to run in one direction only, and hence the motorman's vesti-

FIG. 11.—INTERIOR OF CAR SHOWN IN FIG. 10

bule is closed on one side. In the space thus gained the hot-water heater is placed. The door of the baggage com-

as shown in Fig. 12, the car has in effect baggage, smoking and passenger compartments. The passenger compartment is arranged with walk-over seats in the usual fashion. The corner next to the rear door is occupied by a toilet room. A considerable gain in space is made by using sliding doors at both ends of the car and in the partition. In the baggage compartment the seats are longitudinal. They are divided in the center so that one-half of the seat folds lengthwise over the other. This is to permit the baggage door to be used and at the same time occupy the space for seats. The method of doing this will also be seen from a reference of Fig. 11. In case of necessity, both parts of the seat can be dropped flat against the side of the car, being supported on brackets. In a very long car a separate compartment would be employed, instead of utilizing the baggage compartment for smokers. The baggage compartment would then be placed at the extreme end of the car. In that case a passageway is placed at the side of the smoking compartment, so as to isolate it entirely.

The framing of this car is shown in Fig. 13. It is comparatively light, but very solid. The six sills run continuously from end to end of the car. Those on the outside are plated with steel, or rather the outside sills are double, forming a sandwich. The end-sill is also steel-plated, the ends of the plates being turned up and bolted into the side-

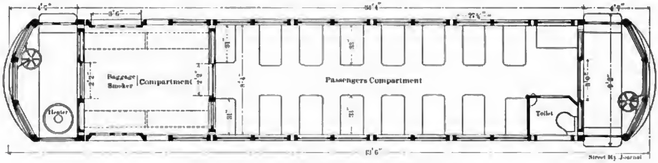


FIG. 12.—PART OF PLAN OF CAR SHOWN IN FIG. 10

partment is placed beyond the bolster and, as the partition comes a short distance inside of this, the two sides of the car are well braced, so that there is almost an equivalent of two end frames. By a peculiar arrangement of the seats,

sills. The cross-framing is spaced 26 ins. apart, and each piece is mortised into the sills. Tie-rods are placed at each

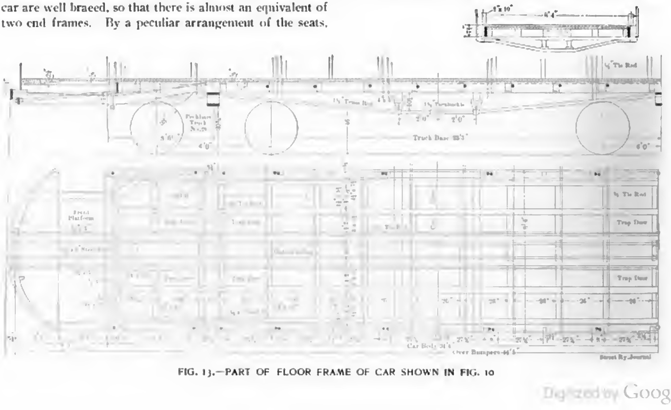


FIG. 13.—PART OF FLOOR FRAME OF CAR SHOWN IN FIG. 10

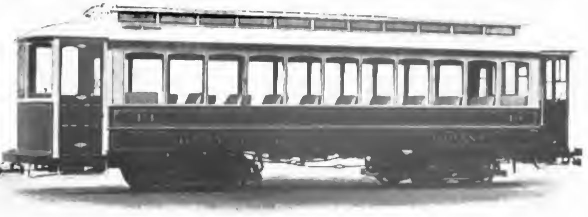


FIG. 14.—SEMI-CONVERTIBLE CAR OF BEAVER VALLEY TRACTION COMPANY

one of the crossings, so that the whole frame is held together and made exceedingly stiff. One feature is worth particular attention. The center member of each of the crossings is a casting (see cross-section of the floor frame in Fig. 13). These castings, being perforated, afford an opening the whole length of the floor frame, which is closed below by a floor. The top of this pocket forms the floor of the car, and is made in removable sections, so that there is a longitudinal pocket, in which are placed the brake air-pipes, cables, wires, etc. The structure not only adds strength to the car, but is a great convenience.

Outside of the center-sills, and taking a bearing against plates at the ends of the platform timbers, are two rods, which combine the offices of tie and truss-rods. Through the center of the car they become tie-rods. At the ends they drop sufficiently to truss both platforms. The bolsters are of wide, thick iron, and have a superabundance of strength. From them are anchored the 1¼-in. truss-rods under the side-sills of the car. The exact weight of these cars is not available at the time of writing this article, but, from the care which is taken in disposing of the metal and the effort made in framing to make the structure as strong and light as possible, it is thought that the weight must be low.

The side of the car is built of two thicknesses, the inner

FIG. 15.—INTERIOR OF CAR SHOWN IN FIG. 14

one horizontal, gained upon the posts, glued in place and nailed. The vertical outside sheathing is also glued in place, and, when all is dry, braces are cut in between the posts and screwed fast to the inside lining. The inside finish is mahogany throughout, with inlaid decorations and carved ornaments. The leading ideas of the designer was to afford every facility and comfort for the long-distance traveler, to provide a car strong enough to be operated at from 60 miles to 70 miles an hour, and to make it so light that it could be accelerated with great rapidity and be stopped with the smallest amount of brake power.

A passing word is perhaps necessary in regard to the

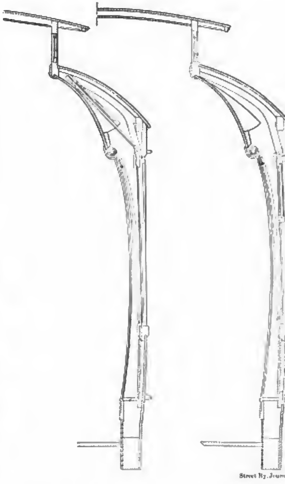


FIG. 17.—DETAILS OF ARRANGEMENT OF STORING SASH

Pullman window arrangement, to which allusion has been made. The windows are in pairs between panels. While in this car the lower sash can be raised, the design also contemplates the dropping of the sash and covering the open-

ing with a window cap. In either case, the outside of the window is protected by guard-rails, a very necessary precaution. Either with or without the drop window, a truss-plank is introduced, which is gained and screwed upon the posts and edge bolted to the sills, the details of its fastening being modified to some extent by the arrangement of the sills and plating.

FIG 16.—PLAN OF CAR SHOWN IN FIG. 14

Passing now temporarily to the semi-convertible type, which the J. G. Brill Company has done so much to advance, and which it recommends so strongly for interurban service, attention is called to Figs. 14-17, which show a typical car of this pattern, one built for the Beaver Valley Traction Company. Fig. 15 shows the interior. The seating plan of the car, Fig. 16, presents no special features, being that of a straight passenger coach with a seating capacity for forty-four persons. It is of moderate length, has street car hoods, and is mounted upon the No. 27-G trucks. These are spaced 18 ft. 8 ins. from center to center. The feature upon which the company lays stress is the fact that the side of the car can be practically left wide open whenever it is desired, and the sash safely and conveniently stored in the roof. While most of the readers of the STREET RAILWAY JOURNAL are familiar with this plan, the details shown in Fig. 17 will be of unusual interest, since they show more clearly than in any previously published sketch the method of lifting and stowing the windows. They also explain a statement frequently made that a considerable gain in the width of the car inside is secured, in this case amounting to 7½ ins. The diagram at the left in Fig. 17 shows both sash in the roof pocket, leaving the window completely opened. The second diagram shows the sash in place.

The car, with its trucks, weighs about 22,000 lbs.

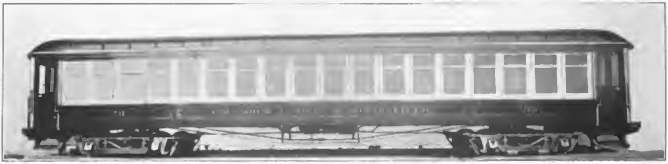


FIG. 18.—SIXTY-FOOT SEMI-CONVERTIBLE CAR, COLUMBUS, LONDON & SPRINGFIELD RAILWAY—CLOSED

One of the most remarkable designs for high-speed interurban cars which has yet been put into actual service was recently brought out by the Jewett Car Company, of Newark, Ohio. The cars are 60 ft. long over the buffers, and have a seating capacity for one hundred and eight persons. Several of these cars have already been built for the Columbus, Buckeye Lake & Newark Traction Company, for the Central Market Street Railway, of Columbus, Ohio, and for the Columbus, London & Springfield Railway. These cars are of the semi-convertible type. Fig. 18 shows the car closed, and Fig. 19 as an open car, but with the curtains down. The sills are plated with steel. They are intended to run at a very high rate of speed and mounted on Peckham's M. C. B. trucks, equipped with General Electric No. 73 motors, which develop 75 hp each. A number of cars of the same type are being built for the Columbus,

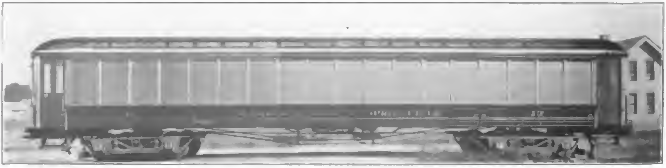


FIG. 19.—CAR SHOWN IN FIG. 18, OPEN, BUT WITH CURTAINS DOWN

Delaware & Marion Railway Company, but they differ from those just mentioned in being 60 ft. 3 ins. long over all. It is claimed that these cars are longer by 5 ft. than any in-

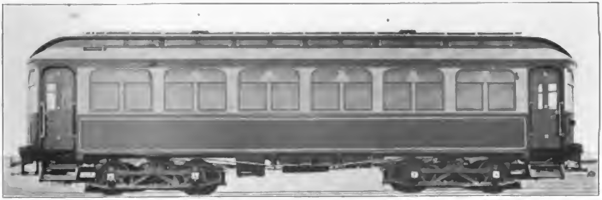


FIG. 20.—45-FOOT HIGH-SPEED INTERURBAN CAR

terurban cars ever built, and, so far as is known, this statement is correct.

The standard interurban car of the Jewett Company is shown in Fig. 20. It has Pullman windows and platforms

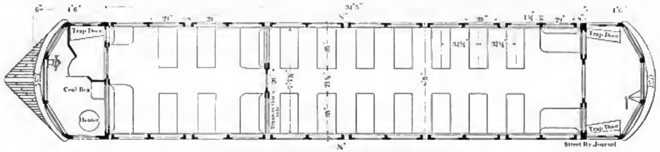


FIG. 25.—PLAN OF CAR SHOWN IN FIG. 23

flush with the floor of the car, the center and the intermediate sills running to the ends of the vestibules. This construction, shown in Fig. 21, is of unusual strength. The sills are I-beams with yellow pine fillers. The side-sills are plated with ¼-in. steel. The construction of the side with the framing of the platform, vestibule and hood, is shown in Fig. 22. Belt-rails, side-plates, deck-sills and deck-plates are of yellow pine in continuous lengths without splicing. Tie-rods are well anchored to bolster and sills. The window braces have tension-rods from the heads of the braces through the sills. This is a detail from steam-car construction, which has proved its value, but is unusual in electric railway work. In these designs we have the features of great floor strength and large seating capacity emphasized. The behavior of these designs in actual

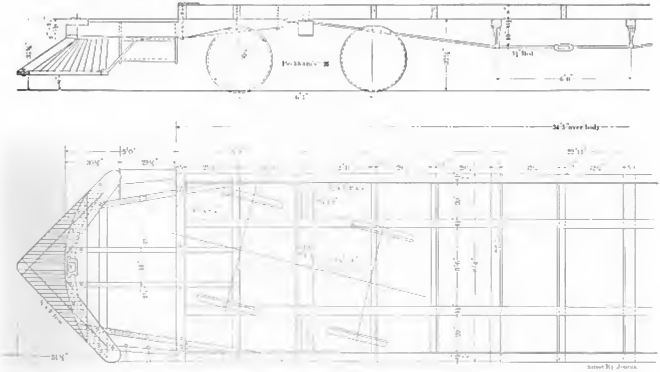


FIG 26.—FLOOR FRAMING OF CAR SHOWN IN FIG. 23

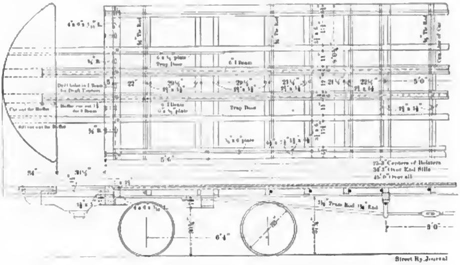


FIG. 21.—FLOOR FRAMING OF CAR SHOWN IN FIG. 20

FIG. 23.—EXTERIOR OF CAR, INDIANAPOLIS, SHELBYVILLE & SOUTHEASTERN RAILWAY

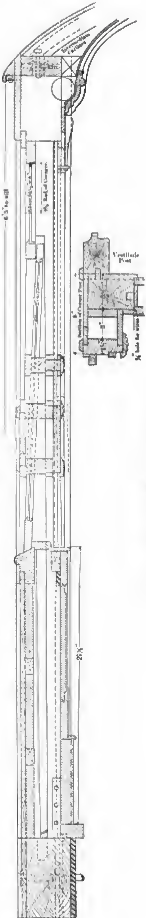


FIG. 27.—SIDE FRAMING OF CAR FIG. 23

service will be watched with great interest by railway managers. With cars of such large size, if they are to operate over any considerable distances, it will be easy to supply them with all the conveniences necessary on steam roads.

Fig. 23 illustrates a type of interurban car manufactured by the Jackson & Sharp plant of the American Car & Foundry Company, and which has proved very popular for interurban service. The interior is shown in Fig. 24. The finish, as shown in the latter engraving, is very handsome, which has long been a characteristic of the company's work. The exterior shows a car with steam road roof, Pullman windows and vestibules at each end. From the presence of a cow-catcher it will be seen that this particular car is intended to run in one direction only. Incidentally it might be said that this is an advantage which railroad men seem to be slow in appreciating. Those most advanced consider the single-end car possesses material advantages over the double-ended car. The plan shown in Fig. 25 presents a number of interesting features. The passenger compartment has

FIG. 24.—INTERIOR OF CAR SHOWN IN FIG. 23

the usual walk-over seats, with two stationary corner seats. In the smoking compartment there are four stationary seats and four walk-overs. The aisle in this compartment is diverted to one side of the center, and the entrance is made through a passage-way entirely separate from the motorman's cab. The heater is arrangement greatly increases the available space on the platform. It is a useful adaptation from steam car practice. The floor framing is of a somewhat novel character. See Fig. 26. There are four continuous sills, with the side-sills steel-plated and the plates turned up against the end-sills. In the place of intermediate timbers short stringers

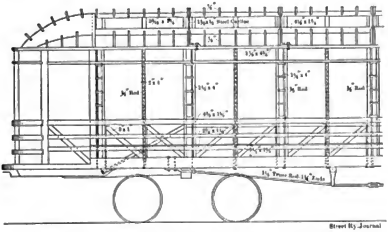
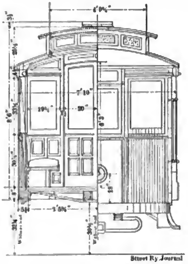


FIG. 22.—SIDE AND ROOF FRAMING OF CAR SHOWN IN FIG. 20



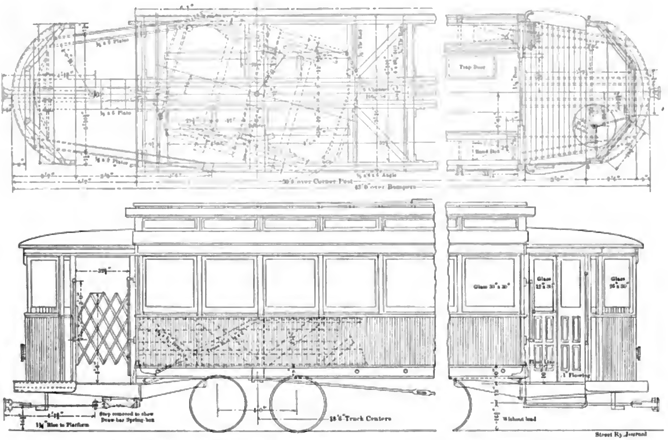


FIG. 28.—SIDE AND END ELEVATION, FLOOR FRAME AND PLAN OF 30 FT. 8 IN. INTERURBAN CAR

placed in the cab, together with coal boxes. This is a detail which has many advantages. In this particular instance a vertical hand-wheel is used, while the ordinary brake handle is employed on the rear brake. While the platforms are dropped the depth of the sills, all the entrances are provided with vestibule doors at the outer line of the car, and trap-doors, which are raised when the vestibule doors are opened and the steps are in use. This are introduced on each side of the bolster. This arrangement presents a great contrast to some of the designs which we have already given. When we consider the fact that most electric cars are run singly and the only endwise shocks to which they are subjected are those occasioned by handling in the car houses, the question arises whether any great amount of longitudinal strength is really necessary. Cars of this class appear to stand well

in service, and, as their repairs are not materially different from those of other types, the only argument for or against them will have to be drawn from cases of accident. The condition of a car in case of derailment at high-speed will be the only argument for or against the design which will have any value. Certainly the saving of dead weight which is effected is one worth the most serious consideration of railway men. In Fig. 27 a detail of the side framing and posts of these cars is given. From this it will be seen that the unusually large windows are easily disposed of in the pocket, which is closed by the usual window caps. One of the trivial details, often a matter of comfort to the weary passenger which may be here mentioned, is the rounding of the interior mouldings.

The vestibules are what are sometimes called octagonal. The arrangement of these cars is unusual for the purpose, consisting of a single compartment having longitudinal seats. This, of course, gives a great standing capacity for given size. The plans are drawn in great detail, and the practical man will find them worth study. The features which deserve most attention are found in the plan of the flooring and in the cross-section. The sills are plated with angle-iron, the bottom of the iron coming underneath the sills. Wrought-iron brackets are introduced at numerous places in the frame, greatly stiffening the joints. The end-sill is plated apparently on both sides, and the unusual feature of a second sill just behind the end-sill is introduced. There are but four continuous sills. The wood center sills are but little more than fillers of their channel-iron plating. It will also be noticed that diagonals are introduced. This, with the numerous brackets, gives the frame a great amount of stiffness. The use of diagonals or their equivalents has always been insisted upon by steam railroad men as very necessary to the durability of a car bottom.

FIG. 29.—TRAIN OF CARS FOR THE AURORA, ELGIN & CHICAGO RAILWAY

FIG. 30.—CAR FOR AURORA, ELGIN & CHICAGO RAILWAY

The Laclede Car Company, of St. Louis, Mo., has done a large amount of work in interurban cars, and one of its standard cars for this work is illustrated herewith in Fig. 28. It presents some unusual features. As will be seen it is a car of moderate length, with street-car hood and vestibule and single windows. The platforms are dropped so that the single step is brought within 16 inches of the ground.

The car, without trucks, weighs about 24,000 lbs., and

the total weight, including trucks and motors, is, approximately, 40,000 lbs. This, it will be seen, for the seating capacity is a very light coach, and the plan will justify study.

The Niles Car & Manufacturing Company built the high-speed interurban car shown in Fig. 29 and Fig. 30 for the Aurora, Elgin & Chicago road. A floor plan of this car is published, in connection with the article, elsewhere in this issue, on the Aurora, Elgin & Chicago Railway. It has a flattened vestibule, with a steam hood, and from the form of the clear-story windows we judge that the interior must be of the Empire style of finish. The windows are oval-headed, of the Pullman type and protected by guard-rails. The body is carried rather lower than usual, so that only two risers are necessary to reach the platform from the ground. Two trolley poles are used. The shape of the vestibules is novel, and is intended to reduce the air resistance. These cars weigh light, including motors and all equipments, 73,000 lbs.

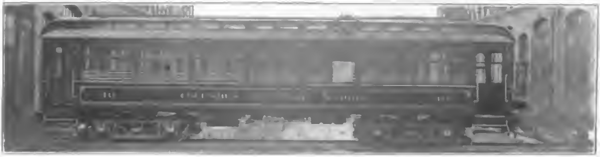


FIG. 31.—CAR FOR COLUMBUS, DELAWARE & MARION RAILWAY

Fig. 31 illustrates a very handsome coach recently completed by the G. C. Kuhlman Car Company for the Columbus, Delaware & Marion Railway. It is 50 ft. over all, and is divided into two compartments, a regular passenger compartment and a smoking compartment. The former is fitted with high, corrugated back, plush seats with grab-handles, while the seats in the smoking compartment are of cane. The car is finished in solid mahogany with extra-heavy bronze trimmings and elaborate electroliers, and cost complete nearly $12,000. The seating capacity of the car is fifty-two passengers. The car is mounted on Peckham M. C. B. trucks with steel-tired wheels, and is equipped with four 75-hp Westinghouse motors. Each car is also provided with Westinghouse double-end air-brakes and an air whistle.

The subject of open cars for interurban railways has not been discussed to any extent in this article, but for completeness, a view of an open car which has given excellent satisfaction on the Northern Texas Traction Company is presented herewith. This car was also built by the Kuhlman Company. On high-speed roads the ordinary type of car with running-boards has certain objections, and this car, as will be seen, has a center aisle with end entrances. It is designed for use as a trail car only, and is hauled by either an interurban coach or a baggage car. It is 50 ft over all, with seating capacity for fifty-five persons. The interior finish is cherry with bird's-eye maple ceiling and bronze trimmings.

FIG. 32.—OPEN CAR FOR NORTHERN TEXAS TRACTION COMPANY

An attempt has not been made in this article to cover all of the types of interurban cars which are being used in interurban work, or even to describe the products of all the prominent car-building companies in the country. Some of these builders are represented in the article on the rolling stock in Detroit, published elsewhere, and there a number in the East, like the Laconia Car Company, Jones and others, whose work is familiar to our readers through published articles in these pages. It might further be said that all the designs which are illustrated herewith are mounted upon M. C. B. standard, equalized, swing-beam trucks, or upon some modified form of it.

THE BOSTON & WORCESTER STREET RAILWAY

MASSACHUSETTS has been the home of the electric railway from the early days of its inception. Pioneer work of the most advanced and daring character, which has since contributed largely to the standards of practice in other States, was done in the "Old Bay State" in the strenuous years of costly experiment which laid the foundations of the mighty street railway industry of to-day. Few, if any, States can boast more splendidly equipped and finely operated local systems than the world-famous "West End," of Boston, now the "Boston Elevated," or the "Worcester Consolidated," with its far radiating branches into the country round about the "Heart of the Commonwealth." Added to these the lines of the Massachusetts Electric Companies, the Boston and Suburban Street Railway Company and those of Springfield, on the west center, gridiron the eastern and central portions of Massachusetts with a network of tracks, which goes far toward completing the total of 2309 miles of track owned at the beginning of 1902, constituting a remarkably well-served territory as regards local traffic. Up to the present time the development of the Massachusetts electric railways has been chiefly from city to town, and from town to town. The strictly high-speed interurban railway has obtained its growth chiefly in the middle or eastern portions of the West, notably in Ohio, Indiana, Illinois and Michigan. Gradually the North Atlantic States are coming to

POWER STATION AT SOUTH FRAMINGHAM

realize the need of more rapid transit between urban centers of population, and particularly is this true in Massachusetts, where the entire eastern half of the State pours an enormous daily traffic into Boston, which is constantly becoming more visibly influential in the remotest corners of the State, and still further securing its strategic position as the financial, commercial and transportation headquarters of New England.

About 40 miles west of Boston, by air line, lies the city of Worcester, with a population in 1900 of nearly 120,000, noted as a manufacturing, educational and railroad center, and, strictly speaking, just without the true suburban limit. For about five years it has been possible to travel from Worcester to Boston by trolley cars, over a somewhat circuitous route about 50 miles long, the time required being in the vicinity of five hours. Some six changes of cars were required, but the fare of 55 cents against $1, as charged by the Boston & Albany Railroad, the steam line serving the two cities, frequently offset in the minds of pleasure-seekers the run of a single hour on the steam road.

BRIDGE AT NEWTON

and created a perceptible traffic in the excursion line over the route, which offered a pleasant ride through some of the most beautiful suburbs of Boston, via either Chestnut Hill reservoir or Newton, through Auburndale, Wellesley, Natick, South Framingham, Framingham Center, Marlboro and Shrewsbury to Worcester.

The need of a direct line between the two cities had long been felt, however, so that in 1901 the Boston & Worcester Street Railway Company was incorporated, its object being to build and operate a high-speed through electric line between terminii, covering the distance of 40 miles in about two hours, on a fare of 35 cents. At the same time it was proposed to provide rapid transit from the suburban towns along the line into the heart of Boston, over a reserved or private right of way in the outer districts. Construction was begun in November, 1901, and it is expected that the first portion of the line, or that between Boston and Framingham, will be in operation Nov. 1, 1902, while the line from Framingham to Worcester will be opened for traffic probably in the early part of the spring of 1903.

The Boston & Worcester Company will take a passenger at Park Street Subway Station, Boston, coming from any point on the immense surface and elevated system of the Boston Elevated Railway Company, and for 35 cents carry him 40 miles west over an air line route to Worcester, there transferring him free of extra charge to any car line of the Worcester Consolidated Street Railway Company's large system. A ride of from 50 to 60 miles for

35 cents is thus possible in the plans of the new company with its connections, a large part of which is at high speed on private right of way. The cars of the Boston & Worcester on leaving the subway at Park Street will run up the Public Garden incline, going thence to Columbus Avenue, up Massachusetts Avenue to Huntington Avenue, and thence to Brookline Village, over the tracks of the Boston Elevated Railway Company, out Boylston Street, Brookline, to the end of the present line of Chestnut Hill cars, near Holyhood Cemetery. At this point the Boston & Worcester Company's own tracks begin, and run through to Framingham, over a superb boulevard road, the tracks being laid on ties in about 1 ft. of ballast in the middle of a reserved grass plot right of way at least 50 ft. wide. The line upon leaving Brookline passes through Newton, then along the old Worcester turnpike to Wellesley Hills. At Newton Highlands connections are made for Norumbega Park and Waltham, and at Wellesley Hills for Wellesley Center and Newton Lower Falls. Crossing the Boston & Albany division of the New York Central & Hudson River Railroad at Wellesley Hills, the line passes on to Natick, with a branch projected to the center of that town, then to Framingham, with connection for South Framingham, Saxonville and Marlboro to Hudson. At Felchville cars connect for Natick Center and Wayland. From Framingham the line runs largely over a private right of way, through Southboro, Westboro, Northboro and Shrewsbury to the tracks of the Worcester Consolidated Street Railway Company, at Lake Quinsigamond, Worcester, a noted pleasure resort about two miles eastward from that city. The Worcester Consolidated then takes the cars into the center of that city, to either the City Hall or Lincoln Square, the latter being the terminus of the system. At all terminals and connecting points transfers will be exchanged. The population served by the road is very large. The Boston Elevated system now serves about 1,000,000 people, and the free transfer at Park Street Subway to the Boston & Worcester cars at once throws open the new line to this vast connecting territory. According to the census of 1900 the population along the main line route of the Boston & Worcester is, as shown in the following table:

Brookline	19,935
Newton	33,587
Wellesley	5,072
Natick	9,488
Framingham	11,302
Southboro	1,921
Westboro	5,400
Northboro	2,164
Shrewsbury	1,626
Total	90,495

On the Marlboro-Hudson branch the population of Marlboro is 13,609, and Hudson 5454, making, exclusive of Boston, with Worcester's 118,421 added, a total of 227,979. Deducting Brookline and Newton from the suburban territory already covered in the table, and adding 800,000 for passengers for or from Boston and its suburbs in touch with the new line, a conservative estimate is 1,000,000 as the population availably contiguous to the Boston & Worcester, of which about 700,000 are situated either directly along the line or inhabit the terminal cities.

The fares to be charged from any point on the Boston Elevated system are as follows:

	Electric	Steam	
Boston to Newton	$ .10	$ .13	Via B. & A. R. R.
Boston to Wellesley	.10	.30	
Boston to Natick	.15	.40	
Boston to Framingham	.20	.55	
Boston to S. Framingham	.20	.50	
Boston to Marlboro	.20	.58	N. Y., N. H. & H.
Boston to Southboro	.25	.65	
Boston to Westboro	.25	.72	
Boston to Hudson	.30	.53	B. & M.
Boston to Northboro	.30	.85	N. Y., N. H. & H.
Boston to Shrewsbury	.30	...	No R. R.
Boston to Worcester	.35	1.00	

PRIVATE RIGHT OF WAY, 50 FT WIDE, NEAR SHREWSBURY, MASS

It is planned to terminate the route of the company's large cars at Park Square, Boston. Ten other surface electric lines are crossed in the route to Worcester.

From Brookline to Framingham the line is doubled tracked. Rails are mostly 60-ft. lengths, 75-lb. T section, American Society of Civil Engineers' standard, double-bonded, and spiked to chestnut and white oak ties, 6 ins. x 6 ins. x 7 ft., if hewn, and 6 ins. x 7 ins. x 7 ft. if sawn, and laid 2640 per mile. Supporting brackets are used on curves. Weber joints with four bolts per joint are employed, and spikes are two per tie, 5¼ ins. over all.

The track rails are of the Pennsylvania Steel Company's section No. 214, drilled 3 15-16 ins., and 5 ins. for 24-in. Weber joints, and with two holes 27-32 ins. in diameter, 2⅜ ins. and 6½ ins from end of each rail for bending. The bonds used are the American Steel & Wire Company's figure 8, 0000 Crown bonds, two at each joint and one on each side of the rail. These are applied by first reaming hole by tapered tool steel reamers in a Bellows Falls drilling machine, then placing terminal in hole, driving steel taper punch entirely through the terminal of the bond, then hammering the steel pin home with a machine hammer. Tracks are cross-bonded every 500 ft. with 0000 cross bonds, and are laid with broken joints, with ⅛-in. clearance between the ends of the rails. The ballasting was

done by using a train consisting of standard gage steam railroad dump cars, holding 7½ cubic yards, and a standard gage railroad locomotive, excavation from pits being done by steam shovel.

Grade crossings are being abolished wherever it is possible to do so without prohibitive expense.

The trolley wire is No. 000 B. & S. Fig. 8, hard-drawn copper, with bracket suspension from center poles. No third rail will be used on the line. The trolley and feeder poles are of hard pine, and 40 ft. high, except in the Newtons, where 50-ft. poles are used. These poles are set about 6 ft. in the ground, in concrete foundations, and present a very solid appearance. The poles are about 9½ ins. square at the top, and 15 ins. square at the top of the concrete foundations, while the butt ends are about 16 ins. square. All poles are fitted with steps, staggered on each side, so that no climbing irons will be necessary when linemen are well above ground. The brackets are of high carbon extra heavy steel tubing, and the feeder cross arms are drilled for four pins, 1½ ins. in diameter, the hole edges covering 3¾ ins. and 10½ ins. from the ends respectively on each side. The poles were furnished by Geo. McQuesten & Co., of Boston, and the brackets and transmission insulators by Percy Hodges, of Boston.

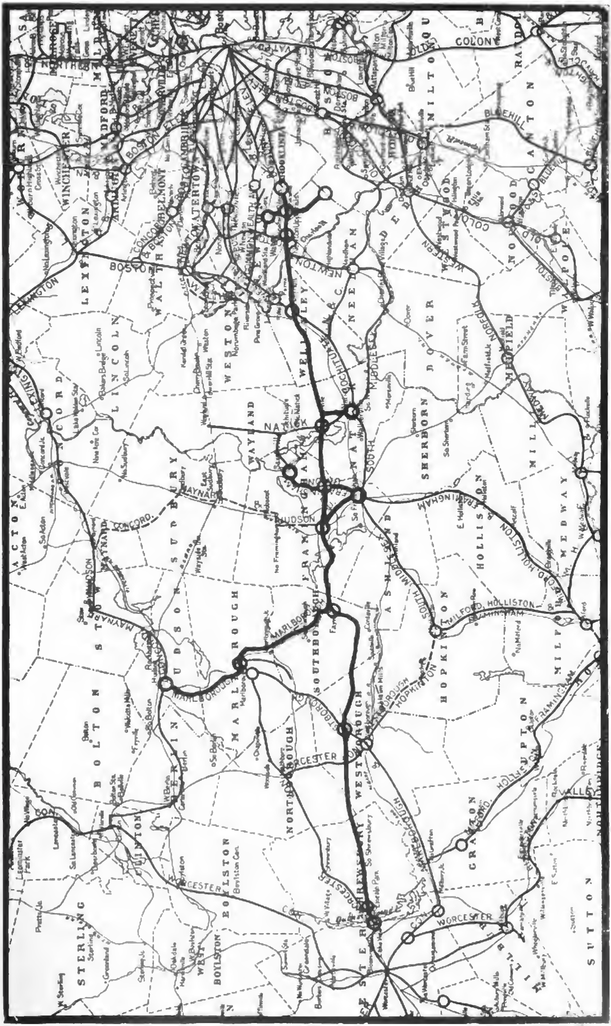
On the large Newton poles centers of cross arms are placed 20 ins. above the brackets, and two 30-in. braces are used. The cross arms are 3½ ins. x 4½ ins. x 6 ft. long. The transmission insulators are of C. S. Knowles' new pattern, type "J. G.," of emerald glass, mounted on 1½-in. locust pins. These insulators are about 6½ ins. in extreme diameter, and are specially designed to carry a working voltage of about 25,000, if necessary. Each insulator weighs 2¾ lbs., and is guaranteed to operate satisfactorily at considerably over the line voltage.

The power supply of the road is to be derived from a large power station, located in Framingham, which has sufficient extending capacity ultimately to provide all the power required by all the cars operating between Boston and Worcester. It is probable that several other lines than those directly related to the Boston & Worcester will be thus supplied with power in the near future. Sub-stations are located at Westboro, Marlboro and Wellesley Hills.

FRAMINGHAM BOULEVARD, LOOKING TOWARD BOSTON, WITH 20-FT. CARRIAGE WAY AT ONE SIDE

Current is generated in the Framingham power station at 13,200 volts, and transmitted as follows: One 3-phase circuit of No. 2 copper, 11.63 miles to Westboro, sub-station No. 1; one 3-phase circuit of No. 2 copper, 8.23 miles, to Marlboro, sub-station No. 3; one 3-phase circuit of No. 000, 9.06 miles, to Wellesley Hills, sub-station No. 2. It is also probable that the Waltham Street Railway, and possibly some of the lines of the Boston & Suburban Street Railway Company will be supplied with power generated at Framingham, so that a single 3-phase line of No. 2 copper, 7.53 miles long, will be run from the Wellesley Hills sub-station to sub-station No. 4, so-called, at Waltham.

The low potential distribution is entirely made up of



MAP SHOWING ROUTE OF BOSTON & WORCESTER RAILWAY

Scale 1 inch = 4 miles.

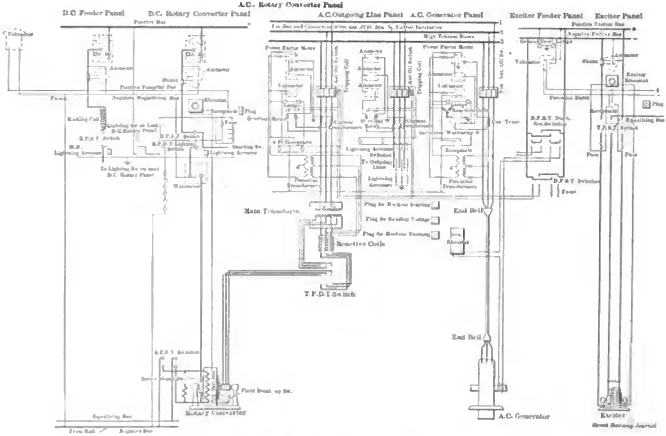
No. 0000 B. & S. copper cable. From the power station in Framingham to the Westboro sub-station runs a feeder 11.63 miles long, supplemented near Westboro by 4 miles of No. 0000 in parallel with it. There is also a line 8.53 miles long from the Framingham power house to the Marlboro sub-station, with an additional 4 miles of No. 0000 feeder extending to Hudson.

From Westboro sub-station to Lake Quinsigamond, Worcester, runs a similar feeder, 5.81 miles long, and this is supplemented by 3.5 miles of No. 0000 feeder running west from Northboro in parallel with the first. From Framingham to Natick runs 2.5 miles of feeder, with another line, 9.96 miles long, to the Wellesley Hills sub-station. A feeder, 7.53 miles long, runs from the latter sub-station to the Waltham sub-station, which is operated by the Waltham street railway system. East of Wellesley Hills a feeder, 4.55 miles long, runs from the sub-station toward Brookline.

The Framingham power station is located on the banks of the Sudbury River, where a sufficient supply of good water for feeding boilers and condensers is available, and an auxiliary supply will also be obtained from the town water service mains. The location of the station is nearly central with the line of the railway between Boston and Worcester. The plant is connected with the New York, New Haven & Hartford Railroad by a spur track leading into the property, which will enable quick and easy deliveries of coal to a bin situated directly behind the boiler room, and arranged to feed, by gravity, directly in front of the boiler room doors. The bin capacity will probably be about 1000 tons. The power station stack is of brick, and is 185 ft. high, with a core of 8 ft. in diameter through its entire height.

The station building is a handsome structure of red brick with granite trimmings, measuring 122 ft. 8 ins. long, by 106 ft. 0 ins. wide, and divided by one main wall into an engine room and basement and a boiler room. The former is a high, well-lighted and ventilated room with a basement, which is in reality the first story, being on the level of the yard outside. The distance from floor to floor is 12 ft., and in this basement are located the heaters, condensers and all large piping connecting the engines with the boiler room piping, as well as the air chambers under the transformers, the toilets, men's room, etc. In this connection it might be mentioned that no piping will be seen in the engine room above its floor line. Stairs provided with "Universal" tread connect the basement with the engine room floor, and an open well in the rear of the engines gives a view of the air pumps and condensers. Heaters were furnished by the Whitlock Coil & Pipe Company, of New Haven, Conn., and condensers by the International Steam Pump Company. Extra heavy piping is employed throughout, and no duplicate piping was installed.

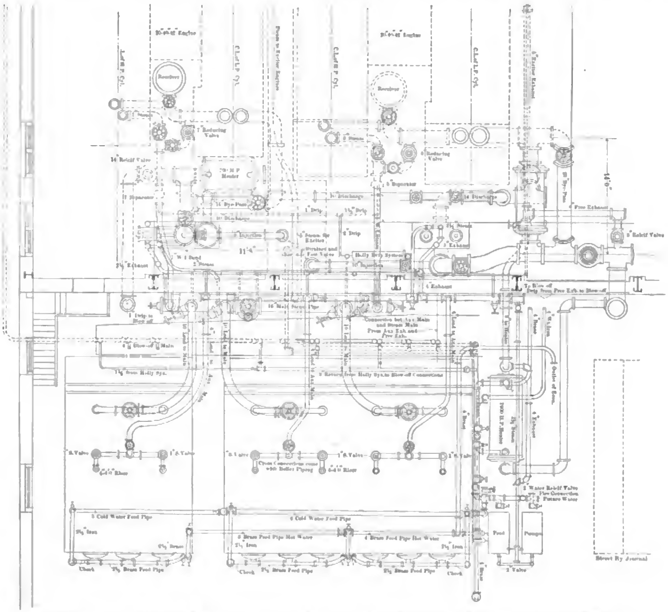
In the boiler room the main features are its excellent ventilation and lighting and general accessibility. The boilers are of the horizontal style, furnished through Thayer & Co., Boston, and made by Aultman & Taylor Company. These will be 500 hp, in one battery, and 1000 hp in the second, with space for 1000 hp additional as soon as the requirements of the service demand it. Hand firing is to be employed. A Green economizer is installed, and the usual complement of pumps and heaters is to be found



SYSTEM OF POWER DISTRIBUTION

here. The Green economizer is situated between the present boilers and the space for the future installation, and the main smoke flues from the boilers are arranged to pass the hot gases through the economizer by a system of dampers, or by a separate by-pass into the chimney. The stack is capped with a sectional cast-iron covering and provided with a ladder and lightning rods. The section of the first 35 ft. is square capped, with a granite belt, and for the remaining 155 ft. it is round, tapering with graceful lines to a slightly spreading top. Solid red brick were used in the walls, and the outer wall is separated from the inner core by an air space for its entire height. The coal bunkers are at the base of the stack.

The main generating units in the engine room at present are two in number. One of these is a Rice-Sargent horizontal cross-compound condensing engine, cylinders 24 ins. x 48 ins. x 48 ins., rated from 1500 hp to 2500 hp, according to cut-off, operating at 150 lbs. steam pressure, and direct-connected to a General Electric 1000-kw 28-pole "A T B" 3-phase 12,200-volt alternator, of the fly-wheel type, revolving at 107 r. p. m. With this type of generator no engine fly-wheel is required, the revolving field being made of sufficient diameter and weight to give all the fly-wheel effect required. In other words the generator is built on the fly-wheel instead of beside it. This does away with one hub and set of spokes, and makes a simpler, neater looking unit. The fly-wheel effect of the revolving field is 81,700 lbs., at a radius of 5.42 ft. The other unit is a similar Rice-Sargent engine, cylinders 20 ins. x 40 ins x 42 ins., rated from 800 hp to 1500 hp, according to cut-off, and operating at 107 r. p. m., direct-connected to a General Electric "A T B" 28-pole, 500-kw, 13,200-volt, revolving field alternator, with a fly-wheel effect of 50,000 lbs at 4.4 ft. radius. The regulation of these engines will be by a high-speed governor in connection with an approved form of Corliss valve gearing. The governors will be capable of controlling the speed so that at full load it will not vary from that at no load by more than 1 per cent, and the instantaneous variation of speed, under any conditions of loading will not exceed 3 per cent, the instantaneous variation in this case meaning the maximum departure of the speed of the engines from the speed at



GENERAL PLAN OF PIPING IN POWER STATION OF BOSTON & WORCESTER RAILWAY AT SOUTH FRAMINGHAM

which they were operating when the load was changed. The governor will be adjustable while running, so that the speed of a generator without load may be made to correspond to that of the other, carrying a full or partial load, so that one or the other may be paralleled and thrown out of service at will. Ample space is provided for the installation of a larger engine in the future. In the engine room are also two steam-driven exciter sets, each consisting of a General Electric M. P., 6-pole, 35-kw, 305 r. p. m., 125-volt direct-current generator, direct-connected to a General Electric single-cylinder marine-type engine. There is also a motor-driven exciter of General Electric work, consisting of a 4-pole, 50-kw, 750 r. p. m., 125-volt direct-current generator, direct-connected to and mounted on a common base, with a 4-pole, 75-hp, 750 r. p. m., 350-volt form "K" induction motor.

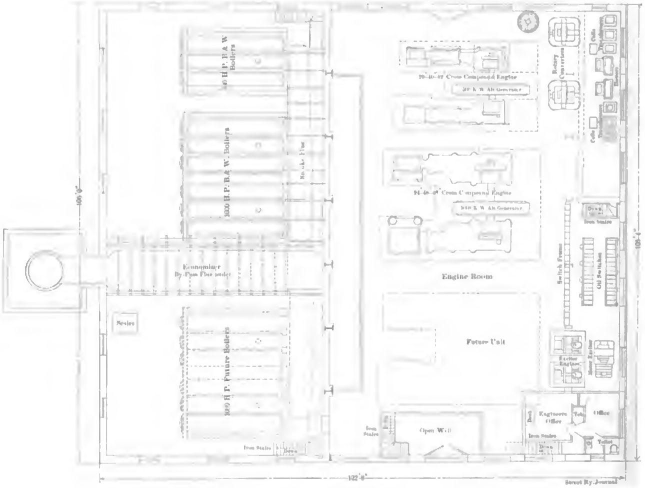
A traveling crane of 25 tons rated capacity sweeps the entire engine room floor, resting on a steel track, supported directly upon steel columns, which pass vertically to the basement floor level. This crane was furnished by the Whiting Foundry & Machine Company, of Harvey, Ill. It was necessary to excavate to a depth of 12 ft. below the basement floor level in order to provide suitable foundations for the building and its heavy machinery. The foundations were all built of Portland cement concrete.

The frame of the building is especially heavy in steel, all roof trusses and the frame of the engine room floor being of steel construction. About 150 tons were used in this work, furnished by the American Bridge Company. Brick arches with 4 ins. of concrete covered with 1 in. of Portland cement, make up the construction of the floor. The first 6 ft. of the engine room walls are of white enamelled brick, with dado above, and the remaining wall is to be treated with cold water paint.

The chief engineer's offices are located at one end of the room, and so arranged that visitors to the station will enter only through a door leading into the basement and by a staircase leading into these offices.

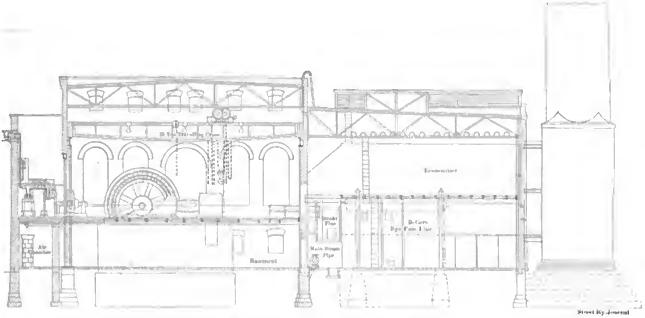
The entire system of steam and water piping has been developed with the greatest care for the service required in the operation of the station. Extra heavy valves and fittings are used where live steam is carried. The Holly system of gravity drip is used to return all drip water to the boilers. The feed water can be sent through or around each of the economizers or direct from the pumps to the boilers. The exhaust from the engines is arranged with a by-pass around the main heaters, so that they can be immediately removed, if required, without shutting down any part of the main operating system. Deane and Knowles condensers of ample capacity take their injection water from the Sudbury River, by means of a well connected with the latter by a canal, provided with a screen and gate at its mouth.

The steam mains are 16 ins. in diameter, and are located at the rear of the boilers, and rest upon heavy adjustable roller brackets, about 3 ft. above the floor, making the large valves especially accessible. A 6-in. auxiliary main over this one supplies steam for all pumps, etc. All leads



PLAN OF POWER STATION

from the boilers are of mild steel, carefully jointed with long-turn bends wherever possible. All gate valves are the Chapman Valve Manufacturing Company's make, and globe valves are of Cody make. Cochrane separators are placed in the lead pipes to each engine. The station is provided with an ample oiling and compressed air system, with fire hose. The contractors for the building were J. W. Bishop & Co., of Worcester. The power plant and sub-stations, with car houses, were designed and built under the superintendence of Engineer E. H. Kitfield, of 53 State Street, Boston, O. O. Rice representing him on the construction work.

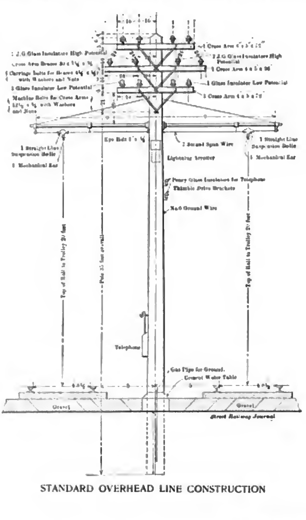


CROSS SECTION OF POWER STATION

Current in the power station is reduced from 13,200 volts to 370 volts for local railway direct-current distribution, at 600 volts, through 25-cycle rotary converters. This is done by six 100-kw air-cooled step-down General Electric transformers. There are two 37.5-kw air-cooled reactive coils in connection with these, and two blower sets, each consisting of a 50-in. fan, direct-connected to an M. P. 4-pole, 1-kw, 400 r. p. m., 600-volt direct-current motor, with automatic release starting rheostat, main motor switch and magnetic cut out. There is also a single 75-kw, 3-phase oil-cooled step-down transformer in the station, for the supply of the induction motor driving the exciter. Two 3-phase, 6-pole, 250-kw, 500 r. p. m., 600-volt, 25-cycle rotary converters transform the alternating current at 370 volts to direct-current, and feed it to the trolley through the switchboard, the direct-current to alternating current ratio being 1.62.

The switchboard is of General Electric make, and contains nineteen panels, viz.: One 500-kw, 13,200-volt generator panel, one 1000-kw generator panel, two 35-kw 125-volt exciter panels, one 50-kw exciter panel, one 125-kw exciter feeder panel, one 75-kw, 3-phase induction motor panel, three 13,200-volt outgoing line panels, two 250-kw alternating current rotary converter panels, two 250-kw direct-current rotary converter 600-volt panels, two 1200-amp. form "A" feeder panels, two 600-volt direct-current blower motor panels. There are nine 13,200-volt lightning arresters, and nine Q. B. lightning arrester switches connected in the transmission lines as they begin in the station.

Each of the outgoing transmission lines is equipped with a motor-driven "Form H" oil switch, of the type used in the large Manhattan and other stations in New York City, in order to make it possible to break a line-short circuit without failure, even if the capacity of the station increases



STANDARD OVERHEAD LINE CONSTRUCTION

several hundred per cent. The other switches are of a smaller breaking capacity and hand operated. All but the generator switches are fitted with instantaneous overload relays, making the switches serve as automatic circuit breakers, doing away with the use of fuses in the high-tension circuits.

The cables running from the switchboard are easily accessible, and the part of the building over the switchboard and its connections is in the form of a tower, into the top of which all feeder cables, etc., are brought and anchored to a cage before connecting with the main switchboard.

The power station is one of the largest planned in New England.

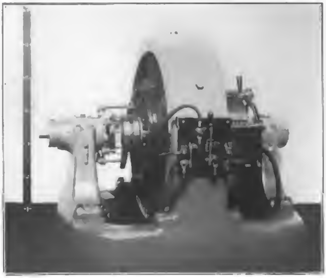
Combined car houses and sub-stations are being built at Westboro, Wellesley Hills and Waltham, and in addition the present street railway power station in Marlboro will be converted into a sub-station. These buildings are substantially built of red brick with steel trusses, furnished by Milliken Bros., of New York, and composition roofs. Ample pits for the cleaning, inspection and minor repairs of trucks and motors are provided, with wash basins for cleaning crews, repair shops, offices for superintendent, assistants, conductors and motormen's room, stock and boiler room. The buildings will be heated direct by steam.

400-KW ROTARY CONVERTER

The Westboro car house has five tracks and two pits, about 128 ft. long each, with two smaller pits, 37 ft. long each. The generating, or rather the rotary room, of this sub-station is 27 ft. x 56 ft. The sand pit is about 22 ft. long.

The electrical equipment of the Westboro and Marlboro sub-stations is the same in each case. After the high potential current of the transmission line has been brought into the sub-station building, it is reduced to 370 volts by six air-cooled General Electric 25-cycle, 100-kw step-down transformers, supplied with two 37.5-kw air-cooled reactive coils. There are two blower sets, each composed of a 50-in. fan, direct-connected to a General Electric M. P. 4-pole, 1-kw, 400 r. p. m., 600-volt motor, operated off the direct-current bus-bars of the sub-station, with automatic release-starting rheostat. Each sub-station has two General Electric 250-kw rotary converters, 6 poles, revolving at a speed of 500 r. p. m., and giving direct-current at 600 volts, to be fed to the trolley lines, as in the Framingham station.

The sub-station switchboards are composed in these two cases of eight panels each. There are two 1200-amp. form "A" General Eletric feeder panels, two 600-volt direct-



400-KW ROTARY CONVERTER, SHOWING FRAME SWITCH

connected blower motor panels, two 300-kw alternating current rotary panels, and two 300-kw, 600-volt direct-current rotary panels. Great care was taken in all switchboards to separate sufficiently bus-bars or wires at different potentials. The material of the switchboards is black enamelled slate.

Each converter is also equipped with a triple pole, double-throw alternating current starting switch, connected in the low-tension circuits between transformers and converter, and so connected as to switch the converter onto taps in the transformer windings, by means of which the converter can be started by alternating currents at low voltage.

In the Wellesley Hill sub-station are located six 25-cycle General Electric 145-kw air-cooled step-down transformers, supplying 3-phase alternating current at 370 volts to two General Electric 400-kw, 600-volt rotary converters, speed 500 r. p. m. There are two 60-kw air-cooled reactive coils, and the blower sets are two in number, composed of Buffalo fans, driven by form K, 350-volt induction motors. The Wellesley Hills switchboard has ten panels in all, made up of two 400-kw alternating current rotary panels, two 400-kw direct-connected rotary panels, two alternating current rotary starting panels, two 1200-amp. form "A" feeder panels, and two 350-volt alternating current blower motor panels. The usual complement of lightning arresters and switches is provided.

All panels are 16 ins. wide and 7 ft. 6 ins. high. The board in the Framingham station is 26 ft. 8 ins. long. Panels are of the standard thickness of 2 ins.

The rolling stock will be composed of fifty cars, supplied by the Newburyport Car Company, of Newburyport, Mass. All closed cars will be vestibuled, and the larger cars are 42 ft. 6 ins. over all. All cars are double-trucked and equipped with General Electric "57" motors, rated at 50 hp on the one-hour basis of 75 degs. C. rise above the

surrounding air. Each motor weighs 2972 lbs., its end armature bearing commutator is 6⅝ ins. x 2⅜ ins., pinion end 8¾ ins. x 3¼ ins., and its armature is 14 ins. in diameter. The armature cores have thirty-three slots, there are three coils per slot, and the commutator segments are 10¼ ins. in diameter, with a wearing depth of 1 in. The wheel diameter is 33 ins., bringing the clearance of 3½ ins. between bottom of motor frame and top of rail. There are two brushes per holder, 2¼ ins. x 1¾ ins. x ⅝ ins. All cars have single trolley, and open cars have special rattan seats, supplied by the Haywood Bros. & Wakefield Company. Peckham trucks, of the type No. 14 B3, extra strong, are used, with axles 4½ ins. in diameter. General Electric ordinary series parallel hand control is used, as it is not planned to couple up cars in trains under the multiple unit

HIGH TENSION FEEDER INSULATOR

system. The seating capacity of the larger cars is seventy-five people, and the smaller cars seat sixty. These latter cars are 36 ft. over all. The cars will be equipped with Christensen air brakes.

Telephone lines will be run along the road, and some form of automatic signal will be used to prevent accidents. The double tracking of the line to Framingham will undoubtedly be as convenient in operation as is the working of similar lines, such as that between Albany, N. Y., and Schenectady, which is well known as a short high-speed line of the same class.

The beginning of operation of the Boston & Worcester road is awaited with much interest in eastern Massachusetts. Up to the present time the Boston & Albany Railroad has supplied the only real rapid transit between the two cities. A few words about this road in its relations to the suburban territory and traffic near Boston may be of interest in connection with the prospective opening of its electric competitor. It is, of course, in the passenger business that the steam road's receipts will be cut into. It is generally accepted that there has been no reduction in the steam road's fares since the middle of the last century. Last year the average passenger fare per mile on the Boston & Albany, including commutation tickets, was 1.74 cents, and the freight rate per ton mile averaged .83 cents. The gross earnings per passenger train mile were $1.569. Operating expenses were 66 per cent of gross receipts. Maintenance expenses per total train mile were: Roadbed, $.099; renewing rails, $.005; bridges, $.009; locomotives, $.078; passenger cars, $.085; freight cars, $.110; wages, $.304; fuel, $.128; total, $0.818. The cost of repairs per locomotive for the year was $2,182.12; per passenger car, $711.93, and per freight car, $62.73. The analysis of the annual reports of the Boston & Worcester will doubtless present many interesting features by way of comparison with the Boston & Albany methods of operation.

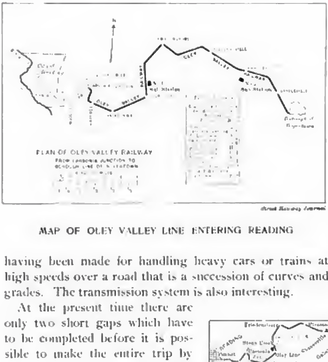
While it is true that extremely low commutation rates are in force on the Boston & Albany between Worcester and Boston, the daily fare being 19.7 cents each way for the 44 miles, it is also true that there are to be about twice as many runs daily on the electric road between the two cities as on the steam road, with the added pleasure of riding through country uninhabited by cinders, smoke and soft coal dust. Then again, the average time of steam trains between the two cities is not far from 1 hour 24 minutes, although several fast expresses make the distance easily in 55 minutes. It is probable that nearly all the pleasure traffic will be captured by the electric road unless a radical change in the Boston & Albany policy is made, until the limits of the Newton circuit loop line is reached. The circuit line of the Boston & Albany from the South Station to Riverside and return, via main line and Brookline, or vice versa, offers a most attractive field for electric equipment, and it is impossible to state how large a proportion of the present traffic will be diverted, but it is safe to assume that beyond Newton Upper Falls the electric competition will be severely felt. On the main line of the Boston & Albany, up to about 5 miles out, the electrics of the Boston Elevated have a large share of the suburban business, and the Boston & Worcester lies a little too far south of the main line to be felt seriously on this side of the circuit, but on part of the Brookline side of the circuit, and westward of Wellesley Hills on the main line, the influence of the Boston & Worcester line will be carefully studied by close observers of transportation methods and analysis in eastern Massachusetts.

The operation of the new line will be in charge of Superintendent A. C. Ralph, who is at present connected with the Shaw interests in Marlboro, and the electrical engineer will be M. V. Ayres, formerly with the General Electric Company in Schenectady. The construction of the entire line has been carried forward under the immediate supervision of James F. Shaw & Co., of Boston, who are also similarly interested in the building of lines between Boston and Providence, Worcester and Hartford, etc. The board of directors of the Boston & Worcester is composed of the following gentlemen, well known in New England street railway circles: William M. Butler, Boston, president; George A. Butman, treasurer and clerk; Charles C. Peirce, of Brookline; J. J. Whipple, Boston; H. Fisher Eldredge, Portsmouth, N. H.; P. W. Sprague, Boston; Albion R. Clapp, Wellesley; A. B. Bruce, Lawrence; W. H. Trumbull, Salem; A. E. Childs, Boston; F. C. Hinds, Boston; C. H. Shippen, Milford. Thanks are due especially to Messrs. James F. Shaw, Charles C. Peirce, B. D. Sumner and E. H. Kitfield for much of the information presented in this article. The street railway map of Massachusetts is undergoing constant changes in these times of combination of interests, and the changes of the future in the western suburban territory outside of Boston are likely to be profoundly influenced by that potent trunk line in the electric rapid transit system—the Boston & Worcester Street Railway.

THE OLEY VALLEY RAILWAY

THE Oley Valley Railway, which was lately completed and put in operation, connects the city of Reading with Boyertown, and is one of the most interesting internrban lines in Pennsylvania. The fact that it will form part of the electric system that is intended ultimately to connect Reading with Philadelphia lends importance to this undertaking at once. Another feature is the character of the construction and equipment, provision having been made for handling heavy cars or trains at high speeds over a road that is a succession of curves and grades. The transmission system is also interesting.

HORSE-SHOE CURVE AT SHANESVILLE

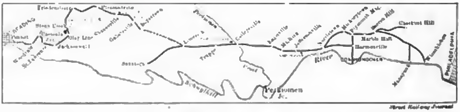


MAP OF OLEY VALLEY LINE ENTERING READING

At the present time there are only two short gaps which have to be completed before it is possible to make the entire trip by trolley along the route indicated in the accompanying map of the proposed line between Reading and Philadelphia. One of these breaks is a short section of about three city blocks, between the present terminus of the Oley Valley line, at the border of Boyertown, and the local trolley system, over the lines of which it is proposed to pass through the town. The company has already taken steps to make this connection but has been delayed in its work by the opposition of rival interests. There still remains to be constructed a 7-mile link between Boyertown and Limerick, indicated by dotted lines on the map. When this has been finished it will join the Oley Valley and the Trappe & Limerick lines into one system, thus making a complete trolley line between Reading and Philadelphia.

The Oley Valley road passes through a mountainous country, but it is built for high speeds and is intended to carry the heaviest class of traffic. At present it is a single-track line following the winding course of the valley as closely as possible to avoid encountering any steeper grades than are absolutely necessary. There are nine side turnouts on the line, which have been located so as to enable the operation of cars at high speeds and without serious delay. At the Reading end of the line, the first six sidings encountered are 1½ miles apart; the other three are located 3 miles apart.

The Oley Valley line proper begins at Carsonia Park, a pleasure resort about 3¾ miles from the center of the city of Reading, but the Oley Valley cars run into town over the lines of the United Traction Company. The new road passes through a section of country that has heretofore been entirely neglected by the electric and steam railway companies, although it is one of the richest and most beautiful parts of Berks County, and has a very prosperous class of farmers and several good-sized towns. The route is traced on the map. It traverses Exeter, Earl, Oley and Coldbrookdale Townships, and touches St. Lawrence, Jacksonwald, Oley Line, Friedensburg, Pleasantville,



MAP OF TROLLEY ROUTE BETWEEN READING AND PHILADELPHIA, INCLUDING OLEY VALLEY LINE

Shanesville, Gabelsville, Morysville, Boyertown and many smaller places. Friedensburg, which is about half-way between Carsonia Park and Boyertown, is a thriving village of 1500 inhabitants, while Boyertown, which is a station on the Philadelphia & Reading road, has 1800 population. Since the opening of the trolley line commercial travelers visiting this district generally leave the steam trains at Boyertown and take the electric cars for Reading, stopping at the villages on the way. The farming territory along the line contains about 4500 inhabitants, and a great deal of local traffic has been developed among this class. The trolley line enjoys the exclusive patronage of this district, and is utilized not only for passenger service but also for carrying mail. Provision has been made for baggage service, one car having already been fitted with a baggage compartment, and it is quite probable that freight and express will eventually be added. There is also a large excursion traffic, and as Carsonia Park is located on this line, the Oley Valley cars are utilized for handling the throngs that flock to this beautiful recreation ground. This traffic contributes largely to the support of this system, and as there are numerous other points along the line, which are very popular with the people of Reading and vicinity, the company secures considerable income from this class of business. Many visitors to these parts make

TRACK CONSTRUCTION AND BRIDGE WORK

a special trip over this road to get a view of the majestic mountains between which it passes. Entering Reading over this road one involuntarily recalls Bayard Taylor's beautiful word picture of this scene in "John Godfrey's Fortunes." On the right is Mount Penn; to the left Neversink Mountain. The glorious landscape, the stately old town stretched at full length on an incline plane, rising from the Schuylkill to the base of the mountain; the river, winding in abrupt curves; hills of superb undulations in interlinking lines, through the middle distance; Scull's Hill boldly detaching itself in front, and far to the north the Blue Ridge lifting its dim wall against the sky are all there to-day as they were in the 50's, to delight the eye and command the admiration of every lover of nature. It is not to be wondered, therefore, that this beautiful spot attracted thousands of visitors since the opening of the trolley line, which has made it readily accessible.

As already explained, the cars of this system enter the city of Reading over the lines of the United Traction Com-

ROADBED AND OVERHEAD CONSTRUCTION

pany. The starting point in Reading is at the corner of Fifth Street and Penn Street, which is the center of the business district. The line extends in a generally eastern direction through the city and suburbs to Carsonia Park, which is 3¾ miles from the starting point. Here the line of the Oley Valley Railway Company actually begins, extending 18¾ miles in a circuitous route through a very hilly country, encountering a number of sharp curves and heavy grades. One of these curves, which is of especial interest, is illustrated herewith. The cut shows a horseshoe-curve near Shanesville and a general view of the locality. It will give some idea of the difficulties which the company encountered in building this line. There is another curve a few miles from this point, which is almost an exact duplicate of the one here illustrated. The nine sidings, each 300 ft. long, are also block signal stations, equipped with the Ramsey signal system. The cars run on a regular schedule, which provides for eighteen trips each way every day at this season, beginning at 4:40 a. m., and continuing until 11:20 p. m. On special occasions, including general holidays and whenever there are any unusual attractions at Carsonia Park or other points along the line, the schedule is abandoned and the cars depend entirely on the block signal service. On Labor Day every available car was pressed into service, and the round trip of 45 miles was made in 2 hours and 10 minutes, including all stops.

There are 13.88 miles of straight track in this line and 4.87 miles of curves. There are only 550 ft. of level track throughout the entire system. The heaviest ascending grades going east are near Shanesville summit, 5.8 per cent for a distance of 1000 ft., and 4.8 per cent for a distance of 2600 ft. The total rise of the ascending grades for the entire line is 754 ft., covering a length of 7.75 miles, or an average ascending grade of 1.85 per cent. The heaviest descending grade going east is, leaving the Shanesville summit, a rate of 4.7 per cent for a distance of 2600 ft. The total fall of the descending grades for the entire line is 780 ft., covering

a length of 10.9 miles or an average descending grade of 1.35 per cent. The grade of the line is undulating, owing to the nature of the country traversed; hence, there is a multiplication of rises and falls more than the difference in elevations of the highest and lowest points shows. Shanesville summit, 4 miles west of Boyertown, is 380 ft. above both the Boyertown and Carsonia Park ends of the line by actual elevation. A turnout is located at this point, and a short stop is usually made there to afford passengers an opportunity to enjoy a splendid view of the surrounding country.

The roadbed construction naturally involved numerous cuts and a great deal of bridge work. The cuts are at least 15 ft. wide, with ditches along the side of the track to keep the water from the ends of the ties. The embankments are wide enough to support the ballast under the ties and leave room on either side for working about the car, should any repairs be required for the machinery. A minimum width of 13 ft. is maintained upon all embankments. The

TRESTLEWORK NEAR READING

slopes of both cuts and embankments are flat enough to resist the action of the rain which washes down the mountain sides in torrents at certain seasons of the year.

There are twenty-three iron bridges on the line, twenty-two wooden bridges and three trestle works. All the bridges over 15 ft. long are of eye-beam construction with angle braces. The total length of the iron bridges is 660 ft., the longest being 45 ft. and the shortest 18 ft. The total length of the wooden bridges is 397 ft.; the longest of these is 98 ft., and is made up of eight spans, and the shortest is 10 ft. The principal trestle is 924 ft. long. This is the first one crossed after leaving Reading, and the general character of the construction may be judged from this example, which is illustrated in the accompanying cuts. The next one is 385 ft., and the third 188 ft. In all this work provision was made not alone for the weight to be carried over the bridges and trestles, but precautions were taken as well against the action of frost and the undermining caused by the severe storms which visit this locality. To reduce to a minimum the danger from roving cattle all private right of way through pasture grounds is fenced in, and cattle guards are placed at all crossings.

In building up the roadbed broken stone ballast, of a uniform depth of 6 ins., was placed under the ties to permit of sub-drainage and tamping the ties to a firm and elastic bearing. The ties were placed 2 ft. apart between centers. They have a top and bottom face of 8 ins., a depth of 6 ins., and they are 8 ft. long. They are of sound oak timber throughout. The space between ties was filled with broken stone, and also between the main track and sidings on the turnouts.

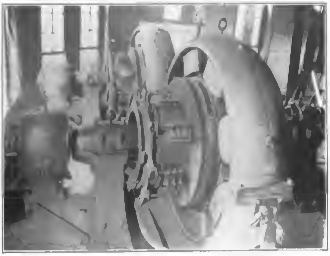
The track consists of 75-lb. T-rails, with open switches and spring frogs, continuous rail joints, and Protected rail-bonds. The rails are laid with suspended broken joints to prevent the double hammer on the joint ties from even or opposite joints, and the resulting slight downward bend to the end of each rail that eventually causes rough riding.

A cross section of the track and line construction is presented, showing complete details. There are also excellent views of a stretch of roadbed through the country, track

CROSS-SECTION OF TRACK AND OVERHEAD CONSTRUCTION

construction over a bridge, and overhead work. Two 0000 trolley wires are suspended by a $\frac{3}{8}$-in. twisted steel span wire 19 ft. above the track level. The poles supporting the span wires carry the three-wire high-tension transmission lines in trianglar construction, as well as the direct-current feeder on one side of the track, and the telephone wires on the other. Poles are set 7 ft. in the ground; those carrying the transmission line being 33 ft. 6 ins., and the others 28 ft. 6 ins. above the top of the rail. They are 8 ins. in diameter at the top. There are two 4-in. cross-arms on the transmission poles, the lower one carrying a 0000 insulated feed wire. The upper arm, which is 22 ins. above the lower one, carries two of the high-tension wires, and the third wire of the alternating current system is on the top of the pole. Five-inch double petticoat porcelain insulators are used. Those on the cross-arms are set on wooden pins, through which a $\frac{1}{2}$-in. galvanized bolt passes, extending down through the cross-arm, and being secured by a nut and washer on the lower end below the cross-arm. A similar insulator is

placed on the top of the pole, but it is secured to a galvanized iron saddle, which sets on the top of the pole. The two insulators on the upper cross-bar, and the insulator on the top of the pole carry No. 4 bare copper wire for the high-tension current. Each of these insulators is located so that the wire it carries is 28 ins. away from the nearest high-tension conductor. The cross-arms are 3 ft. 4 ins. long, 4 ins. wide, and are placed 1 ft. 10 ins. apart. The upper cross-arm is 1 ft. 10 ins. from the top of the pole.



TWO 400-KW INVERTED ROTARIES AT READING POWER STATION

There is also a bracket carrying a No. 10 signal wire, for the block system, beneath the span wire. The signal boxes are placed on the pole at each turnout, 5 ft. above the track level, within easy reach of the train man. The telephone wires, which are carried on the opposite pole line,

SUB-STATION NO. 1 AT OLEY LINE

consist of No. 10 bare copper wire, and the construction follows the standard methods. Each car is fitted with a complete telephone set, thus enabling the crew to report promptly to headquarters any serious breakdown or the failure of any part of the system.

Giant strain insulators are used on the span wires. They are located 6 ins. outside of the rail, between the trolley hangers and the transmission line. The requirements of this service led to the development of a special mechanical clip and soldered ear, to carry the grooved trolley wire. The clip is about 15 ins. long, with a smooth finished channel, on each side of which is a downwardly projecting lip, having on the inside a small rib, which fits into the groove of the trolley wire. The latter is sprung into the channel and the sides of the clip are then crimped together, so that the ribs on the inside are closely fitted into the groove of the trolley wire. This would generally be considered sufficient to hold the wire, but in order to make the arrangement doubly secure, the clamped wire is soldered throughout the entire length of the clip. On the upper side of the clip, on each side of the centrally supporting hub, is a hole which communicates with the channel around the trolley wire. Solder is poured into each of these holes, thus entirely filling the interstices between the wire and the clip. When in place, the exterior of the clip conforms almost to

STATIC TRANSFORMERS IN SUB-STATIONS

the circumference of the wire, thus giving practically an even surface, with no appreciable obstruction to the movement of the trolley wheel. This device is used in conjunction with round top insulators of extremely heavy construction. The surface of the insulation inside of the round top bell, between the edges of the latter and the supporting stud, instead of being smooth, is provided with an ample petticoat molded in the insulation and about 1 in. in height from the base of the petticoat on the main surface of the insulating material to the tip. This provides almost 2 ins. of additional surface between the metal of the bell hanger and the central stud, and retains all the other advantages of a petticoat in such devices. This hanger weighs almost twice as much as one of ordinary construction. The stud projecting from the insulator into the clip hub is ⅞ in. in diameter.

In feeding into the line a 00 copper insulated cable is substituted in place of the ordinary ⅜-in. twisted steel span wire, insulating the ends with the same giant strain

insulators just outside the eye bolts, and making a non-insulated soldered connection with the trolley wires. A short feed tap, of the same wire, is made between this wire and the feeder, just beyond the first insulator, near the pole. This construction protects the tap from being torn off by the trolley pole should the wheel jump at this point, as sometimes happens in high-speed roads. There are no switches at the turnouts, the wire on the turnout side being deflected and following the turnout. To every tenth span there is a feed span and tap, and at every twentieth span there is a lightning arrester. At about every half mile strains are run off from the trolley wires in both directions, extending to the pole at the next span, above its span wire, and from this to the next pole to which it is attached at about 8 ft. from the ground.

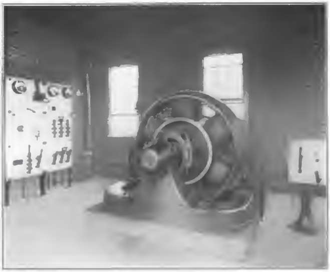
The spans on straight lines are 100 ft. apart, this distance being reduced on curves according to their sharpness or length of radii. The shortest span is 40 ft., on a curve

SUB-STATION NO. 2 AT SHANESVILLE

with a radius of 100 ft. In operation all turnouts are run, none skipped, and the car always keeps to the right.

Power for the operation of this line is secured from the plant of the United Traction Company, which controls all of the street railway lines of Reading and vicinity. Current is furnished by three direct-current generators, directly connected to vertical engines, two of 400-kw capacity and one of 800 kw., generating at 550 volts. The power from the direct-current switchboard is distributed through the feeders for operating the city cars, and as the Oley Valley cars operate over the regular city line for 3¾ miles, as far as Carsonia Park, this section is fed by an independent feeder of 500,000 cm. running directly from the power house and tapping in at frequent intervals. Two sub-stations have been equipped, one at Oley Line, and the other at Shanesville. Power for these sub-stations is transmitted at 16,000 volts over a high-tension line, consisting of three No. 4 hard-drawn copper wires, supported on porcelain insulators, carried on cross-arms upon the same poles as the 500-volt transmission, as already described.

From the bus-bars of the main switchboard, feeders are run to the two S. K. C. 400-kw inverted rotaries, at the city power house. On the rotary switchboard the current coming from the main switchboard passes successively through the circuit breaker and meter, starting rheostat and main switch to the commutator of the rotary. The negative current returning from the commutator passes through a negative switch mounted on a separate equalizer stand, and from there directly to the power house switchboard. By this arrangement no negative leads are on the rotary board, thus minimizing the dangers from short circuits on this board. The rotary is separately excited from the small 120-volt exciter, mounted on the same shaft. The alternating current from the rotary passes through low-tension switches and instruments mounted on the low-tension board, and runs to the three 280-kw oil-filled water-cooled S. K. C. transformers, which are in a separate room. The current is here stepped up from 360 volts to 16,000 volts. In the transformer room there is also an S. K. C. lightning arrester equipment, including choke coils. The high-tension current passes to the high-tension switchboard, which is equipped with compression ball fuses and emergency switches. The current then passes



SUB-STATION ROTARY CONVERTER AND SWITCHBOARD EQUIPMENT

through 1 mile of lead-covered cable to outskirts of the town, where it terminates in a lightning arrester station, and is there connected to the three separate high-tension wires described. This lead-covered cable is said to be the highest voltage three-wire cable in the United States.

The two sub-stations are practically identical in arrangement and equipment, as shown in the illustrations. Each consists of two rooms, a transformer room and a rotary room. In the transformer room the high-tension current, having passed through the choke coils and lightning arresters, comes to the high-tension switchboard, equipped with bayonet plug switches and compression ball fuses. Thence it passes to the three 100-kw step-down transformers. In the power house the ratio of transformation is 360 to 16,000. The transformers in the sub-stations were designed for 15,000 volts on the high-tension side, stepping down to 360 volts on the other. As the drop on the line does not amount to 1000 volts, the direct current furnished by the rotaries at the sub-stations is, therefore, at a slightly higher voltage than that of the power-house bus-bars. The direct current from the low-tension side of the transformers in the sub-station passes to the low-tension switchboard equipped with instruments and switches, and then to the collector rings of the 300-kw rotary. From the positive brushes of the rotary the current goes to the direct-current feeder panel, passing through ammeter and circuit breaker, and it is then connected to the trolley line. The negative lead is connected

at Oley Line, except that space has been provided for the installation of an S. K. C. frequency changer, which will enable the frequency to be changed to 60 cycles for lighting the town of Boyersville.

At the sub-stations water is circulated in the transformers by a small pump belted to the rotary, the source of water

INTERIOR OF OLEY VALLEY CAR

being a small stream in the vicinity. In the discharge pipes of the circulating system thermometers are placed, and the valves are so adjusted that the temperature of the water discharge is the same for all transformers. Any variation in temperature during operation indicates that the load on the transformers is unbalanced, and more water is supplied to the transformer carrying the larger load. If this does not reduce the temperature it is taken as an indication of trouble in the line. The entire power plant and transmission equipment for the Oley Valley Road was supplied by the Stanley Electric Manufacturing Company, of Pittsfield.

Very heavy cars are operated on this line. They were built by the J. G. Brill company, of Philadelphia, and are illustrated in the accompanying cuts, which show the exterior of a combined passenger and smoking car and an interior view of the arrangement of seats, curtains, head linings and other features of interior equipment. The car bodies are 40 ft. long over the end panels and 52 ft. over all. The platforms are 5 ft. 2 ins. long, and are completely enclosed by round-end vestibules. The vestibules have folding doors, and there are double doors leading to the car body. Ratchet brake-handles, angle-iron bumpers and Brill steps are features of the equipment. The roof is of the steam-car form, with iron rafters, but is built along street-car lines of construction. The side sheath is vertical. The cars are 8 ft. 6 ins. wide, weigh 20 tons, and are mounted on No. 27 trucks with 6-ft. wheel base. The wheels weigh 425 lbs., being 33 ins. in diameter, and having 2½-in. tread and ⅞-in. flange. The gage is the Pennsylvania standard for street railways, 5 ft. 2½ ins. There are two truss-rods with the usual needle beams. In addition to this the sides are plated with steel plates. The sash is in two parts, the top being stationary and the lower one dropping into the side of the car.

The car is divided into two compartments, one for smokers being about 11½ ft. long. The partition between the two compartments is fitted with doors which swing into the smoking room.

The seats are of spring cane and are reversible in the passenger room, but longitudinal in the smoking room. There are parcel racks in both compartments. The interior finish of the cars is in cherry with three-ply birch veneer decorated ceilings. The windows are fitted with printed duck curtains, having pinch handle fixtures. The windows in the vestibules have drop curtains. The inside trimmings are of bronze.

In place of the regular smoking compartments fitted with longitudinal seats, the company has devoted the space at the end of one of the cars to a baggage compartment. The construction of this car is somewhat different from the ordinary cars, as the windows are eliminated. There is a side door for loading trunks and packages on each side of the baggage compartment.

HEAVY INTERURBAN CAR FOR OLEY VALLEY LINE

Two rubber-cushioned trolley boards are placed on each car, each set to one side of the center line. Each car is equipped with four G. E.-57 motors geared for a maximum speed of 55 miles an hour, the schedule speed being 20 miles an hour. Type K controllers and Christensen air brakes are used on all the cars.

The Oley Valley Company is controlled by the same interests as the United Traction Company, which operates the city lines at Reading and the mountain railways of the vicinity. A separate organization is maintained for the Oley Valley property, however, and the officers are: President, John A. Rigg; vice-president, Henry C. Moore; secretary and treasurer, William S. Bell; general manager, F. L. Fuller; superintendent, Samuel E. Rigg.

The engineering and construction on the road were done by the company's organization under the direction of James Fagan and S. S. Hoff, of the engineering department.

THE AURORA, ELGIN & CHICAGO RAILWAY

WHILE it is not always easy for those in the midst of events to judge of their relative importance, it is probably not far from a correct estimate to say that future historians of electric railway progress will note the construction of the Aurora, Elgin & Chicago Railway as one of the important mile-posts in the history of the electric railway. Many people have asked the writer what is the notable feature of this road which is attracting so much attention to it. The answer in a nutshell is: speed. That is the one characteristic which to the lay mind distinguishes the road from dozens of other electric railways. The detailed discussion of all the elements which go to make possible in a financial and engineering way this one element of speed, forms the principal object of this article.

There are two standpoints from which to consider the work on the Aurora, Elgin & Chicago Railway, that of the electric railway financier and that of the electric railway engineer. The financier sees in it a road which is expensively, though not extravagantly, built, and which has liabilities in the shape of stocks and bonds per mile of track about double the ordinary interurban road. To show for this investment he sees a road built after the manner of the heaviest steam-trunk lines, equipped with electrical apparatus and rolling stock to carry people between Chicago and three towns 40 miles west in the Fox River Valley at a speed and with a frequency to completely eclipse any service heretofore given by the steam roads between those points. He sees further preparations to carry people to intermediate and suburban points at a speed and frequency having no previous parallel in railway history. The engineer sees a third-rail electric road with alternating-current power distribution. He sees a track, over much of which 80 miles to 100 miles an hour can be made with safety. He sees cars equipped with the multiple-unit system of control, with the heaviest motor equipment ever put under an electric car for its own propulsion alone; in fact, with all provisions made for a regular maximum speed of 65 miles per hour and an acceleration at the rate of 2 miles per hour per second to attain it, a performance never before equaled in regular electric railway practice. Certainly these are matters worthy of closer investigation by both financier and manager, for they mean much to the future of the electric railway industry.

The road owes its financing and construction to a number of Cleveland gentlemen, who are by no means novices in the electric interurban railway business. L. J. Wolf, of Cleveland, is president; M. H. Wilson, vice-president; M. J. Mandelbaum, treasurer, and Warren Bicknell, of Chicago, secretary. During the construction of the road Will Christy, of Akron, Ohio, has acted as general manager, and W. E. Davis, of Cleveland, as electrical engineer. These gentlemen of the Cleveland Construction Company and their associates deserve much credit for the splendid piece of engineering afforded by the road. The other gentlemen actively connected with the construction were Charles Jones, chief engineer, who has been on the ground in charge of the construction of the road from the beginning; W. L. Morris, mechanical engineer, who designed and built the power station, and Ernest Gonzenbach, electrical engineer in active charge of electrical construction. In operation, the road is under the general supervision of Secretary Warren Bicknell, with C. E. Flenner as auditor; W. W. Crawford, superintendent of transportation; Ernest Gonzenbach, electrical and mechanical engineer in charge of power house, electric power distribution, shops and maintenance of rolling stock, and Charles Jones, engineer maintenance of way and structures.

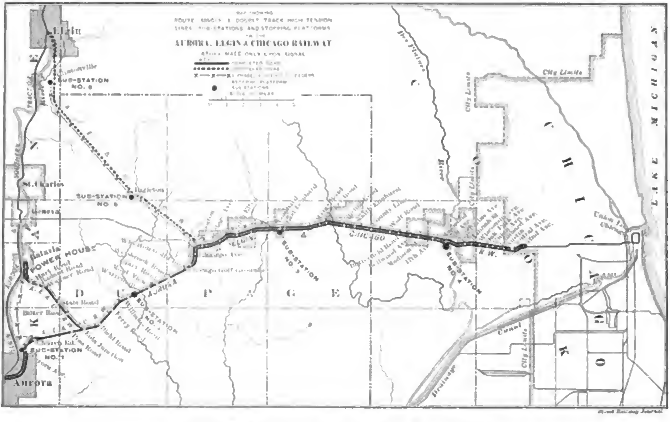
To build the 82 miles of track which the company will have when the road is completed, a bond issue of \$3,000,000 and capital stock to the amount of \$4,500,000 is provided for. Of the \$4,500,000 stock \$1,500,000 is 6 per cent cumulative preferred. The bonds bear 5 per cent. The bond issue is therefore \$36,585 per mile, and the total liabilities \$91,219 per mile. As this is considerably higher than on most interurban roads up to the present time, it is natural to inquire into the conditions which have justified this expenditure in the minds of the builders of the road. That the conditions were unusual goes without saying. For a distance of 20 miles due west from the Chicago city limits is a series of suburban towns with an aggregate population according to the 1900 census of 24,065. Thirty-five miles west of Chicago is a belt of towns along the Fox River which are already interconnected by the Elgin, Aurora & Southern Traction Company lines, but which have had only infrequent steam service to Chicago. The new road, as seen by the accompanying map, touches the Fox River Valley at the three largest towns; Aurora, with a population of 21,147; Batavia, 3871, and Elgin, 22,433. The total population reached directly in the Fox River Valley by the Aurora, Elgin & Chicago Railway is 47,451, and that in the towns along the valley reached by the Elgin, Aurora & Southern Traction Company lines, which population is really tributary to the new road, is 91,224. Taking all the population in the tributary Fox River towns, together with the suburban population mentioned, gives a total of 115,289 tributary to the road, not including rural population. This is 1405 per mile of track. Now it can be seen why such an expenditure was justified. The population per mile along many good electric interurban lines running into less important centers than Chicago is frequently less than 500.

In order to make this undertaking fully successful, those responsible for it rightly figured that if the maximum possible business was to be developed fast schedules must be made. It would undoubtedly have been possible after many years of vexation to secure a franchise along the highways and to operate at the usual schedule of 15 miles to 20 miles per hour, picking up considerable local travel, as many another road has done before. But the men to whom time was valuable would have planned their trips as far as possible for the suburban steam trains, and many a person would have remained at home, where fast service at frequent intervals would have induced them to ride. It was decided, therefore, since there was population to justify it, that track and roadbed should be built on a private right of way, and of such substantial construction that over the greater portion of the route there would be nothing to hinder sustained runs at speeds as high as known to the railroad world of to-day. It was further decided to provide electrical equipment which would give the fastest

schedules possible (with stops 3 miles apart on local service 40 miles per hour), 65 miles per hour maximum speed. Only the electric railway engineer familiar with schedule speeds and rates of acceleration in common use can realize what a bold step in advance of previous actual commercial practice this was. To accelerate a car from a standstill up to a rate of 50 miles per hour in 25 seconds to 30 seconds, and to sustain it at a speed of 65 miles per hour, calls for an investment in motors and power furnishing apparatus that is apt to make the engineer and manager hesitate when it comes to the actual selection of the equipment. But the step was taken, and the result is the most powerfully equipped and solidly constructed interurban electric railway in existence to-day.

The fast acceleration needed for the local service making all stops as well as the long runs at high speed practically threw out of consideration everything but the multiple-unit system. The equipment of the motor cars is four 125-hp G. E.-66 motors. The General Electric Company's type M train-control system with small master controller on each platform operating magnetic contact makers or "contactors" under each motor car was adopted. One and two-car trains will have every axle motor driven. Three-car trains will have one car without motors. The motor cars have the most powerful equipment ever put on a motor car, except on elevated roads, where the motor car acts as a locomotive to pull trailers. The type-M control permits the train or car to be operated from any car, and is practically the same as that put on the Manhattan Elevated in New York, and was described, together with the G. E.-66 motor here used, in the October (1901) Street Railway Journal.

The cars upon which these motors are placed were built by the Niles Car & Manufacturing Company, and are notable for strength of sub-frame, drawings of which are shown. These cars are 47½ ft. over bumpers and 39 ft. 4 ins. over bodies. This length was selected to allow the cars to pass around the sharp curves of the Union loop in Chicago as it was the original intention to run these cars into Chicago over the tracks of the Metropolitan West Side Elevated Railway. The cars seat fifty-six people in seats disposed according to the seating plan shown. There is no waste room either on platforms or inside the car, hence the relatively high seating capacity as compared with other interurban cars of similar length. The heating is by Consolidated electric heaters placed along the side of the car. An exterior view of one of these cars is shown in the article elsewhere in this issue on "Cars for High-Speed Interurban Service." An interior view of one of these cars is given in this article and shows the location of the International register on the partition between the smoking and main compartments. The seats are rattan of the Hale & Kilburn walk-over type, 38 ins. wide. Van Dorn draw-bars are used. The trucks are Peckham's M. C. B. 30, which follows the general lines of a M. C. B. truck, but has a diamond frame and combines spiral and elliptic springs under the bolsters. In addition to the regular equalizer springs which support the frame, there are spiral springs between the frame and each journal box, which take a small part of the weight and are intended to prevent the tilting of the frame. Nichols-Lintern compressed air track sanders are mounted on the truck frames so that they will sand the track both on curves and straight line. The Christensen straight air brakes with independent motor-driven compressor and automatic motor regulator are employed. The automatic motor regulator is controlled by electric contacts on the air-pressure gage.

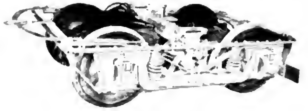


MAP SHOWING ROUTE OF AURORA, ELGIN & CHICAGO RAILWAY

The car wheels are 36 ins. in diameter, and have the standard M. C. B. tread and flange. The axles are 6½ ins. in diameter, the largest yet used under an electric motor car.

The weight of these cars is 74,325 lbs. The motors alone weigh 17,120 lbs. The gear ratio is 1.61 to 1, and the large size of the pinions and car axles and smallness of the gear wheels gives a most peculiar "fat" appearance to the equipment when apart.

Although no extensive tests have been made on the performance of the regular car equipment in service because

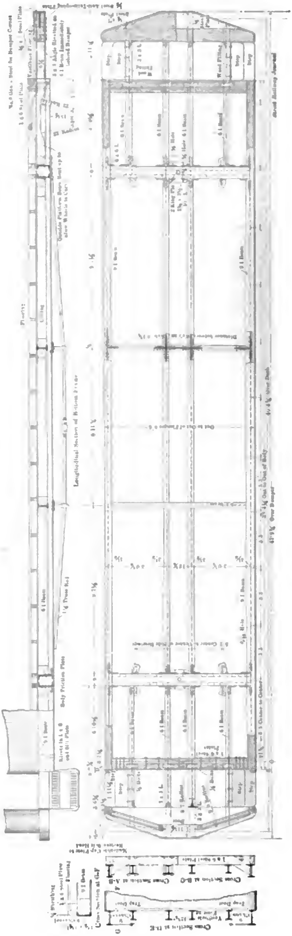


STANDARD TRUCK

of the short time the road has been operating and the many more pressing duties claiming attention, it has been found that at full speed the current required by a car on level track is 400 amps. At present line voltage, these cars run a little under 65 miles per hour maximum on a level. When accelerating at the rate of 2 miles per hour per second with motors in multiple, they require 1200 amps. or 300 amps. per motor. The present equipment consists of ten motor cars, and ten more motors and ten trailers are ordered. It is safe to say that never before in the history of electric railroading have motor cars been put through the daily mileage that some of these cars were put through the first two weeks the road was in operation, when, on account of lack of cars, some cars were run over 550 miles per day.

There are approximately 82 miles of main line, all on private right of way, the route of which is shown by the accompanying map. From Fifty-Second Avenue in Chicago, which is the eastern terminus, where the road connects with the Metropolitan West Side Elevated Railway, and at which point an elaborate transfer terminal depot has been erected, the line is double tracked for 21 miles to the golf grounds, 1 mile west of Wheaton. From Wheaton to Aurora is 14 miles, with a branch of 7 miles to Batavia. From Wheaton to Elgin is 16½ miles. The branches to Aurora, Batavia and Elgin are nominally single track, but have long sidings, which practically make the road double tracked for short distances, and really should be counted as short sections of road double tracked. Three miles west of Wheaton is 800 ft. of double track; 9 miles west of Wheaton is 1 mile of double track; 12 miles west of Wheaton, or about 2 miles from Aurora, is 400 ft. of double track. At Aurora there is double track for 1½ miles. On the Batavia branch is ¾ mile double track, at the main power house, and 700 ft. of double track at the Batavia terminal. On the Elgin branch there is ½ mile double track at Ingalton depot and sb-station, 1000 ft. at Wayne, ½ mile near the southern city limits of Elgin and 1500 ft. in the city of Elgin at the terminal. On the single-track portion of the line when large cuts were made they were cut sufficient width to provide for a double-track line in the future as soon as it is needed. Between Wheaton and Aurora there are 2½ miles of this double-track grading.

The roadbed for single track is 16 ft. wide, with 9 ins. of



PLAN AND SIDE ELEVATION OF CAR, SHOWING STEEL SUB-FRAME

gravel ballast. The double-track roadbed is 28 ft. wide, which is also the width of the single-track cuts where provision is made for double track. Double tracks are laid 15 ft. between centers. Current is supplied from a third rail which occupies the standard position relative to the track, which is in use on the elevated roads of Chicago and elsewhere. The top of the third rail is 6 3-16 inches above the top of the track rails, and it is placed 19½ ins. outside of the nearest track rail, the gage lines of the track and third rail being used as points of measurement in this case, and not the centers.

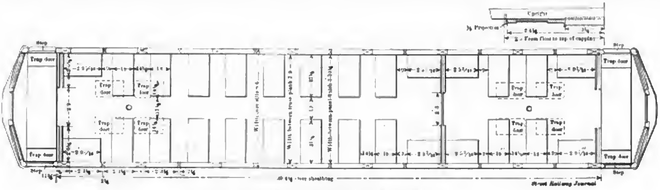
The track rails are standard T, 80 lbs. to the yard, in 60-ft. lengths. They are joined with four-bolt angle-bars 28 ins. long. The third rail is standard T, 100 lbs. to the yard, in 33-ft. lengths, and in order to give it better conductivity it is made of a lower percentage of carbon than the track rails, the percentage being .1. The regular ties are 6 ins. x 8 ins. x 8 ft., 2840 to the mile. Every fifth tie is 9 ft. long, and carries on one end an insulating support for the third rail. Except at two points, Wheaton and Waldheim Cemetery, where there are 16-deg. curves, the curves are limited to 1 deg., 2 degs. and 3 degs., so there is nothing to require a reduction of a speed from 70 miles per hour.

INTERIOR VIEW OF CAR

The third-rail insulators were furnished by the Ohio Brass Company. The first of these laid were wooden blocks boiled in paraffine oil, and the balance a special design of Mr. Gonzenbach, made by the same company. This new design of third-rail insulator consists of a cast-iron base, over which fits a thin circular cap of "Dirigo" insulating material. On top of this is placed the cast-iron cap, upon which rests the third rail. The insulating material is not joined to the cast-iron fittings in any way, and the rail simply rests on top of the cap, as the weight of the rail is sufficient to hold the three parts of the insulator together.

END DOOR IN VESTIBULE OF CAR

The arrangement of the third rail at the cross-overs and the cable terminals connecting the third rail with the lead-covered underground cables, are clearly shown in the accompanying engravings. It will be noted that instead of omitting the third rail at the beginning of a cross-over to prevent catching of the contact-shoes on cars which are passing along the main line, the third rail has been bent downward so as to clear the contact-shoe. This is a more simple construction and does away with some underground connections which would otherwise be necessary were a separate isolated section of third rail put in for the cross-over. On the double track there is a cross-over



PLAN OF CAR SHOWING SEATING ARRANGEMENT

about every three miles. The switches are all of the standard steam-road pattern, with No. 10 spring frogs, furnished by the Morden Frog & Crossing Works. Interlocking signal towers, with home and distant signals so that trains

SINGLE TRACK, GOOD FOR 100 MILES AN HOUR

need not stop if the way is clear, are placed at three points where the steam roads are crossed. One of these is at Forest Home Cemetery, where the Wisconsin Central, Great Western and the Chicago Terminal Transfer Companies' tracks are crossed. Towers are also located at Chicago Junction Railway crossing, and at the crossing

THIRD RAIL AND INSULATORS

with the Illinois Central, at South Elmhurst. As far as possible highways and steam roads have not been crossed at grade.

At highway grade crossings it is, of course, necessary to omit a short section of the third rail. At a 66-ft. highway crossing, which is the regular width of country highways, the third rail is omitted for a distance of 75 ft. For connecting across this interruption in the third rail, a lead-covered cable of 1,500,000-circ. mils cross section is placed in the ground, no protection being used for the lead sheath except a board placed over the cable. The Climax vitrified clay stock guards have been put in at all such crossings.

The bonding of the track rails is accomplished with two United States bonds of the American Steel & Wire Company at each joint. These bonds are 12 ins. long, with 1-in. terminals, and have each a cross-section of 250,000 circ. mils. Each third rail joint is bonded with two Protected Rail-Bond Company's bonds of 250,000 circ. mils. Tracks are cross-bonded ten times every mile with bonds of 300,000 circ. mils.

Experience has demonstrated the necessity for thoroughly protecting the ends of the conductor and sheath of the lead-covered cable which is used for connecting across the break in the third rail at highway crossings and special work. If this is not done moisture soon works in between the lead sheath of the cable and the conductor, and as the distance between these is very short, there is certain to be trouble unless there is some means of protecting the insulations from moisture at the place where it is cut. A special terminal has been designed by Mr. Gonzenbach,

THIRD RAIL, INSULATOR APART

which has the double purpose of forming a connector and protecting the cable insulation at the end of the cable. In this terminal a bell of insulating material is clamped firmly down over the end of the lead sheath, and poured full of an insulating composition. Electrical connection is made by a cap, which is soldered over the end of the stranded cable conductor and to which a terminal lug is secured by a cap screw. This terminal lug is soldered to copper bonds connecting with the third rail.

A cast-iron tip is put on the third rail where it is interrupted, which furnishes an incline for the contact-shoe of the car. These tips can be seen in the engravings. They are 28 in. long, and in addition to the incline these afford, the third rail is dropped 2 ins. in 33 ft. approaching the tip.

Bridge work has been mainly of concrete masonry, with deck girders wherever possible, and elsewhere through girders between concrete piers. This concrete masonry is in striking contrast to some of the wooden trestle work on adjacent steam roads, and simply illustrates one of the many ways in which this company has spared no expense to get the best. Some of these bridges and culverts were illustrated in the STREET RAILWAY JOURNAL of February, 1902.

Power for the whole road is supplied from sub-stations operated by high-tension alternating current, from a power house at Batavia on the Fox River. This power house contains many interesting features, for which William L. Morris, mechanical engineer, is responsible. Drawings showing its general arrangement were given in the STREET RAILWAY JOURNAL of February, 1902. Lack of space for-

bids going into a discussion of the power house until later. The present article will confine itself to the electrical distribution and matters intimately related to it.

The road is laid out for six sub-stations, the locations of which are indicated on the map. The transmission is by 26-000-volt 3-phase alternating current.

The high-tension lines are carried on cross-arms with insulators 30 ins. between centers on the cross-arms, and the cross-arms 24 ins. apart. The telephone lines are on cross-arms 7 ft. below the lower transmission cross-arm. There are two telephone circuits, one for general business and the other for despatching. The telephone lines are transposed every fourth pole, and the high-tension lines every mile, both being transposed more frequently than is map. Three high-tension feeder lines leave the power house. From the power house to Batavia a line runs direct across country to sub-station No. 1, near Aurora. Another high-tension pole line follows the line of the railroad, supplying sub-stations Nos. 2, 3 and 4, and extending to Maywood. The third line from the lower power house is built directly across country to sub-station No. 5 on the Elgin branch, and along the right of way from this sub-station to Wheaton, at which point it joins the pole line from the Aurora branch, and the two three-phase circuits run on the same poles to sub-station No. 3, with one circuit from there to No. 4. Sub-station No. 6 is supplied by a single line running from sub-station No. 5.

Another respect in which this transmission differs from

VIEW SHOWING ARRANGEMENT OF THIRD RAIL AT CROSS OVER

common. The telephone wires are transposed by tieing both to a single wide petticoat transportation insulator every fourth pole.

No direct-current overhead feeders are needed, as the third rail has sufficient carrying capacity to conduct all the current from the sub-stations to the trains. The overhead pole line, therefore, has only to carry the 26,000-volt three-phase high-tension feeders which supply the various sub-stations and two telephone circuits. The high-tension feeders are of standard aluminum cable equivalent to No. 000 copper wire. The poles carrying these lines are 40 ft. long placed 80 ft. apart, sixty-six to the mile. In towns the poles are 60 ft. long. The system of high-tension distribution is very complete, and is arranged to secure freedom from interruptions of service due to short circuits or breakages on any one transmission line. The high-tension lines are indicated by dotted lines on the accompanying

the majority is in going under, instead of over, a number of other pole lines. The usual practice is to carry the high-tension lines over every other pole line. This line goes under all unusually high telephone pole lines, and at such places guard-wires are put over the lines. The guard-wires are strung between rectangular frames surrounding the cross-arm, some of which can be seen in the background in the view taken at Wheaton.

At the crossings, which are of sufficient length so that the car must drift for a distance with no current, the annoyance to passengers from the lights going out will be obviated by putting up a short section of trolley wire at these places, with which a small sliding contact-bow trolley on the car roof will make contact. This will carry current enough for the lights on the car.

The arrangement of the direct-current feed and sectioning of the line is a matter of much importance on a high-

speed road of this kind, where the fluctuations in load will be extremely violent. The arrangement employed on this road is practically the same as on all interurban roads fed by sub-stations. The third rail between any two sub-stations constitutes a continuous section fed from the sub-stations

SUB-STATION AND PLATFORMS AT MAYWOOD

at each end. Sectioning of the third rail takes place only at the sub-stations. Each sub-station will, therefore, feed both ways, and as long as there is no trouble on the line, all the third-rail sections on the entire system will be connected together through the medium of the sub-station bus-bars and feeder panels, so that there will be opportunity for the sub-stations to divide the load among each other as far as the conductivity of the third rail will permit, and in case of an excessive load upon one section, the sub-station nearest will not be required to carry the total load. In case of a short circuit on any section of a third rail the circuit breakers at the two sub-stations that feed it will open, and it will be entirely disconnected. On the double track part of the road, the third rails on the two parallel tracks are not to be connected together permanently, but form two separate sections connected through the medium of the sub-station feeder panels and bus-bars, just as are any other sections.

SECTION THROUGH CABLE TERMINAL

To the specialist in high-voltage switchboards and switching arrangements the installation is of more than usual interest, because it is one of the first large high-tension alternating-current distribution plants to go into operation in which all the switching will be done on the high-voltage side of step-up and step-down transformers. Each generator in the power house has its own bank of three transformers, and each rotary converter in the sub-stations has its bank of three transformers. In each case the transformers are considered as a unit with the generator or converter. Each generator is connected with its bank of transformers directly without any switches or circuit breakers. In other words, each generator and its transformers constitute practically a 26,000-volt machine. Doing away with all low-tension switching apparatus and depending on switches in the 26,000-volt circuit alone is a proposition at first nothing short of startling to those familiar with the high-tension work that has been done in the past, and especially that in the far West, where it is the practice to do as much of the switching as possible on the low-tension circuits. The manufacture of oil switches, which will with certainty open circuits of over 20,000 volts, has, however, materially changed the nature of the problem. Once a high-tension switch is introduced which is easily operated and certain in operation there are many reasons for doing way with the expense and complication of low-tension switches. The oil switch, which has made this feasible, is

THIRD-RAIL TAP AND CABLE TERMINAL

of the same general type as that made by the General Electric Company for the Manhattan Elevated power house in New York. Each leg of the switch is in an oil cylinder in a separate brick compartment. It is motor operated, a motor on each switch keeping wound up a spring which trips the switch open or shut. After each operation of the switch the motor winds up the spring to make up for the amount it unwound during the operation. The motor is operated by direct current from the exciter panel, and is entirely automatic in its action. The trip of the switch is also worked by direct current from a small switch on the generator panel. Indicating lamps on the generator panel show whether the switch is open or closed.

Taking up the circuits in their logical order, on the station-wiring diagram, the main current from the generators (2300-volt three-phase) is taken directly to the low-tension terminals of its three-delta connected transformers, taps being taken off between the generator and transformer for a potential transformer which supplies switchboard instruments on the generator panel. Taps also lead off to a three-pole, double-throw oil switch on a transfer panel, from which a panel governing an induction motor driving the exciter is run, and also blower motor and lighting circuits. On the transformer panel the three generators are so connected, as seen, to the two three-pole, double-throw oil switches as to allow any of the three generators to operate the station circuits, which are run from the transfer panels.

The lighting circuits can be supplied either by direct current from the exciters or by alternating current. The main generator current, after passing through its three step-up transformers and being raised to 26,000 volts, passes through current transformers, which are for operating the ammeter, power-factor indicator, induction wattmeter and reversal relay on the generator panel. After passing the current transformers the leads are taken to the machine-operated oil switch, from which they pass to the alternating-current 26,000-volt bus-bars. The reversal relay is a combination of current and potential coils so arranged as to trip the generator switch should current start to flow from the line toward the generators. Direct current from the exciter circuit is brought to the generator panel for controlling the main switch, which is located some distance from the switchboard. The generator and feeder

AT WHEATON, ON THE AURORA, ELGIN & CHICAGO RAILWAY, SHOWING SIDEWALK CROSSING, SIGN AND STOCK GUARD. SUPERINTENDENT'S AND DISPATCHER'S OFFICE IN DEPOT AT RIGHT. HIGH TENSION LINES WITH GUARD WIRE FRAMES AT LEFT IN DISTANCE

TYPICAL VIEW OF DOUBLE TRACK ON AURORA, ELGIN AND CHICAGO RAILWAY

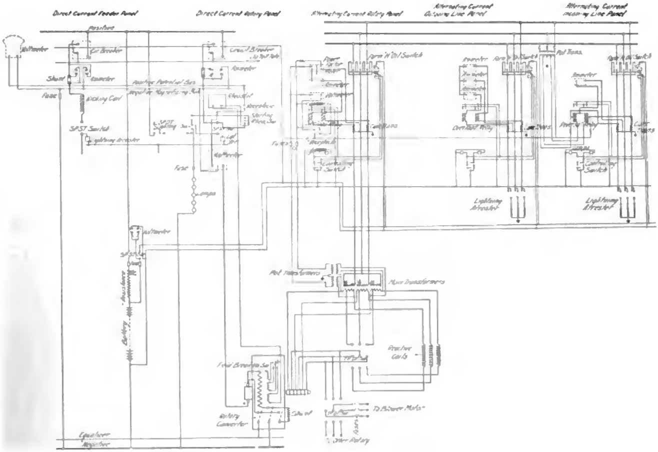
panels have no high-voltage wires upon them whatever.

From the generator panels the 26,000-volt bus-bars pass to the high-tension feeder panels. Each feeder passes first through a machine-operated oil switch similar to those in the generator circuits. It then passes a current transformer, which operates feeder power-factor meter, ammeter and the overload relay, which closes the switch-tripping circuit whenever the current flowing exceeds the amount for which the relay is set. The main feeder switches can also be operated by a hand control switch, as well as automatically by overload. Other features of the power-house switchboards are made plain by the wiring diagram. There are three 1500-kw three-phase General Electric generators now installed. The 26,000-volt wiring in both power station and sub-stations is carried in brick flues or conduits, which isolates each circuit from adjacent circuits. The regular sub-station equipment for all the sub-stations comprises two 500-kw rotary converters with a bank of transformers for each. The sub-stations have basements which are air-tight, and in which air is kept under pressure by the blower for cooling the transformer.

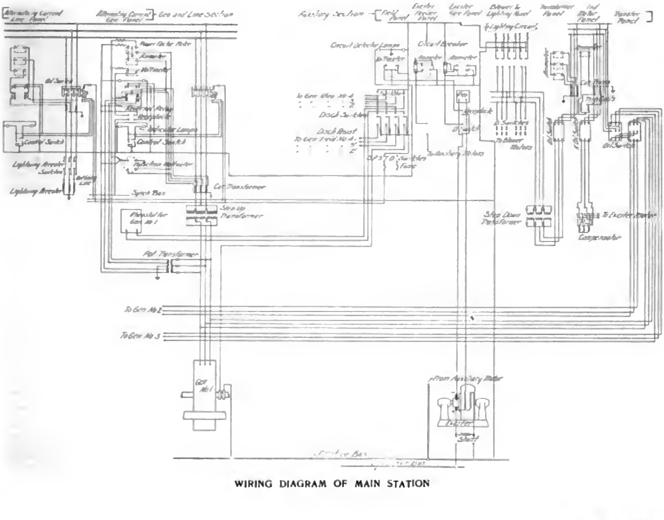
LONG CUT ON THE AURORA, ELGIN & CHICAGO RAILWAY

Referring to the accompanying wiring diagram of a sub-station it is seen that one panel of the switchboard is devoted to the incoming 26,000-volt line. Where there is one or more sub-stations beyond this one there is another panel devoted to the outgoing line to the next sub-station. The principal object of this is to make it possible to cut off the line beyond in case of short circuit. After passing the lightning arresters the incoming line goes through current transformers which supply current for an indicating ammeter and the current coils of a reversal relay. This reversal relay is similar to that on the power-house generator panels, and will act to open the oil switch in the incoming feeder in case the sub-station attempts to give current to the line instead of receiving it. This might happen at any of the sub-stations on a loop circuit in case of a short circuit on the high-tension lines between the power house and the sub-station. The sub-station would then receive current from the other direction, and feed back into the short circuit. In case it were desired as a regular thing to feed back from the sub-station because of some section of the high-tension lines being cut out, it would be done by adjusting the reversal relay to allow this. After passing the current transformers, the incoming line is taken to the three-pole oil machine switch. The switch is controlled by a hand switch on the feeder panel, as well as by the reversal relay on that panel. From the oil switch the incoming feeder goes directly to the bus-bars. The panel for the outgoing line and controlling apparatus connected therewith are similar to the incoming, except that the machine switch is controlled by an overload relay, instead of a reversal relay, and there is an ammeter in each leg of the circuit. The potential transformer for the reversal relay on the incoming panel is connected directly to the bus-bars. Current for the operation of the machine switches is supplied from the 500-volt direct current ordinarily, but when the converters are not in operation and the third rail is dead, the switches can be worked by current from a small storage battery located in a cabinet in the sub-station. This is a 125-volt battery in series with a resistance.

Each rotary converter has its bank of transformers controlled by an oil machine switch. The alternating-current panel for each converter, while having no high-voltage wires upon it, is, to all intents and purposes, a high-tension



WIRING DIAGRAM OF SUB-STATION



WIRING DIAGRAM OF MAIN STATION

panel, because its instruments and controlling switches all relate to the 26,000-volt line before it passes to the step-down transformers. After passing the main switch, which is operated by a hand switch or by an overload relay on the converter panel, the high-tension lines go through current transformers for the switchboard instruments, and then to the three main step-down transformers. Potential transformers for the switchboard instruments are on the low-voltage side of these. The converter panel contains a power-factor meter, ammeter, voltmeter, overload relay and controlling switch. The controlling switch on all these type-H oil switches is arranged on the principle of a faucet handle. The handle, or key, rotates to open or close the switch, standing vertical when the switch is closed, and horizontal when it is open. Indicating lamps show green when the switch is open, and red when it is closed. The rotary converters can be started either by direct current from the third rail or by alternating current. The converters are connected six-phase, as shown. When starting from the alternating-current end the three-pole double-throw switch is first put up, thereby giving only part of the full voltage until some speed has been attained, when this switch is thrown down and the converter given full alternating-current pressure through the reaction coils, the latter being for enabling the converter to make use of its compound field winding to hold up the voltage. The three-pole starting switch is mounted near the transformers on top of the reactive coils.

The road is operated under despatcher's orders given by telephone. At sub-stations train orders are received by the sub-station attendant for delivery. There are also telephone booths at all sidings and crossovers for emergency use when cars fall behind time. There are two telephone circuits the length of the line, one for despatching, the other for general business. Double-throw, double-pole knife switches at each telephone instrument make it possible to talk over either circuit from any instrument. Double-pole switches are provided at stations for cutting out sections of telephone line in case of trouble. Some device for automatically cutting out booth telephones when not in use will be installed, so that careless trainmen cannot leave a telephone bridged across the line to the detriment of the efficiency of the circuit and to fall a prey to lightning. The stationary telephones are all Stromberg-Carlson make. Each car carries a portable telephone to connect in along the line. These are made by the Garl Electric Company.

INTERIOR OF SUB-STATION, AURORA, ELGIN & CHICAGO RAILWAY

The rates of fare are approximately $1\frac{1}{4}$ cents per mile, and are about half the regular steam-road fare between the points reached. Because of the present limited equipment no attempt has been made yet to meet the steam-railroad monthly commutation rates. All 5-cent fares are registered. Tickets are sold at sub-station waiting rooms and at terminals. Cash fares are receipted for by conductors with a ticket like that used on the Orchard Lake Division of the Detroit United Railway, which is illustrated elsewhere in this issue in an article on the passenger department

of that system. The car shops are being built at Wheaton, where also are the operating offices.

At present writing the road has not been in operation long enough to have made it wise management to give the fast train service ultimately intended, because the roadbed is new and subject to settling, and the trainmen need time to get used to the service. The present service is a car every half hour from the terminal at West Fifty-Second Avenue to Aurora. The Elgin line is not completed because of lack of rails, and at present writing the Batavia branch is not open, although almost ready. The run to Aurora is made in 1 hour and 15 minutes, making all stops. Cars stop at platforms along the line only to receive or discharge passengers. Stopping platforms are all shown on the map. The time to Wheaton, 20½ miles, is 42 minutes. There are twenty-four platforms in that distance, but in ordinary operation only about a quarter of these require stops. The present schedule speed is maintained with great ease, and gives the company good reason to think that with track ballast settled the local trains between Chicago and Aurora can make the distance in one hour. A through service, stopping only at Wheaton and at some points within the Chicago city limits, is contemplated, with a running time of 45 minutes. The distance is 34.6 miles. The time required to go from the Union Elevated loop in Chicago to Fifty-Second Avenue over the Garfield Park line of the Metropolitan Elevated is 30 minutes at present, and could be reduced somewhat by an express service, which may be put on. A 45-minute run from Fifty-Second Avenue to Aurora would mean that Aurora could be reached from the downtown district in Chicago in considerably less time and with less annoyance than on the steam roads, to say nothing of the greater frequency of the electric cars. The infrequency of the steam trains is one of their greatest drawbacks, as all Chicago people who have visited towns along the Fox River can testify.

However, this electric service needs no argument in its defense, because the traffic it has carried every day since it opened has demonstrated that the road is meeting a popular demand and also creating travel which did not before exist. Considering the newness of the road and the fact that some paving operations in Aurora have prevented the cars from running to the center of that city, or even leaving these out of account, the results are very gratifying. For two of the first weeks of operation the gross receipts from the half-hour local service between Chicago and Aurora were given by the management as $904.19 per day.

The service called for the operation of five cars. On Sundays the traffic has been enormous, and has sometimes swamped the ability of the company to take care of it, even with two-car trains. One Sunday, Aug. 31, with only five cars in operation, the receipts ran as high as $1,872. One gratifying thing about traffic so far has been the amount of through business between Chicago and Aurora, which constitutes the best and largest part of the business. And this is the very business which the increase in speed and operation to the center of Aurora will help. With the entire mileage of the road open for business, as it will be upon the completion of the Elgin and Batavia branches, and with fast through service inaugurated, it would not be unreasonable to expect that the gross receipts would be three times those at present. Allowing even a liberal percentage of this for operating and maintenance, as compared with other interurban roads, would leave enough for the investors in the securities to put the road on a solid financial footing. Of course, these are unusually prosperous times, and all railroad earnings are abnormally high. On the other hand, while there may be temporary declines in receipts, the general average is sure to rise as time passes, because of the increase in the riding habit and the increase of population along the line. At the present time this road touches the southern edge of a number of old, thickly settled suburban towns. There is certain to be growth in these towns along the line of the road, as well as in the villages further out. Taken altogether, it is gratifying to know that the prospects for this enterprise are so good, for it is a matter of interest to many more than the investors in this company's securities. The financial outcome of such an electric railway undertaking as this has an important bearing on future development and investment in the electric railway field; a matter in which both the public and all connected with the electric railway business are interested.

OIL SWITCH AND TRANSFORMERS IN SUB-STATION

Washington, Baltimore and Annapolis Single Phase Railway*

BY. B. G. LAMME.

The Washington, Baltimore & Annapolis Railway is the new high-speed electric line extending from the suburbs of Washington to Baltimore, a distance of 31 miles, with a branch from Annapolis Junction to Annapolis, a distance of about 15 miles. The overhead trolley will be used and schedule speeds of over 40 miles per hour are to be attained. This road is to be the scene of the first commercial operation of an entirely new system of electric traction.

The special feature of this system is the use of single-phase alternating current in generators, transmission lines, trolley car equipment and motors. It constitutes a wide departure from present types of railway apparatus, and while retaining the best characteristics of the present standard direct-current motor system the use of alternating current makes it possible to avoid many of the bad features.

The standard direct-current railway equipment possesses several characteristics which fit it especially for railway service. These characteristics have been of sufficient importance to overbalance many defects in the system. In fact, a far greater amount of effort and engineering skill has been required for overcoming or neutralizing the defects than for developing the good features possessed by the system. By far the most important characteristic possessed by the direct-current system is found in the type of motor used on the car. The direct-current railway motor is in all cases a series-wound machine. The series motor is normally a variable field machine, and it is this feature which has adapted the motor especially to railway service. Shunt-wound motors have been tried and abandoned. All manner of combinations of shunt, series and separate excitation have been devised and found wanting, and in many cases the real cause of failure was not recognized by those responsible for the various combinations. They all missed to a greater or less extent the variable field feature of the straight series motor. It is true that a variable field can be obtained with shunt or separate excitation, but not without controlling or regulating devices; and the variation is not inherently automatic, as in the series motor. Polyphase and single-phase induction motors do not possess the variable field feature at all, as they are essentially constant-field machines. They are equivalent to direct-current shunt or separately excited motors, with constant field strength, which have been unable to compete successfully with the series motor. The variable field of the series motor makes it automatically adjustable for load and speed conditions. It also enables the series motor to develop large torques without proportionately increased currents. The automatically varying field is accompanied by corresponding variations in the counter e. m. f. of the armature, until the speed can adjust itself to the new field conditions. This feature is of great assistance in reducing current fluctuations, with a small number of steps in the regulating rheostat. Any increase in current, as resistance is cut out, is accompanied by a momentary increase in the counter e. m. f., thus limiting the current increase to a less value than in the case of a constant field motor.

Next to the type of motor the greatest advantage possessed by the direct-current system lies in the use of a single current, or circuit, thus permitting the use of one trolley wire. The advantages of the single trolley are so well known that it is unnecessary to discuss them. For third-rail construction, the use of single current is of even greater importance than in the case of overhead trolley. It is seen, therefore, that it is not to the direct current that credit should be given for the great success of the present railway system, but to the series type of motor and the fact that up to the present time no suitable single-phase alternating-current motor has been presented.

Some of the undesirable features of the direct-current railway system should also be considered. The speed control is inefficient. A nominally constant voltage is supplied to the car, and speed control is obtained by applying variable voltage at the motor terminals. This variation is produced by the use of resistance in series with the motors with a loss proportional to the voltage taken up by the resistance. By means of the series-parallel arrangement the equivalent of two voltages is obtainable at the motor terminals without the use of resistance. Therefore, with series-parallel control there are two efficient speeds with any given torque, and with multiple control there is but one efficient speed with a given torque. All other speeds are obtained through rheostatic loss, and the greater the reduction from either of the two speeds, series or parallel, the lower will be the efficiency of the equipment. At start the rheostatic losses are always relatively large, as practically all the voltage of the line is taken up in the rheostat. For heavy railroad service, where operation for long periods at other than full and half speeds may be necessary, the rheostatic loss will be a very serious matter.

The controlling devices themselves are also a source of trouble. An extraordinary amount of time and skill has been expended in perfecting this apparatus. The difficulties increase with the power to be handled. The controller is a part of the equipment which is subjected to much more than ordinary mechanical wear and tear, and it can go wrong at any one of many points. The larger the equipment to be controlled the more places are to be found in the controller which can give trouble. The best that can be said of the railway controller is that it is a necessary evil.

Another limitation of the direct-current system is the trolley voltage. Five hundred volts is common at the car and 650 volts is very unusual. By far the larger number of the railway equipments in service to-day are unsuited for operation at 600 volts, and 700 volts in normal operation would be unsafe for practically all. The maximum permissible trolley voltage is dependent upon inherent limitations in the design of motors and controllers. The disadvantages of low voltage appear in the extra cost of copper, etc., and in the difficulty of collecting current. In heavy railroad work the current to be handled becomes enormous at usual voltages. A 2400-hp electric locomotive, for example, will require between 3000 amps. and 4000 amps. at normal rated power and probably 6000 amps. to 8000 amps. at times. With the overhead trolley these currents are too heavy to be collected in the ordinary manner, and it is a serious problem with any form of trolley or third-rail system which can be used. It is evident that for heavy service, comparable with that of large steam railroads, a much higher voltage than used in our present direct-current system is essential, and the use of higher voltage is destined to come, provided it is not attended by complications which more than overbalance the benefits obtained. A further disadvantage of the direct-current system is the destructive action known as electrolysis. This may not be of great importance in interurban lines, chiefly because there is nothing to be injured by it. In city work its dangers are well known, and very expensive constructions are now used to eliminate or minimize its effects.

From the foregoing statements it is evident that an alternating-current railway system to equal the direct current should possess the two principal features of the direct current system, viz., a single supply circuit and the variable field motor, and to be an improvement upon the direct-current system the alternating current should avoid some of the more important disadvantages incident to the present direct current railway apparatus.

The system must, therefore, be single-phase. The importance of using single-phase for railway work is well known. The difficulties and complications of the trolley construction are such that several alternating current systems have been planned on the basis of single-phase supplied to the car, with converting apparatus on the car to transform to direct current, in order that the standard type of railway motors may be used. Such plans are attempts to obtain the two most valuable features of the present direct current system. The polyphase railway system, used on a few European roads, employs three currents, and therefore does not meet the above requirements. The motor for the alternating-current railway service should have the variable speed characteristics of the series-direct-current motor. The polyphase motor is not suitable, as it is essentially a constant field machine and does not possess any true variable speed characteristics. Therefore it lacks both of the good features of the direct-current railway system. A new type of motor must therefore be furnished as none of the alternating current motors in commercial use is adapted for the speed and torque requirements of first-class railway service. Assuming that such a motor is obtainable for operation on a single-phase circuit, the next step to consider is whether the use of alternating instead of direct current on the car will allow some of the disadvantageous features of the direct-current system to be avoided. The direct-current limits of voltage are at once removed, as transformers can be used for changing from any desired trolley voltage to any convenient motor voltage. Electrolytic troubles practically disappear. As transformers can be used, variations in supply voltage are easily obtainable. As the motor is assumed to have the characteristics of the direct-current series motor, speed control without rheostatic loss is practicable when voltage control is obtained. This combination, therefore, allows the motor to operate at relatively good efficiency at any speed within the range of voltage obtained. If the voltage be varied over a sufficiently wide range the speed range may be carried from the maximum desired down to zero, and therefore down to starting conditions. With such an arrangement no rheostat need be used under any conditions, and the lower the speed at which the motor is operated the less the power required from the line

* Read before the American Institute of Electrical Engineers, New York, Sept. 26, 1902.

The least power is required to start, as the motor is doing no work and there is no rheostatic loss. The losses at start are only those in the motor and transforming apparatus, the total being less than when running at full speed with an equal torque. Such a system, therefore, permits maximum economy in power consumed by motor and control. This economy in control is not possible with the polyphase railway motor, as this motor is the equivalent of the direct-current shunt motor, with which the rheostatic loss is even greater than with the series motor.

The use of alternating current on the car allows voltage control to be obtained in several ways. In one method a transformer is arranged with a large number of leads carried to a dial or controller drum. The Stillwell regulator is a well-known example of this type of voltage control. This method of regulation is suitable for small equipments with moderate currents to be handled. The controller will be subject to some sparking, as in the case of direct-current apparatus, and therefore becomes less satisfactory as the car equipment is increased in capacity. Another method of control available with alternating current is entirely non-sparking, there being no make-and-break contacts. This controller is the so-called "induction regulator," which is a transformer with the primary and secondary windings on separate cores. The voltage in the secondary winding is varied by shifting its angular position in relation to the primary. With this type of voltage controller very large currents can be handled, and it is especially suitable for heavy equipments, such as locomotives. It is thus seen that there is one method of control available with alternating current which avoids the inherent troubles of the direct-current controller. The induction regulator is primarily a transformer, and all wear and tear is confined to the supports which carry the rotor. Therefore the objectionable controller of the standard direct-current system can be eliminated, provided a suitable alternating-current motor can be obtained. This ideal type of controller is not applicable to the polyphase railway motor, in which speed control can be obtained only through rheostatic loss. The polyphase control system is even more complicated than the direct current, as there must be a rheostat for each motor and two or three circuits in each rheostat. It is thus apparent that by the use of single-phase alternating current with an alternating-current motor having the characteristics of the direct-current series motor the best features of the direct-current system can be obtained, and at the same time many of its disadvantages can be avoided.

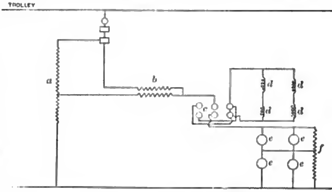
This portion of the problem therefore resolves itself into the construction of a single-phase motor having the characteristics of the direct-current series motor. There are several types of single-phase alternating-current motors which have this series characteristic. One type is similar in general construction to a direct-current motor, but with its magnetic circuit laminated throughout, and with such proportions that it can successfully commutate alternating current. Such a motor is a plain series motor and can be operated on either alternating or direct current and will have the same torque characteristics in either case. Another type of motor is similar in general construction, but the circuits are arranged in a different manner. The field is connected directly across the supply circuit, with proper control appliances in series with it. The armature is short-circuited on itself across the brushes, and the brushes are set at an angle of approximately 45 degs. from the ordinary neutral point. The first of these two types of motors is the one best adapted for operation in large units.

This is the type of motor which is to be used on the Washington, Baltimore & Annapolis Railway. Several motors have been built and tested with very satisfactory results, both on the testing stand and under a car. The results were so favorable that the system was proposed to the Cleveland Engineering Company, representing the Washington, Baltimore & Annapolis Railway, and, after investigation by their engineers, it was adopted. A description of the apparatus to be used on this road will illustrate the system to good advantage.

Single-phase alternating current will be supplied to the car at a frequency of 16 2-3 cycles per second, or 2000 alternations per minute. The current from the overhead trolley wire is normally fed in by one trolley at approximately 1000 volts. Within the limits of the District of Columbia two trolleys are employed, as by act of Congress the use of rails as conductors is prohibited in this district, presumably on account of electrolysis. In this case the trouble, of course, will not exist, but the contracting company has been unable to obtain permission for the grounded circuit.

The alternating current to the car is carried through a main switch, or circuit breaker, on the car to an auto-transformer connected between the trolley and the return circuit. At approximately 300 volts from the ground terminal a lead is brought out from the auto-transformer and passed through the regulator to one terminal of the motors. For starting and controlling the speed an induction regulator is used, with its secondary winding in series with the motors. This secondary circuit of the regulator can be made either to add to or subtract from the transformer voltage, thus raising or lowering the voltage supplied to the motors. The regulator therefore does double duty. The controller for direct-current motors merely lowers the voltage supplied to the motors, but cannot raise it; but an alternating-current regulator can be connected for an intermediate voltage and can either raise or lower the motor voltage. In this way the regulator can be made relatively small, as it handles only the variable element of the voltage, and the maximum voltage in the secondary winding is but half of the total variation required.

In the equipments in question, the range of voltage at the motor is to be varied from, approximately, 200 volts up to 400 volts, or slightly higher. The transformer on the car will supply 315 volts, and the secondary circuit of the regulator will be wound to generate slightly more than 100 volts when turned to the position of its maximum voltage. This voltage of the regulator is about one-fourth of that of the motors at full voltage. The regulator can consequently be made relatively small, in comparison with the motor capacity of the equipment. It has been found unnecessary to



a. Auto-Transformer. *b.* Induction Regulator. *c.* Reversing Switch. *d.* Field of Motors. *e.* Armature of Motors. *f.* Equalizing Transformer.

FIG. 1

use much lower than 200 volts in this installation, as this allows a comparatively low running speed, and approximately 200 volts will be necessary to start with the required torque. The greater part of this voltage is necessary to overcome the e. m. f. of self-induction in the motor windings, which is dependent upon the current through the motor and is independent of the speed of the armature.

There will be four motors of 100 hp on each car. The full rated voltage of each motor is approximately 220 volts. The motors are arranged in two pairs, each consisting of two armatures in series, and two fields in series, and the two pairs are connected in parallel. The motors are connected permanently in this manner. Since voltage control is used, there is no necessity for series-parallel operation, as with short-circuited motors. To ensure equal voltage to the armatures in series, a balancing or equalizing action is obtained by the use of a small auto-transformer connected permanently across the two armatures in series, with its middle point connected between them. The fields are arranged in two pairs, with two fields in series and two pairs in multiple. This parallels the fields independently of the armatures, which was formerly the practice with direct-current motors. It was a defective arrangement with such motors, as equal currents in the field did not ensure equal field strengths in the motors, and the armatures connected in parallel, therefore, would be operating in fields of unequal strength, with unequal armature currents as a direct result. With alternating currents in the field the case is different. The voltage across the fields is dependent upon the field strengths, and the current supplied to the fields naturally divides itself for equal magnetic strengths. The chief advantage in paralleling the fields and armatures independently is, that one reversing switch may serve for the four motors, and one balancing transformer may be used across the two pairs of armatures. The ordinary direct-current arrangement of armatures in series with their own fields can be used with a greater number of switches and connections.

The general arrangements of the auto-transformer, regulator, motors, etc., is shown in Fig. 1.

The induction regulator or controller, resembles an induction motor in general appearance and construction. The primary winding is placed on the rotor, and the secondary or low-voltage

winding on the stator. The rotor also has a second winding which is permanently short-circuited on itself. The function of this short-circuited winding is to neutralize the self-induction of the secondary winding as it passes from the magnetic influence of the primary. The regulator is wound for two poles, and therefore is operated through 180 degs. in producing the full range of voltage for the motors. One end of the primary winding of the regulator is connected to the trolley, and the other to a point between the regulator and the motors. It thus receives a variable voltage as the controller is rotated. There are several advantages in this arrangement of the primary in this particular case. First, the regulator is worked at a higher induction at start, and at lower induction when running, the running position being used in these equipments for much longer periods than required for starting. Second, when the motors are operating at full voltage the current in the primary of the regulator passes through the motors, but not through the auto-transformer or the secondary of the regulator. This allows considerable reduction in the size of auto-transformer and regulator. The motors on the car are all of the straight series type. The armature and fields being connected in series, the entire current of the field passses through the armature as in ordinary series direct-current motors. The motor has eight poles, and the speed is approximately 700 revolutions at 220 volts. The general construction is similar to that of a direct-current motor, but the field core is laminated throughout, this being necessary on account of the alternating magnetic field. There are eight field coils wound with copper strap, and all connected permanently in parallel. The parallel arrangement of field coils assists in the equalizing of the field strength in the different poles, due to the balancing action of alternating circuits in parallel. This arrangement is not really necessary, but it possesses some advantages, and therefore has been used. With equal magnetic strength in the poles, the magnetic pull is equalized even with the armature out of center. The armature is similar in general construction to that of a direct-current motor. The fundamental difficulty in the operation of a commutator type of motor on single-phase alternating current lies in the sparking at the brushes. The working current passing through the motor should be practically no more difficult to commutate than an equal direct current, and it is not this current which gives trouble. The real source of trouble is found in a local or secondary current set up in any coil, the two ends of which are momentarily short-circuited by a brush. This coil encloses the alternating magnetic field, and thus becomes a secondary circuit of which the field coil forms the primary. In the motors of the Washington, Baltimore & Annapolis Railway this commutation difficulty has been overcome by so designing the motor that the secondary or short-circuit current in the armature coil is small, and the commutating conditions so nearly perfect that the combined working and secondary currents can be commutated without sparking. This condition being obtained, the motor operates like a direct-current machine, and will give no more trouble at the commutator than ordinary direct-current railway motors. Experience covering a considerable period in the opration of motors of 100-hp capacity indicates that no trouble need be feared at the commutator.

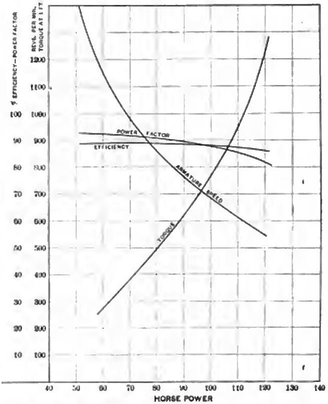
An extended series of tests were made with these motors at the Westinghouse shops at East Pittsburgh, both in the testing room and under a car. Fig. 2 shows curves of the speed, torque, efficiency and power factor plotted from data from brake tests.

It should be noted that the efficiency is good, being very nearly equal to that of high-class direct-current motors. The power factor, as shown in these curves, is highest at light loads and decreases with the load. This is due to the fact that the power developed increases approximately in proportion to the current, while the wattless component of the input increases practically as the square of the current. The curve indicates that the average power factor will be very good. The calculations for the Washington, Baltimore & Annapolis Railway show that the average power factor of the motors will be approximately 80 per cent.

The average efficiency of these equipments will be much higher during starting and accelerating than that of corresponding direct-current equipments, as rheostatic losses are avoided. When running at normal full speed, however, the efficiency will be slightly less than with direct current. This is due to the fact that the alternating-current motor efficiency is slightly lower than the direct current, and in addition there are small losses in the transformer and the regulator. The alternating-current equipments are somewhat heavier than the direct-current, thus requiring some extra power, both in accelerating and at full speed. Therefore, for infrequent stops, the direct-current car equipment is more efficient than the alternating current; but for frequent stops the alternating current shows the better efficiency. Tests on the East Pittsburgh track verified this conclusion. But the better efficiency of the direct-current equipment, with infrequent stops, is offset with the alternating current by decreased loss in the trolley wire, by reason of the higher voltage used, and by the elimination of the rotary converter losses. The resultant efficiency for the system will therefore be equal to or better than that of the direct current.

In the Washington, Baltimore & Annapolis Railway contract the guarantee given by the Westinghouse Electric & Manufacturing Company states that the efficiency of the system shall be equal to that of the direct-current system with rotary converter sub-stations.

There is one loss in the alternating-current system which is relatively much higher than in the direct current. This is the loss in the rail return. Tests have shown that at 2000 alternations it is three to four times as great as with an equal direct current. This would be a serious matter in cases where the direct-current rail loss is high. But the higher alternating-current trolley voltage reduces the current so much, that the alternating-current rail loss is practically the same as with direct current at usual voltages. In many city railways the direct-current rail loss is made very low,



Westinghouse Alternating Current Railway Motor, No. 91.; Single-Phase; 220 Volts.

FIG. 2

not to lessen waste of power, but in order to reduce electrolysis. In such cases the alternating-current rail loss could be higher than direct current, thus decreasing the cost of return conductors. More numerous transformer sub-stations, with copper feeders, connected to the rail at short intervals will enable the rail loss to be reduced to any extent desired. As a frequency of 2000 alternations per minute is used, the lighting of the cars and the sub-stations was at first considered to be a serious difficulty, due to the very disagreeable winking of ordinary incandescent lamps at this frequency. Two methods of overcoming the winking were tried, both of which were successful. One method was by the use of split phase. A two-phase induction motor was run on a single-phase 2000 alternating circuit, and current was taken from the unconnected primary circuit of the motor. This current was, of course, at approximately 90 degs. from the current of the supply circuit. A two-phase circuit was thus obtained on the car. Currents from the two phases were put through ordinary incandescent lamps, placed close together. The resulting illumination a few feet distant from the lamps showed about the same winking as is noticed with 3000 alternations. With two filaments in one lamp the winking disappears entirely. A three-phase arrangement would work in the same way.

A much simpler method was tried, which worked equally well. This consisted in the use of very low-voltage lamps. Low voltage

at the lamp terminals allows the use of a thick filament with considerable heat inertia. Tests were made on lamps of this type at a frequency of 2000 alternations, and the light appeared to be as steady as that from the ordinary high-frequency incandescent lamp. The low voltage is not objectionable in this case, as a number of lamps can be run in a series, as in ordinary street railway practice, and any voltage desired can readily be obtained, as alternating current is used on the car.

There will be an air compresser, driven by a series alternating-current motor, on each car, for supplying air to the brakes, and for operating the driving mechanism of the controller. The details of this mechanism are not sufficiently near completion to permit a description of it. The method used will be one which readily allows operation on the multiple-unit system.

The generating station contains some interesting electrical features, but there is no great departure from usual alternating-current practice. There will be three 1500-kw single-phase alternators. These are twenty-four-pole machines, operating at eighty-three revolutions and wound for 15,000 volts at the terminals. They are of the rotating field type, with laminated magnetic circuits and field coils of strap on edge. The field coils are held on the pole tips by copper supports, which serve also as dampers to assist in the parallel running. The armatures are of the usual slotted type. The armature coils are placed in partially closed slots. There are four coils per pole. The proportions of these machines are such that good inherent regulation is obtained without saturation of the magnetic circuit. The rise in potential with full non-inductive load thrown off will be approximately 4 per cent. An alternative estimate was furnished for the generators proposing 20,000 volts instead of 15,000. The simplicity of the type of winding used, and the low frequency, are both favorable for the use of very high voltage on the generator. As 15,000 volts was considered amply high for the service, the engineers for the railway considered it inadvisable to adopt a higher voltage.

There are to be two exciters, each of 100-kw capacity at 250 revolutions. The exciters are wound for 125 volts normal. The armature of each exciter has, in addition to the commutator, two collector rings so that single-phase alternating current can be delivered. It is the intention to use the exciters as alternators for supplying current to the system for lighting when the large generators are shut down at night. The main station switchboard comprises three generator panels, one load panel, and three feeder panels. High-tension oil-break switches are to be provided, operated by means of controlling apparatus on the panels. The switches, bus-bars and all high-tension apparatus will be in brick compartments, separate from the board. In each generator circuit there are two non-automatic oil-break switches in series; and on each feeder circuit there are two overload, time-limit, oil-break switches in series. The two oil-break switches in series on the same circuit, can be closed separately, and then opened to test the switches without closing the circuit. With the switches in the closed position they are both operated at the same time by the controlling apparatus, to ensure opening of the circuit, and to put less strain on the switches, although either one is capable of opening the load. There will be nine transformer sub-stations distributed along the railway line. Each station will contain two 250-kw oil-cooled lowering transformers, supplying approximately 1000 volts to the trolley system. Two transformers are used in each station so that in case of accident to one transformer the station will not be entirely crippled. It is the intention of the railway company to operate a direct-current road already equipped with the direct-current system. The present direct-current car equipments are to be retained, but the current will be supplied from a rotary converter sub-station fed from the main system of the Washington, Baltimore & Annapolis Railway. As this system is single phase, it is necessary that single-phase rotaries be used in the sub-stations. There are to be two 200-kw 550-volt rotary converters. These are four-pole, 500-revolution machines. The general construction of these machines is very similar to that of the Westinghouse polyphase rotary converters. The armature resembles that of a polyphase rotary, except in the number of collector rings, and in certain details of the proportions made necessary by reason of the use of single-phase. The commutating proportions are so good that any reactions due to the use of single-phase will result in no injurious effect. The field construction is similar to that of a polyphase rotary. The laminated field poles are provided with dampers of the "grid" or "cage" type, a form used at present in the Westinghouse polyphase rotary converters. The dampers serve to prevent hunting, as in the polyphase machines, and also to damp out pulsations due to single-phase currents in the armature. The damper acts to a certain extent as a second phase. Each rotary converter is started and brought to synchronous speed by a small series alternating-current motor on the end of the shaft. The voltage at the motor terminals can be adjusted either by loops from the lowering transformer or by resistance in series with the motor, so that true synchronous speed can be given to the rotary converter before throwing it on the alternating-current line.

From the preceding description of this system and the apparatus used on it, some conclusions may be drawn as to the various fields where it can be applied to advantage. It is evident that a good field for it will be on interurban long-distance lines such as the Washington, Baltimore & Annapolis Railway. On such railways high-trolley voltage and the absence of converter sub-stations are very important factors.

For heavy railroading, also, this system possesses many ideal features. It allows efficient operation of large equipments at practically any speed and any torque, and also avoids the controller troubles which are ever present with large direct-current equipments. It also permits the use of high-trolley voltage, thus reducing the current to be collected. In this class of service the advantages of this alternating-current system are so great that it is possible that heavy railroading will prove to be its special field.

For general city work, this system may not find a field for some time to come, as the limitations in the present system are not so great that there will be any urgent necessity for making a change. It is probable that at first this system will be applied to new railways, or in changing over steam roads rather than in replacing existing city equipments. One difficulty with which the new system will have to contend is due to the fact that the alternating-current equipments cannot conveniently operate on existing city lines, as is the present practice where interurban lines run into the cities. It will be preferable for the alternating-current system to have its own lines throughout, unless very considerable complication is permitted. When the alternating-current system applied to interurban and steam railways finally becomes of predominant importance, it is probable that the existing direct-current railways will gradually be changed to alternating current, as a matter of convenience in tieing the several lines together.

As was stated, alternating-current equipments cannot conveniently be operated on direct-current lines. It does not follow, however, that the motor will not operate on direct current. On the contrary, the motor is a first-class direct-current machine, and if supplied with suitable control apparatus and proper voltage it will operate very well on the direct-current lines. This would require that the motors be connected normally in series, as the voltage per motor is low.

A complete set of direct-current control apparatus would be needed when the alternating-current equipment is to be run on direct current, and considerable switching apparatus would be necessary for disconnecting all the alternating-current control system and connecting in the direct current. The complication of such a system may be sufficient to prevent its use, at least for sometime to come.

In some cities very strict laws are in force in regard to the voltage variations in various parts of the track system. The permissible variations are so small, in some cases, that an enormous amount of copper is used for return conductors; and in some cases special boosters are used in the return circuits to avoid large differences of potential between the various parts of the track system. The object in limiting the conditions in this manner is to avoid troubles from electrolysis. The alternating-current system will, of course, remedy this.

For city work, it is probable that voltages of 500 or 600 would be employed instead of 1000 or higher. The transformers and controllers can be designed to be readily changed from full to half voltage, so that low voltage can be used on one part of the line, and high voltage on another. As the car equipments of such railways are usually of small capacity, it is probable that speed control will be obtained by means of a transformer with a large number of leads carried out to a control drum, rather than by means of the induction regulator, as the latter device is much more expensive in small units. This is chiefly a question of cost, and if the advantages of the induction regulator are found to overweigh the objection of the high first cost, then it will be used, even on small equipments.

In the Washington, Baltimore & Annapolis Railway, the generators are wound for single-phase. In the case of large power stations with many feeders, the generators may be wound for three-phase, with single-phase circuits carried out to the transformer sub-station, or three-phase transmission may be used with the transformers connected in such a manner as will give a fairly well-balanced three-phase load.

There are many arrangements and combinations of apparatus made possible by the use of alternating current in the car equipments, which have not been mentioned, as it is impracticable to give a full description of all that can be done. But enough has been presented to outline the apparatus and to indicate the possibilities of this new system which is soon to see the test of commercial service.

RECENT TRACTION APPARATUS

The S K C 401 Railway Motor

This motor, which has recently been brought out by the Stanley Electric Manufacturing Company, is designed for city and suburban service and has a rating of 37½ hp. based on the usual shop test of 75 degs. F. rise at the expiration of one hour's run at full load. As a matter of fact, however, on account of the ventilation of the motor the temperatures actually reached in service are considerably below those that might be expected in view of this rating. The frame is approximately cylindrical in shape and is divided horizontally into two halves, which are held together by four bolts. On the side furthest from the axle there are two eye bolts on the lower half, which fit on hooks cast in the upper half. The lower half can be swung down by taking out the two bolts nearest the axle, leaving it hanging on the two eye bolts and their hooks. If it is desired to remove the lower half entirely all four bolts are removed and the lower frame dropped into the pit by suitable jack or tackle.

The pole pieces are made up of soft laminated steel punchings, riveted together and attached to the frame by bolts passing through the frame and tapped into a large rivet in the center of the pole piece. Each pole piece has a flare or offset at the armature end, which, besides holding the field coil in place, also effects that distribution of the magnetic flux entering the armature which results in the best commutation.

The armature bearings are babbit-lined cast-iron shells. These are of ample size, the commutator bearing being 6¼ ins. long and

STANLEY MOTOR—OPEN

the pinion bearing 7¾ ins., so that the wear of bearings, which has been such a frequent source of trouble, is reduced to a minimum. The bearings are held in place by bearing caps bolted to greased boxes cast in the upper half of the frame. The caps themselves are entirely separated from the lower half of the frame so that the lower half may be removed, leaving the armature supported by the upper half. If desired, however, the caps may be removed before the frame bolts and the armature lowered with the lower half of the frame. The caps are deep and hollow, furnishing ample oil cellars, and the bearings are kept lubricated by wicks bearing against the shaft. Grease boxes fitted with spring-closed covers are cast in the upper half of the frame and project over the bearings, furnishing an additional source of lubrication in case the oil runs out or the bearing begins to heat from other causes. A space is left between the bearing cap and the frame, through which projects the oil guard on the armature shaft. Any oil escaping from the bearing is thus thrown outside of the motor and prevented from reaching or injuring the field or armature. The axle bearings resemble the armature bearings in their general construction. The field coils are wound with square wire thoroughly insulated. By allowing ample room in the frame casting the designers have been able to use a flat coil, so that the wire is not injured by bending after being removed from the form on which it is wound.

The method of bringing out the terminals of the field coils is a feature which will be appreciated by those who have had experience in the repairing of street railway motors. The inner end of each coil is attached to a flat, flexible copper strip, which is brought out through the insulation, and the strips from the several ends are clamped together. The outer end of each coil is attached to a rubber-covered flexible wire several feet in length. These wires are brought through appropriate holes in the frame and are attached to the car wiring on the outside. This removes the danger of broken field wires at the terminals inside of the motor and makes it impossible for a repair man in replacing the coils to connect them in the wrong order. The coils after winding are dried in an oven and, while hot, are dipped in an insulating compound, which fills the spaces between the wires and prevents the entrance of oil or moisture. The coils are then wrapped in layers of rope paper, mica and tape, with leatheroid protection where there is a liability of chafing, and are finally thoroughly japanned and baked. The company's experience in insulation of high voltage coils indicates the very best results in insulation of both field and armature coils in this way.

The armature is unusually well ventilated. Large ducts, parallel to the shaft, allow the air to enter the body of the armature and ventilating ducts, perpendicular to the shaft, allow the heat to escape from the interior of the iron. The magnetic densities of armature core and teeth are so proportioned as to insure good commutation at heavy overloads, and the ample ventilation protects the insulation from injury by reason of these overloads.

The armature end-casting projects above the level of the coils so as to protect the end-windings from injury. This casting, being well cored out and well ventilated, is light and allows ample access of air to the windings.

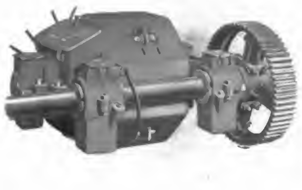
The armature coils are form-wound, dipped and thoroughly insulated with oiled linen and tape. The band wires holding the coils in place lie in grooves below the general surface of the armature, so that even if the bearings wear down the face of the iron protects the armature bands from injury and thereby avoids a source of trouble frequently experienced in earlier types of motors.

The commutator is carefully designed and solidly constructed. The bars are clamped together in a jig with micanite insulation between and baked to soften or remove the shellac or other cementing material. The clamping screws are then tightened and the bars drawn solidly together. The ends are then turned to gage and the insulating heads and end clamps fitted into place, after which it is again baked and the end clamps set up and locked into position.

A neat cover over the commutator permits inspection of the same and replacing of brushes. Another hand hole at the bottom of the motor allows inspection from below. This hole is fitted with a ventilated cover filled with a sponge, which prevents the en-

trance of dust, but allows any water in the bottom of the motor to escape.

The motor is not watertight, in the sense that the entrance of water into its interior is absolutely prevented. The object has been to design a well-ventilated motor from which the heat from the interior, as well as any water, can readily escape. There are ventilating spaces under the cover of the motor, as well as at the opposite end, through which the air can enter the armature body, to be thrown out through the perpendicular ventilating ducts in the armature. Ventilating ducts are also provided in the pole



STANLEY MOTOR—CLOSED

pieces, corresponding to those in the armature, an arrangement which results in a very free circulation of air in the interior of the motor. Gear and pinion for this motor are furnished with four standard ratios of reduction. The following table gives approximately the gearings ordinarily used for different kind of service:

CHARACTER OF SERVICE.	Pinion	Gear	Ratio
Freight	15	69	4.60
Ordinary Passenger	17	67	3.94
Medium Speed	19	65	3.42
High Speed	22	62	2.82

Track-Laying Cars

The accompanying cut illustrates the track-laying car manufactured by the Roberts Car & Wheel Company, of Three Rivers, Mich. A special feature of this car is that the frame is fastened together by double blind tenons at each end of the four cross

TRACK LAYING CARS

sills and four ⅝-in. rods running full width of car, also with two diagonal truss-rods to keep it in perfect tram. For standard-gage track the measurements of the car over sills are 7 ft. 8 ins. x 6 ft 3 in. It is equipped with cast iron wheels 16 ins. in diameter with chilled tread 4 ins. or 6 ins. wide, as required, on steel axles 3 ins. in diameter with babbited boxes. The tool box is in the center of the car. There are steel rolls and draw-hooks at each corner, and the cross sills are plated with iron. This car is built for any gage track.

A Remarkable Specimen

The illustration herewith shows a straight line hanger and ear which were taken from the line of the Mill Creek Valley Street Railroad Company, St. Bernard, Ohio. The damaged appearance of the hanger and ear was caused by a dead short-circuit between the trolley and ground. It seems that in some way the positive trolley wire came into contact with the negative wire on one of the cars, causing a short-circuit of the line. The circuit breakers, being set at 2000 amps., would not open up until the engi-

DAMAGED HANGER AND EAR

neer opened the circuit by pulling out the breaker, and at the time that was done, he noticed that the short-circuit was carrying 150 amps.

An examination of the cut will show the extremely disastrous nature of the arc caused by the short-circuit, which was sufficient to melt entirely away the ends of the trolley ear, and also the lower part of the skirt of the hanger supporting it. The hanger in question was a type D hanger, made by the Ohio Brass Company, of Mansfield, Ohio, and the insulation was its well-known "Dirigo" make. Despite the fact that the hanger and ear were so badly damaged by the arcing that the stud bolt of the hanger was partially melted away and fused on to the boss of the ear, the insulation was practically uninjured, with the exception of a slight charring of it at the lower edge of the insulated bolt. A test of 500 volts afterward applied between the hanger casting and ear showed that the insulation of the hanger was still perfect, a fact which, in itself, speaks well for the heat-resisting and insulating properties of "Dirigo" insulation.

The first electric train over the Sixth Avenue Division of the Manhattan Elevated Railroad, of New York, was run from South Ferry Station to Fifty-Eighth Street on Sept. 29. The train consisted of three cars similar in construction to those which have been in use on the Third Avenue division, and later in the afternoon a second train of six cars was sent over the same line. The test having been made successfully, the company is now prepared to open the regular Fifty-Eighth Street and South Ferry service, which was discontinued several weeks ago on account of the coal shortage. Preparations are practically complete for installing the electric service on the Ninth Avenue division, and it is probable that a trial trip will be made over this line within a few days. The company plans to start the regular schedule of electric trains over the Ninth Avenue division on Nov. 1.

Robins Belt Conveyors in Power Houses

The accompanying drawings seem to illustrate two instances of the broadening use of Robins belt conveyors in the field of coal and ash handling. These conveyors have proved themselves to be especially adapted for carrying coal under various conditions, as their use has been found to reduce the breakage of coal to a minimum. But, though they have been used for years at breakers, washeries, shipping piers, coal pockets, locomotive coaling stations and in handling the coal required at various industrial plants, the installations here described are the first cases of the use of these conveyors to take care of the entire coal supply of large stations for generating electricity. For this service their large capacity is of great importance, as is also their lightness and the small amount of space they occupy. At the shipping pier of the Dominion Coal Company at Louisburg, Cape Breton, 750 tons of coal per hour are handled on a 30-in. Robins belt conveyor.

The Robins patent conveying belt is provided with a heavy rubber cover on the carrying side, thicker in the center than at the edges, the reinforcement at the centre serving to prevent abrasion where the wear is heaviest, while the stiffer sides make the belt bend more easily at the center and better preserve its trough shape between the sets of idler pulleys. The latter consist of three cast-iron pulleys running on hollow steel shafts, which, in turn, are held by two cast-iron brackets. Lubrication is accomplished by forcing grease into the shafts with compression grease cups. The grease enters the bearing at the center and is constantly forced toward both ends where it forms a collar which keeps out dust and dirt. The Robins patent tripper is propelled by the motion of the conveying belt, which is connected with the driving wheels through spur gears. It reverses its direction automatically at either end of its run, thus traveling constantly back and forth, all the while distributing its load as it goes.

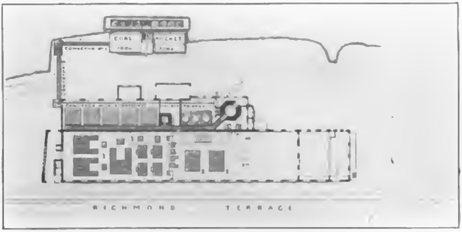


FIG. 1.—PLAN OF RICHMOND LIGHT & RAILWAY POWER EQUIPMENT

Figs. 1 and 2 illustrate the conveyor machinery in the station of the Richmond Light & Railroad Company at Livingston, Staten Island. The timber pocket is of 1600 tons capacity and was erected on a pile sub-structure. Coal is taken from barges moored alongside the pocket by a one-ton Hayward shovel operated by a Lidgerwood steam engine. The coal is crushed, weighed and delivered; the crusher and weighing hopper are mounted on a traveling frame, the boom being the Robins Conveying Belt Company's balanced shear leg type operated by one man. The coal is withdrawn from the storage pocket by chutes in the bottom decking, which feeds a Robins conveyor with a belt 16 ins. wide, which passes under the pocket and then rises on an incline to feed the transverse belt—conveyor No. 2, which passes over the railroad tracks. Conveyor No. 2 delivers coal to a long conveyor, which extends through the boiler rooms and delivers coal automatically into suspended steel bunkers. This is effected by means of a Robins automatic and self-reversing tripper. The conveyors have a capacity of 125 tons per hour. The coal is handled without dust or breakage and the conveyors run noiselessly. The ashes are removed by a steel tip-car, which is elevated when full on a platform elevator, to a convenient dumping point for loading cars by a chute.

Fig. 3 illustrates the coal and ash handling apparatus at the Kingsbridge power station of the Third Avenue Railroad Company, now being erected by Westinghouse, Church, Kerr & Co.

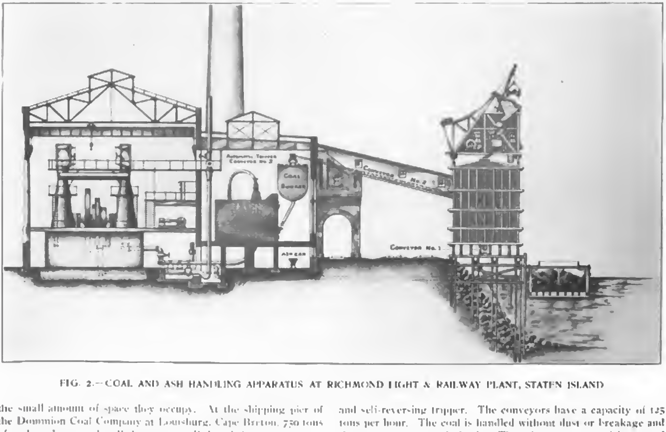


FIG. 2.—COAL AND ASH HANDLING APPARATUS AT RICHMOND LIGHT & RAILWAY PLANT, STATEN ISLAND

The coal at this station will be unloaded by a one-ton power shovel rigged on a steel "steeple" tower which is of unusually heavy construction. The engine for operating the shovel was built especially for this plant by the Lidgerwood Manufacturing Company and has cylinders 16 ins. x 24 ins. The truck is moved by a similar engine with 10 in. x 12 in. cylinders. The power shovel delivers coal to a receiving hopper which has a full-length grizzly and by-pass to deliver fine coal to the duplex weighing hoppers. Large lumps of coal pass over the grizzly to a powerful Westinghouse coal cracker, which delivers to the duplex weighing hoppers. The coal passes from the weighing hoppers to a two-way chute, which delivers the coal to either of the two belt conveyors. Each of these has a 24-in. belt and the capacity of each is 250 tons per hour. These parallel conveyors elevate the coal to conveyors in the roof of the boiler house, extending over the coal bunker. Coal is distributed in the storage bunkers, as in the Livingston installation, by automatic self-reversing trippers. The connecting inclined bridges are of extremely light construction, owing to the lightness of the belt conveyors. Ashes are drawn off into steel tip cars, which are hauled by electric locomotives to the dumping pits and chutes, which feed the ashes to a conveyor which elevates them to the pocket under the coal-hoisting towers. The ashes are distributed in the bunker by an automatic tripper. From the pocket the ashes may be chuted to barges or to carts.

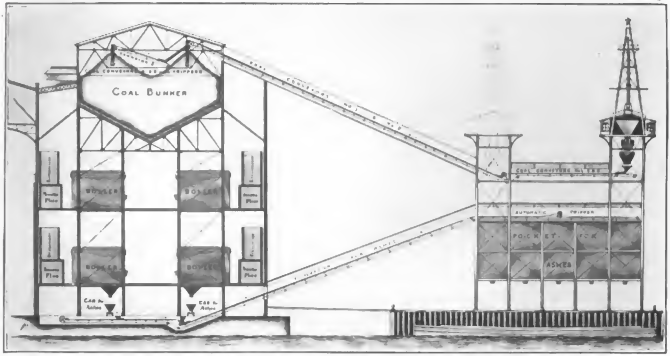
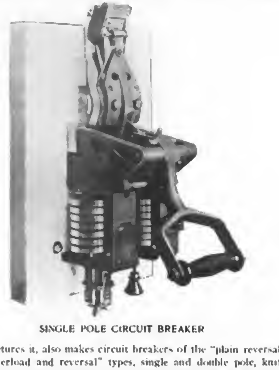


FIG. 3.—HANDLING COAL AND ASHES AT THIRD AVENUE RAILWAY PLANT, NEW YORK

The Robins belt conveyor has been in use for several years in the Ninety-Sixth Street Station of the Metropolitan Street Railway for removing ashes. Among other power plants at which they are in use for auxiliary purposes of coal and ash handling are the Boston Elevated Railroad Company, Cleveland Electric Railway Company, Chicago Edison Company and South Side Elevated Railway Company.

Single Pole I-T-E Circuit Breaker

The type of circuit breaker illustrated by the accompanying cut, originally designed for the protection of the generating side of boosters, has found a still wider field of usefulness in the protection of generators running in parallel. When used for the protection of boosters, this instrument not only opens the circuit in case of an overload or short circuit, but it also opens the instant the current tends to flow into the booster, the reversal of the current being due to a drop in the voltage of the latter below that of the line to which it is connected, in which case, unless the circuit is promptly opened the booster operates as a motor, resulting invariably in overloading the circuit and not infrequently in serious mechanical injury to the booster itself. When used for the protection of generators running in parallel, the circuit breaker prevents injury to the machines by making it impossible to connect them in parallel until their voltages are properly equalized. The breaker will also automatically cut out any generator in case of interruption of the field circuit. In either of these cases, in the absence of the protection afforded by circuit breakers of this class, the other generators would tend to run the low voltage one as a motor, often overloading and throwing out the main circuit breakers in the whole power house. Overload and reverse current circuit breakers, such as the one shown, are especially serviceable for the protection of generators operated by water-wheel. The Cutter Company



SINGLE POLE CIRCUIT BREAKER

manufactures it, also makes circuit breakers of the "plain reversal" and "overload and reversal" types, single and double pole, knife blade or laminated contacts, in any capacity for voltages up to 800 volts.

Garrigus Mechanical Boiler Cleaner

The Garrigus mechanical boiler cleaner has been before the public for four years, and in spite of the fact that many owners of steam plants have had a sad and costly experience with so-called cleaners, this invention has made many friends among practical men and is now in actual use in over 400 boilers, where it has proved very satisfactory under ordinary commercial conditions. It is strictly a mechanical device. A feature is the floating skimmer that conforms to the scum line at all times, keeping the boiler

MECHANICAL BOILER CLEANER

clean no matter what the condition of the water may be. It removes and prevents scaling, pitting, corroding and foaming, and besides the greater efficiency of the boiler, due to the absence of scale, it strengthens and preserves the iron, thus greatly increasing the life and safety of the boiler.

The impurities in water separate under ordinary working pressures and are held in suspension. The sediment thus formed, together with any earthy matter, is carried by the currents to the surface of the water and then to the rear of the boiler, where it is arrested by the trough-shaped wings; when the junction of the wings is reached the sediment is taken up by the floating skimmer (the mouth of which is always at the scum line) and discharged through the outlet pipe, with a centrifugal force, into the precipitator. The lower temperature in the precipitator and its special construction cause the sediment to settle rapidly. It then remains in the lower compartment of the precipitator until drawn off through the blow-off pipe. The circulation is completed by the return pipe, which is connected with the boiler, and takes only clear water from the precipitator. Thus the sediment is continuously and effectively removed from the boiler. The precipitator should be blown off every two or three hours. This requires very little time—about one minute at each operation.

The economical advantages of operating a perfectly clean boiler are apparent, and the fact that this cleaner removes all impurities before such foreign matter settles, or, in other words, before any damage is done, appeals to practical men. One company writes that "the mechanical floating skimmers attached to ten boilers in different plants of ours in this city are all that you claim for them. Every one is working admirably and our boilers are as clean as a bright silver dollar. We use no compounds whatever, and can cheerfully recommend the cleaner to the confidence of boiler users."

It is claimed for the cleaner that it pays for itself, that the saving on fuel alone will more than meet the cost in a short time, and the fact that the company proposes to place the cleaner on boilers entirely at its own expense, giving ample time to thoroughly try them and guaranteeing them to give satisfaction before payment is made, is certainly sufficient evidence that the company has confidence in the device.

The illustration shows the device attached to a tubular boiler. It may be used on all kinds of water-tube boilers. Coe, Smith & Co., 413 Western Union Building, Chicago, are the selling agents for the Garrigus Mechanical Boiler Cleaner Company, and will be represented at the American Street Railway Convention by W. R. Mason, the Western manager.

New Works for Knell Air Brakes

The Knell Air Brake Manufacturing Company, Ltd., which was organized recently at Battle Creek, Mich., for the purpose of manufacturing the Knell air brake, air compressors, air hoists and special machinery, commenced operations in its new plant on Sept. 1. The shop is equipped with the very best and latest machine tools and the company is in a position to take prompt care of all its business in the future. The company's air brakes have given excellent results in the past on a number of roads, and with the company's new manufacturing facilities an excellent business is expected.

Keystone Instruments

The Cutter Company, of Philadelphia, which some months ago assumed the sales management of the Keystone Electrical Instrument Company, has given especial attention to these instruments in connection with street railway work, and the high reputation of the Cutter Company in electrical matters, together with that of the Keystone Company for electrical instrument manufacture, makes an extremely strong combination. The accompanying engraving shows the latest type of the Keystone "illuminated dial" instrument. This instrument is made in either black and copper or black and nickel, as may be desired by the customer, and this finish is also applied to the standard "round pattern" type.

A growing demand is reported for a combined ammeter and voltmeter in one case. This type was originally designed for automobile use, but its compact form has rendered it particularly adaptable for small switchboards. The second illustration shows an instrument of this type. The case is almost square, with rounded corners, the whole covered with black enamel, which is an extremely pleasing finish and very durable. When required, either voltmeters or ammeters, separately, can be supplied in cases of this character.

COMBINED AMMETER AND VOLTMETER

KEYSTONE ILLUMINATED DIAL

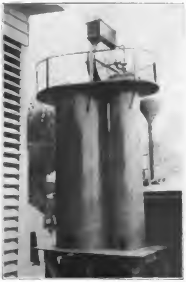
The Keystone Company also manufactures a complete line of portable testing instruments, the merits of which are fully known. All of these instruments are guaranteed by the Cutter Company.

Since his return to London, Mr. Yerkes, if the cable despatches are to be believed, has been talking very freely concerning the ruinous competition of the J. P. Morgan combination in the underground railway field. He is quoted as saying that lines other than those to be built by him are not needed, but that he is prepared to meet all competitors.

Automatic Apparatus for Feed-Water Softening

The treatment of feed-water to prevent boiler scale is now settling down to certain definite well understood lines. Many of the schemes which have been tried in the past for preventing boiler scale have been somewhat after the nature of the cure for rheumatism, which consists in carrying a potato in the pocket. Scale-forming solids in the great majority of boiler feed-waters are carbonate of lime or magnesia held in solution by carbonic acid gas and sulphate of lime or magnesia. There are many chemicals which will precipitate these salts. Carbonate of lime is precipitated by lime water, sodium phosphate, caustic soda, barium hydrate, tannin extract or common sugar. By far the cheapest of these per pound of carbonate of lime which must be precipitated from the water, is lime water obtained from common unslaked lime. Sulphate of lime is precipitated by soda ash (sodium carbonate) sal soda, barium chloride tannin extract, sugar and sodium phosphate. Of this list, soda ash is the cheapest. The use of these chemicals for the purification of water by precipitating the injurious scale-producing salts has been known for many years under the name of the Porter-Clark Process. The Clark process adds lime in the form of lime water or milk of lime to the water to be treated, thus precipitating the carbonates of lime and magnesia. The Porter process consists of adding soda to the water to be treated to precipitate the sulphates of lime and magnesia. The precipitates being settled out of the water, the resulting pure water is used for boiler feed. It is evident that to work this purification process the analysis of the water must be known so that the right amount of quicklime and soda solution can be used to completely precipitate the scale-producing salts without wasting lime or soda. Once these proportions are fixed by the analysis of the water, the whole problem lies in the apparatus for mixing the precipitating solutions and separating the precipitates. It is not desirable to have an expert chemist in charge of every steam plant to supervise the water purification. It is, on the other hand, desirable to have a water purification apparatus so simple that it will require practically no knowledge of chemistry for its operation. In fact, that it should be as nearly automatic as possible.

The water-softener plant made by the Kennicott Water Softener Company, of Chicago, has had all the details worked up with great care, originally with the idea of offering the steam railroads softening plants which could be located at water tanks along the road and be looked after by the men operating steam pumps for these tanks. The Kennicott process is what is known as a continuous process, that is, the mixing and precipitation go on continually as long as the apparatus is in operation. It is thus distinguished from processes in which tanks are filled with a certain mixture of feed water and precipitating solutions, and then allowed to stand and settle. Such plants require considerably more room than the Kennicott apparatus of the same capacity, because of the necessity of duplicate tanks, so that one tank can settle while the other is being used. Referring to the cross-sectional view of the Kennicott water softener plant, which is shown herewith, the feed-water enters the small tank at the top of the apparatus. The water flows from this box, which is called the hard-water box, and flows over an overshot water-wheel. The wheel furnishes the small amount of power required for the agitation in the lime-water saturator and a scoop wheel, the purpose of which will be explained later. It also operates a slow hoist for lifting barrels of lime and soda ash to the top of the machine. There is a float in the hard-water box which varies at the rate of flow of the soda and lime solutions, according to the head and rate of flow from the box to the softening tank. In order to provide soft water for making the lime water solution, the scoop wheel seen revolves continuously, emptying enough purified water into an adjacent box to supply the lime-water saturator. The lime saturator is the cylinder in the middle of the apparatus. The soft water from the box supplied from the scoop wheel flows down in a pipe shown at the left and enters the lime-water saturator at the bottom at which point is the lime agitator which revolves on a vertical shaft. The caustic lime is placed in this cylinder so that the agitator keeps it constantly stirred. As water flows into the lime-water saturator at the bottom, the saturated lime water overflows at the top of the cylinder and mixes with the incoming hard water from the hard-water box. At the same time the soda ash solution from another box mixes with the hard water and this mixture settles down through the conical chamber which surrounds the lime-water saturator. On account of the shape of this chamber the velocity of the water settling constantly decreases, thereby aiding the precipitates to fall to the bottom. After reaching the bottom of the cone, the water rises past perforated baffle plates (which catch some of the finer precipitates and are self-condensing), and finally rises through a mass of excelsior to the top of the purification tank, and overflows into a storage tank which may be separate or a part of the plant. The precipitated salts are drawn off from the bottom of the purification tank, and the residue is drawn off from the bottom of the saturator. The fresh caustic lime is simply poured into the top of the lime saturator cylinder and soda ash is put in a box from which this solution is drawn according to the height of the float in the hot-water box. It is, of course, assumed in this operation that the lime and soda solutions are both full saturated solutions, the apparatus being proportioned so that there is opportunity for this complete saturation to take place in the passage of water through the solu-


KENNICOTT WATER SOFTENER—TOP OPEN


KENNICOTT WATER SOFTENING PLANT—TOP CLOSED


SECTION THROUGH KENNICOTT WATER SOFTENER

tion chambers. Attention is called to the fact that the main precipitation takes place as the water is falling, and hence is in the direction of the flow of the water and not against it. The heavier particles of the precipitate tend to carry down the lighter particles. The final filtration is through common excelsior, which is renewed once in six months, since it catches only the smallest particles not heavy enough to precipitate. When desired, the storage tank is placed surrounding the purifying apparatus tank. This form is compact, requiring but one foundation for storage and purifying tanks, and is probably the most economical of space of any of the forms yet designed.

The Thomas Rail-Bond

The rail bond illustrated by the accompanying engravings consists of a series of flat strips of soft rolled copper, soldered to one another at the ends, but having a central flexible portion where the strips are unattached, the ends forming flat feet which are soldered to the rails, while the flexible part is bent into a loop that projects through an opening punched in the rails at the point of meeting, as shown in Fig. 1. A soft copper strip is placed under the ends of the bond and extends to the head and foot of the rail, giving a very large contact area between the bond and the rail. For convenience in installing the bond, and as an additional element of strength in its attachment to the rail, a small cap screw is put through the web of the rail and tapped into the foot of the bond, serving to draw the bond into close contact with the rail, and relieving the solder of much of the stress which comes upon it in service. Since the cap screw is soldered both to the rail and bond in the process of attaching the bond, it is impossible for it to become loose. The construction of the bond and its application to the rail are shown in Fig. 2. The punching of the necessary opening at the ends of the rails may be accomplished at the rail mills, or at the point of use, but the work will preferably be done by a hydraulic punch of sufficient power to punch both rails at one time after the rails are laid and the track is surfaced. The rails are then drilled for the cap screws and ground with an emery wheel where the bond is to be attached, until the surface is bright. The work of brightening the surface is done rapidly and well by means of a grinding equipment consisting of a portably mounted gasoline engine driving a flexible shaft fitted to a small emery wheel in the manner illustrated in Fig. 4. Fig. 1 shows a rail ready for the application of the bond, which is held in position by the cap screws, while the rail and bond are being brought to a soldering heat by a powerful gasoline heater. When the solder in the feet of the bond is thoroughly melted, enough is added with acid to ensure the complete filling of the space under the foot of the bond, and the cap screws are turned up hard, drawing the layers of the bond together and pulling the bond as a whole into intimate contact with the rail. The rail and bond are then allowed to cool slowly, the result being a perfectly secure, permanent joint, which cannot be broken except with use of tools.

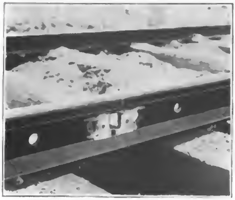


FIG. 1.—RAILS PREPARED TO RECEIVE BOND

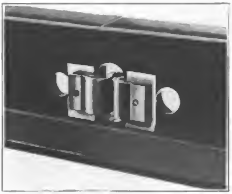


FIG. 2.—CONSTRUCTION AND APPLICATION OF BOND

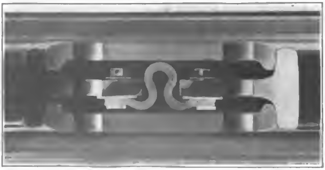


FIG. 3.—HORIZONTAL SECTION OF BOND APPLIED TO 90-LB. RAIL

One of the features of the Thomas bond is its extremely short length, being but $4\frac{1}{2}$ ins. in length between the centers of the attaching surfaces. The manufacturer states that by thus employing in the circuit a greater length of rail and a shorter length of bond, the resistance of the joint is less, by 25 per cent to 40 per cent, than that of a joint bonded in the ordinary way with the same section of copper in bonds of the riveted terminal type. He says further that the rail is weakened far less by the punching necessary for this bond than by the drilling of the two holes needed for ordinary double bonding, since the metal removed from the rail is taken from a point where it has little value in supporting the rail-head, and where entire dependence is placed on the rail-joint to hold up the rail. To double-bond with riveted terminals requires drilling two $\frac{7}{8}$-in. holes in the line of shear through the bolt holes, while the horizontal dimension of the punching for this bond, added to the width of the hole for the cap screw, is less than the diameter of a single $\frac{7}{8}$-in. hole. Fig. 3 is a horizontal section through the bolt holes and angle-bars, showing the application of the bond to the 90-lb. T-rail.

Shop tests of these bonds indicate great life, both under horizontal bending, such as would be produced by the expansion and contraction of the rails, and under vertical deflection of one end, such as would be due to a loose joint. Under expansion and contraction of $\frac{1}{2}$ in. at the rate of 100 per minute, these bonds last from 12,000 to 20,000 complete movements, and at no time did the soldered joint break. Under a vertical deflection of $\frac{1}{8}$ in. at the same rate, which could be caused only by an extremely loose joint, a bond was tested for 300,000 movements without any signs of breaking, either in the copper strands or in the soldered joint. Under these tests the bonds retained their shape perfectly, showing

FIG 4.—PORTABLE GRINDING EQUIPMENT FOR BRIGHTENING CONTACT POINTS

that in ordinary use no deformation can occur which will bring the bond into contact with either rail or joint plate. These bonds can be installed under any fish-plate or rail-joint that provides for any bonding whatever between the plate and the rail. The manufacturer, Edward G. Thomas, 4 State Street, Boston, Mass., is prepared to undertake the installation of these bonds under contract for the complete work, and can also furnish and install soldered bonds under the rail for open work, cross bonds, and feeder connections.

New Quarters of the Mayer & Englund Company

The new quarters occupied by the Mayer & Englund Company in the modern eight-story, fireproof building at 1020-1024 Filbert

BASEMENT STOREROOM FOR WIRE AND HEAVY MATERIAL

Street, Philadelphia, are admirably adapted to meet the requirements of this enterprising establishment. The location, in the heart of the business district of the city, conveniently near all of the depots, affords every facility for the economical handling of a large business.

A fine suite of offices for the accounting and executive departments have been fitted up on the second floor of the building. The general shipping and store rooms occupy the first floor. The basement is utilized for heavy material, and extensive overflow storage capacity has been provided on the seventh floor. Each of the floors is 60 ft. x 80 ft., so that the company uses a total of nearly 20,000 sq. ft. of floor space, which is nearly four times the room formerly occupied in the old building on South Tenth Street. A glance at the accompanying illustrations affords conclusive evidence that this increase in space was secured none too soon.

The growth of this company's business has been in keeping with the development of the industry. Having been so closely identified with the street railway supply business for a number of years, it will undoubtedly be of interest to trace the progress of this house from its inception in 1893 by Charles J. Mayer, who acted as a commission agent for several makers of street railway supplies. When A. H. Englund became associated with Mr. Mayer during the latter part of 1895 the firm name became Mayer & Englund, and at that time the business was carried on in a single office in the Betz building, where one stenographer, one bookkeeper and a clerk to look after orders and shipments constituted the office force, the selling department being represented by Mr. Mayer and Mr. Englund. Gradually the business developed until it was necessary, in January, 1897, to move to 10 South Tenth Street, where the firm occupied the first floor and basement, the latter being used as a store room. In order to meet the requirements of an increasing trade, however, it was deemed advisable in March, 1900, to incorporate a company to transact the business as the Mayer & Englund Company, the second floor of the building on Tenth Street being engaged to meet the demand for more room, but again, in 1901, it was necessary to secure enlarged facilities, and at this time the company secured the whole building in which it was then located, comprising five floors and basement. The latest move, by which the company takes possession of the Filbert Street building, is the most important change that has yet been made, as it enables the company to handle a much larger business than could possibly be taken in the old quarters.

During the firm's early history the line of goods handled by Mayer & Englund consisted almost entirely of the gears, pinions and trolleys made by the R. D. Nuttall Company; the fare registers and fixtures made by the International Register Company, and a line of overhead insulation made by the W. T. C. Macallen Company, of Boston. To this line have been added from time to time specialties and standard street railway material, so that at the

TWO VIEWS OF SHIPPING DEPARTMENT AND STOCK ROOM ON MAIN FLOOR

present time the company is furnishing a complete line of electrical and mechanical supplies required for street railway construction, maintenance, and operation, as well as supplies required by large industrial plants and factories It was this constant growth of the business that brought about the company's last move to the commodious quarters now occupied in the new building on Filbert Street, where every up-to-date convenience is to be found.

Among many noticeable features of the new offices attention is attracted to the equipment of the clerical department, in which the loose-leaf system of bookkeeping is in use, except in the case of the general ledger. The system used is known as columnar bookkeeping, in which separate accounts are kept with each general line of specialties for the purpose of ascertaining the relative profit on different lines at the end of the year, the entire cost of conducting the business being charged pro rata to each of the different lines, according to the volume of gross sales. All the company's correspondence is kept by the vertical file and index system, under which each particular subject is given an index number, and all papers relating to the same subject are filed under the same number All letters are duplicated in carbon, the duplicate being filed with the answer. All orders, job tickets, bills, shipping blanks, etc., are written on book typewriters. The general office and other departments are also provided with the latest labor-saving office devices and appliances.

During the last two or three years the firm has acquired a large number of patents, covering Protected rail-bonds, as well as tools and machines for installing such bonds. All of these patents are owned by the Protected Rail-Bond Company, which is controlled by Mr. Mayer and Mr. Englund, and for which the Mayer & Englund Company acts as general selling agent. The growth of the company's bond business has been phenomenal, Protected bonds having been installed on 515 electric railways, bonding a total of 9000 miles of track, which of course comprises a large part of the electric street railway mileage in the United States. The overhead construction material handled by the firm is of the best quality, being of heavy, substantial design. The company is in a position to give prompt attention to the shipment of orders at short notice. For the convenience of its patrons a 580-page catalogue is issued, covering a list of over 5000 separate and distinct articles. For the purpose of saving its customers unnecessary expense when ordering goods by cable or telegram the catalogue is provided with a code formulated by the company.

One of the pronounced indications of growth is the fact that the company now employs thirty-two persons, including nine in the sales department; eleven in the purchasing, accounting, order and general office department, and twelve in the shipping department and store room. Branch offices are maintained in charge of the following agents: W. A. Cockley, 85 Liberty Street, New York City; George W. Provost, Park Building, Pittsburgh; J. M. Gallagher, 135 Adams Street, Chicago; H. M. Lofton, Equitable Building, Atlanta, Ga. Mr. Lofton also maintains a branch office in the Hennen Building, New Orleans, La., which is under his supervision. The company contemplates establishing an office in Cleveland. No regular foreign agencies have been established, but the company now enjoys a very large foreign business.

The following is a list of the principal manufacturers represented by the Mayer & Englund Company: R. D. Nuttall Company, Pittsburgh, Pa.; the International Register Company, Chicago, Ill.; the Protected Rail-Bond Company, Philadelphia, Pa.; W. T. C. Macallen Company, Boston, Mass.; William Hall & Company, Boston, Mass.; Speer Carbon Company, St. Mary's, Pa ; Simplex Electrical Heating Company, Boston, Mass.; Garton-Daniels Company, Keokuk, Iowa; Stricby & Foote Company, Newark, N. J.; Sterling Varnish Company, Pittsburgh, Pa.; Pittsburgh Insulating Company, Pittsburgh Pa.; Universal Safety Tread Company, Providence, R. I.; Trolley Vestibule Shade Company, Bridgeport, Conn.

Labor-Saving Tools

Although the cost of pole-raising in electric railway construction is likely to be very high, many companies do not seem to have appreciated the possibilities of saving labor in this work. A few electric railway companies have built special wagons or derricks, but it remained for W. H. Anderson & Sons, of Detroit, Mich., manufacturers of contractors' tools, to appreciate the desirability of a staple article of this kind and to manufacture it so that it is within the reach of all. This wagon is fixed with an adjustable boom or derrick, by which the lifting of the poles into position is greatly facilitated. The wagon has been made for several years, and many improvements in details, as the result of this experience, have been made. The wagon and its method of operation are shown by the accompanying engravings, taken from photographs. The boom is made of steel tubing, with a hardwood spar inserted, which allows it to be extended to any desired length to lift poles from 35 ft. to 70 ft. in length. On the front end of the wagon is a hoisting winch which operates the guy lines. The boom can be moved to any angle, even with the load in suspension. The tackle on the boom is arranged to be worked with the team which operates the wagon. It is not necessary for the team to be hitched to the wagon to move from pole to pole, as they can pull the wagon with one of the crew steering it by the tongue. The companies not using these wagons usually employ eighteen men, as a pole-raising crew, with a team of horses, and the average day's work is to set twenty to thirty-two poles. With the Anderson pole-raising derrick wagon, from eight to twelve men are used, setting forty-five to sixty-five poles per day. The saving in labor is easy to figure. This company makes many other devices which


WAGON READY TO LIFT


POLE PARTLY RAISED

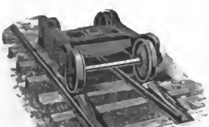

POLE READY TO BE LOWERED


CABLE REEL JACK

are popular with contractors. A cable reel jack, which is proving very popular, is shown herewith. Instead of supporting cable reels on blocks or rollers, which are cumbersome to carry around and slow to operate, this device is a neat support made with angle iron frame, and with height adjustable as any other jack-screw. This company makes railroad picks all steel, which can be used when worn much shorter than ordinary steel-pointed picks. The Anderson man-hole cable hanger for supporting cables in manholes, permits any number of cables to the capacity of the man-hole, to be put neatly in to one side, without requiring any room for hangers until the cables are put in. This company makes many other tools for the use of electric railway contractors and track maintenance departments, which are too numerous to mention here.

Car Replacers

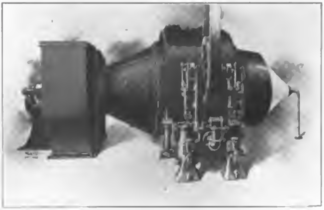
The car replacer is a small but very essential part of the equipment of an electric railway, and any improvement in a device of this kind means much to the car crew or "man about the barn." This has been accomplished by the Heitzman Tool & Supply Company, of Hoboken, N. J., which has recently brought out a pressed steel car replacer which is claimed to answer the requirements of a light, strong and thoroughly reliable wrecking frog for modern heavy equipment.


PRESSED STEEL CAR REPLACER

These replacers are pressed in the form of a truss and are guaranteed to hold up 150 tons without flattening or breaking. They weigh 115 lbs. to the set, so that one man can easily carry and place them in the most difficult places. They bind the rail without the use of clamps, and will put all four wheels of a truck on the rails, even when they are some distance removed, and roll the car on without a jolt. Another advantage is that but one size of replacer is required for all patterns of rail.

Condensing by Evaporation

The great heat absorbing capacity of evaporating water has been known for years, but it is only recently that condensing apparatus in commercial form has been worked out to employ the heat absorbed by the evaporation of water for condensation. In ordinary practice cooling for condensation is accomplished by conducting away the necessary amount of heat by passing a large body of water through the condensers. To condense a pound of steam from atmospheric pressure or near it takes the absorption of about 1000 heat units. In the ordinary condenser this heat is conducted away by water which is raised, say 50 degs., in the process, so that each pound of the water used in condensation absorbs 50 heat units, and 20 lbs. of condensing water are required in a condenser per pound of steam. If water could be sprayed upon the steam-heated pipes of a closed condenser so that the water in evaporating would absorb the heat to condense the steam, it would take only a pound of water to condense a pound of steam. The condenser made by the Cosmopolitan Power Company, of Chicago, which has recently been put on the market, makes use of the evaporation principle with the practical result that plants not on a natural body of water, which have heretofore run non-condensing because of the great amount of water required for condensing purposes, and the room and expense required for artificial cooling towers, can now operate condensers in connection with their engines at a cost for condensing water which will certainly not exceed that required at present for boiler feed-water, and will probably be considerably less; this, too, with a compact apparatus taking up but little more room than any closed or surface condenser. The apparatus consists essentially of a closed or surface condenser with pump, the cooling in which is accomplished by water sprayed from a nozzle and blown through the condenser tubes. A condenser complete, with spraying apparatus, is illustrated herewith. The condenser cylinder into which the exhaust from the engine passes is filled with copper tubes, expanded into one head like the flues in a boiler, and provided with a packed slip joint at the other to allow for the contraction and expansion of the copper tubes, which is, of course, not the same as that of the iron. At the left-hand end of the apparatus is a nozzle which sprays water into the copper tubes, and at the right is an exhaust fan which draws a continuous current of air and spray through the tubes. The water from the nozzle is broken up into very finely divided particles, and the current of air evaporates the water to make the cooling effect required for condensation. Combined with this there is the conducting away of heat from the steam by the water. After being drawn through by the fan the water not evaporated into the air falls, and is piped back to be used again at the nozzle. No cooling of this water is needed, as it is so broken up in its passage through the condenser that it remains at a workable temperature, water being added continuously by a float valve in the hot well to supply that taken by evaporation. The company installs its apparatus with the guarantee that it will not take more than one pound of fresh water per pound of steam condensed. This would bring the cost for condensing water practically down to that for boiler feed-water, were the plant non-condensing. As a matter of fact some tests have been made under rather unfavorable conditions, where but six-tenths of a pound of water per pound of steam condensed was required, the balance of the cooling being accomplished by conduction to the air drawn through the apparatus. A 300-hp condenser cylinder now under construction at the works is 5 ft. long and 72 ins. in diameter. A 1000-hp condenser cylinder, also under way, is 8 ft. in diameter and 5 ft. long.


CONDENSER WITH SPRAYING APPARATUS

The H. W. Johns-Manville Company, of New York, has issued a small sixteen-page pocket catalogue telling about the Manville fire extinguisher, which is simply a dry powered chemical, put up in nicely decorated tubes that may be hung in any convenient place in the home, office or shop. The powder should be thrown at the base of the flame, which is thereupon extinguished by the generation of carbon dioxide, which will not support combustion. The powder will not freeze or cake in the tubes; is not affected by dampness, and does not deteriorate with age. It is perfectly safe, and will not injuriously affect the finest fabrics.

The business of the Burt Manufacturing Company, Akron, Ohio, has grown to large proportions, over 12,000 of the company's oil filters having been sold during the past twelve years throughout the world. They are used in twenty-eight different countries and have been adopted by ten governments. These facts in themselves would seem to be an ample guarantee of satisfaction, but rather than allow any opportunity for dissatisfaction upon the part of the buyer, the company is glad to allow a thirty-days' trial of its filter to prove the claim that it will reduce lubricating oil bills at least 50 per cent and satisfy in every way.

The American Oil Filter

The oil filter illustrated by the cut presented herewith was designed by the Burt Manufacturing Company, Akron, Ohio, for filtering very heavy grades of oil, which cannot be successfully cleaned in an ordinary filter because of the liability to clog up easily. The claim is made that such oils are readily purified by this filter, the oil being heated and thereby thinned immediately upon being

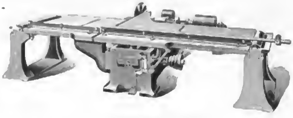
AMERICAN OIL FILTER

poured into the filter. The pan for receiving the waste oil is surrounded by a hot-water chamber, through which passes a steam pipe coil. When this chamber has been filled with warm water, and the lower part of the filter has also been filled with warm water until it flows from faucet 2, the filter is ready for operation, the proper steam connections having previously been made. Through the filtering material in the cylinder the oil makes its way into tube *B* and down onto the filter plate *D*, where the pressure of the oil above overcomes the resistance offered by the weight of the water, and the oil spreads out in a very thin film, becoming thinner and thinner as it travels from the center to the circumference of the plate. Every particle of the oil is thus exposed to the action of the water. This process is repeated as the oil flows upon plates D_1 and D_2, the separation of foreign ingredients from the oil thus being made, the remaining impurities then settling by force of gravity to the bottom of chamber *E*, from which they are drawn off by simply opening the valve. The purified oil is drawn from faucet 1.

Attention is called to the minimum of care required by this filter to keep it in operative order. Any kind of filtering material may be used, or none at all, and the filtering material may be removed without interrupting the oil service. The method of cleaning the filter is very simple, requiring only that the cylinder at the top be unscrewed, the filtering substance removed, and the sediment pan lifted out and emptied of the large quantity of dirt and grit which has collected in it through force of gravity. In nearly all other oil filters the bulk of the dirt is collected at the bottom, while in the American oil filter it is collected at the top, greatly increasing the ease with which the latter may be cleaned.

New Automatic Railway Cut-off Saw

The heavy power feed railway cut-off saw illustrated herewith was recently designed to meet the requirements of car shop work in large steam and electric railway plants, where it has been installed with satisfactory results. This machine is manufactured by the S. A. Woods Machine Company, South Boston, Mass., for cutting up lumber or timber into accurate lengths, taking heavy stock up to 14 ins. by 16 ins., or boards 30 ins. wide and carries saws up



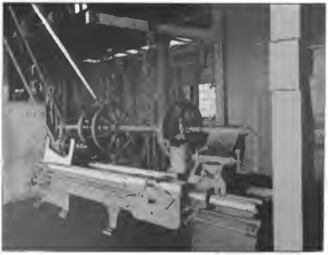
RAILWAY CUT-OFF SAW

to 40 ins. in diameter. The saw carriage is operated by power, and three rates of speed may be obtained by friction cone pullies. The travel of the carriage is controlled by a treadle, pressure upon which brings it forward at the rate intended. The return is automatic, and such jar as would ordinarily result by the fall of the carriage as it returns is eliminated by a pneumatic attachment which acts as a cushion at any point. A tension device for the driving belt keeps it tight as it moves with the carriage. The saw arbor can be made long enough to enable the use of a gaining head. The table is built in sections, so that it may be extended at any time, and rolls located at suitable intervals facilitate handling of the lumber. The fence or gage which is provided is extra heavy, and adjustable stops are furnished for duplication of work and convenience in locating the lumber. The stop bar is interchangeable with fences on both sides of the saw. The pulley on the arbor is of a patent pneumatic type, so constructed as to save about 30 per cent of the power which is usually lost. The loose pulley on the countershaft is also of a patented self-oiling type. Where much heavy cutting is done this machine is indispensable. It is quick-acting, self-contained, and is capable of doing the work of several old-style machines where the saw is brought forward by hand. It weighs about 4000 lbs.

The manufacturers have also lately produced a new vertical cut-off saw and will be glad to furnish full details on application.

Double-Spindle Repair Shop Lathe

The accompanying illustration, representing a portion of the repair equipment of the Brooklyn Heights Rapid Transit Company



DOUBLE-SPINDLE LATHE FOR RAILWAY REPAIR SHOPS

on Fifty-Second Street. Brooklyn, shows, in actual operation, a double-spindle lathe built by J. J. McCabe, 14 Dey Street, New York. This lathe is particularly well-adapted for general repair work, com-

bining the capacity of a 26-in. and 48-in. swing in the one machine, and thus making it possible to conveniently handle large work as well as medium and small size jobs. On the lower spindle, which is back-geared, the ordinary range of work may be done, while on the upper spindle an axle, to which 33-in. wheels are attached, may be swung, as indicated by the illustration presented herewith, and all the necessary turning of the shaft accomplished without removing the wheels, which may be trued up, if necessary, at the same time that the shaft for which they are mounted is being turned.

Car House Doors at Oldham, England

The accompanying illustration is from a photograph of the principal opening in the tram car house of the Oldham Corporation Tramways, Oldham, England. The doors, which were supplied by the Kinnear Manufacturing Company, Columbus, Ohio, are made in a series of three, being unequal in size and separated

STEEL ROLLING CAR HOUSE DOORS

by very substantial intermediate posts. These posts, being hinged at the top, can, after the doors are open, be readily raised to the ceiling, maintaining the opening perfectly clear without obstruction. In the rolling door at the right hand end will be noted a small wicket or hinged door which is utilized for a passageway by employees when the rolling doors are closed. Two of the doors are equipped with "Kinnear" trolley wire arms.

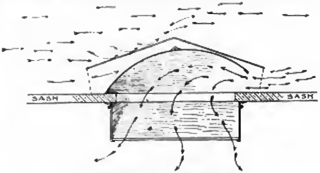
New Cars for Allentown & Reading Traction Company

The accompanying illustration shows one of a recent shipment of handsome cars to the Allentown & Reading Traction Company by the J. G. Brill Company, of Philadelphia. The cars are of the Brill semi-convertible type, particularly suited to the interurban service for which they are intended. The advantages of the transverse seating arrangement is enhanced materially by the addition of 7¼ ins. to width of aisle and length of seats by doing away with the necessity of wall pockets and bringing the seat ends within the posts. The roof storage of the windows is described in detail elsewhere in this issue.

The measurements are frequently adopted for this form of service, viz., length over vestibule, 37 ft. 5 ins.; width over sills, 7 ft. 10½ ins., and over post at belt, 8 ft. 2 ins. The interiors are done in natural cherry, handsomely inlaid. The ceilings are of decorated birch. Among the fittings are Brill sand-boxes, "Dedenda" gongs, angle-iron bumpers, radial draw-bars and ratchet brake handles. The speed capacity of these cars is practically equal to steam service, as they are mounted on Brill No. 27 high-speed trucks.

Pullman Automatic Car Ventilator

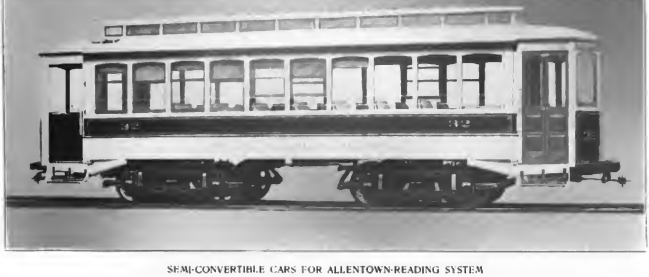
The ventilator shown by the accompanying cut consists of two parts, the hood and a diffusion box. The hood is so shaped as to leave openings at both ends. In this hood there is a metal arc-



AN AUTOMATIC CAR VENTILATOR

shaped valve poised on a perpendicular pin, and of the same length and width as the shutter-frame opening into the car. The hood-side of the device, with its enclosed valve, is projected on the outside of the car window by being placed in the lower part of the sash. Thus adjusted, the hood receives and breaks the direct blast of the wind admitting air on the breathing line of the passengers in the car in sufficient quantities to make each passenger comfortable, and at the same time it is claimed that the vitiated air within the car is exhausted. The air admitted is free from dust and dirt, and without draught, and the passengers do not suffer any inconvenience. In the transom at the top of the car, a 5-in. ventilator is installed inverted, which acts both as an intake and exhaust, and by making this installation in connection with the sash installation, makes an even temperature throughout the car.

The valve in the hood is so acted upon by the wind pressure cre-



SEMI-CONVERTIBLE CARS FOR ALLENTOWN-READING SYSTEM

ated by the forward movement of the car that it closes the end to the wind, and at the same time opens the end opposite to the direction from which the blowing wind is coming, thus shutting out the direct blast, with its dust, rain, or snow, and admitting the fresh air gently to the car through the open rear end of the hood.

The diffusion box which projects into the car is of galvanized iron, handsomely finished, covered with a lid or shutter, which can be raised or lowered according to the amount of air that is needed. Below this is a strip of perforated metal, which distributes the air as it enters the car. The total amount of air admitted through the ventilators is sufficient to change the air in the car four times an hour, and at all times, even if the car is overcrowded, it is stated that the air will be pure and fresh. This ventilator is made by the Pullman Ventilator Company, Washington, D. C.

New Haven Controller Regulator

The New Haven Car Register Company has perfected a controller regulator to prevent a motorman from throwing on at once more current than is indicated by one point of contact on the controller top and necessitates the pressing down of a thumbpiece arranged on the top of controller handle at each succeeding contact point. This forces the motorman to give full value to each notch of the controller as intended by the manufacturers, and prevents the shock to both controller and motor which the throwing on at once of a full current causes. This produces a material saving to both controller and motor and results in a saving of current. The operation of throwing off the current is not changed, being performed by a backward motion of the handle in the regular manner without operating the thumbpiece. The controller regulator will fit on any of the "K" type of controllers manufactured by the General Electric Company without alteration.

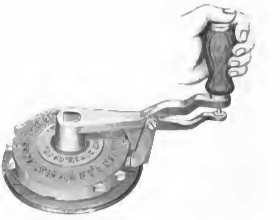
CONTROLLER HANDLE

The New Haven Car Register Company will have on exhibition a sample of this controller regulator at the Detroit convention. The use of this new device will eliminate the annoyance caused by the sudden jolting so common in the starting of electric cars.

Register Test in Brooklyn

An interesting test of a number of different types of registers was recently completed in the Fifty-Second Street shops of the Brooklyn Heights Railroad Company, the object of which was to determine the ability of the different machines to register 1,000,000 fares. Two registers of several different makes were taken and were rung by machinery. If any register gave out before the end of the test, the defective part was repaired or replaced and the machine was put into service again. The test was held in the presence of the representatives of each of the register companies and the railway company.

An upright frame was built 14 ft. 4 ins. long and 6 ft. 1 in. high, and consisting chiefly of five uprights of 4-in. x 4 in. stuff spaced 3 ft. 4 ins. center to center and braced at the top and bottom. At the top of each upright were fastened two 18 in. x 24-in. boards, to which were attached the registers. To the back of the frame and running its entire length was a 1-in. longitudinal shaft placed 13 ins. below the top of the register boards, and having bearings on the five uprights. At the middle of this shaft was clamped a horizontal wrought-iron driving lever 16 ins. long, which, by means of a 1½-in. x ½-in. connecting rod, was connected with a crank having a distance of 2 ins. between the center of its shaft and the center of the the crank run, this shaft being fastened rigidly to the shaft of a pulley driven by power from the mill room. This mechanism gave the longitudinal shaft an oscillating motion, which was transmitted to each register by means of a vertical slotted lever clamped rigidly to the shaft and a spring connecting rod. The purpose of the spring connecting rod was to avoid damaging the register in case its mechanism became locked.



CONTROLLER HANDLE IN OPERATION

The rate of speed agreed upon was 300 registrations per minute, and the test was conducted twenty hours daily from 5 a. m. to 1 a. m., during which time, however, certain hours were allowed for repairs. As a result of the test, which was commenced Sept. 15 and ended Sept. 20, the St. Louis register made the best showing.

New High-Voltage Insulator

Fred M. Locke, of Victor, N. Y., whose work in the direction of improved insulators for high-voltage transmission is well known, has recently brought out a modified type of insulator, illustrated herewith. This insulator is somewhat similar to that shown in a recent issue, but is slightly higher, and is provided with three petticoats, as shown in the illustration. It is 14 ins. across the hood. This insulator has been tested up to 160,000 volts, and is made for any voltage up to 100,000 line pressure.

HIGH VOLTAGE INSULATOR

Acme Oil Filter

The accompanying engraving shows a section of the Acme oil filter, manufactured by Walter L. Flower & Co., of St. Louis. The large amount of oil used in street railway power stations makes a filter of this kind, which is simple in construction, easy of operation and of effective filtering capacity, of interest.

The filter is built of heavy galvanized iron and the filtering materials employed are animal boneblack or charcoal, recognized by the oil refiners as the best oil filtering medium extant. Five sizes are built. The four largest are fitted with steam connections, inducing greater and more effective filtering capacity.

OIL FILTER

In the engraving, which shows the arrangement of one of the intermediate sizes, "A" is the receptacle for the oil to be filtered. The oil falls by its own weight then rises by gravity through the water and filtering material, which is immersed in water, and is finally drawn off from faucets, as shown "C" indicates filtering material and its location. "D" is a pan that catches dirt precipitated by oil coming in contact with water "E" is the double bottom or steam chamber for heating the water in the three sizes of filters mentioned. The larger size is equipped with a steam coil in the bottom. "F" is the inlet. The outlet is on the reverse side for steam for heating the filter. The steam connection increases the filtering capacity about 10 per cent.

The Prometheus Electric Heater

There has recently been placed on the American market a new type of car heater, which, on account of its success abroad, and the number of advantages claimed for it, has attracted the attention of street railway officials in this country. It is known as the "Prometheus" heater, and it is equipped with the "Prometheus" wireless heating units which are also used in numerous types of heating and cooking apparatus.

The system differs materially from all other systems in which the heating is effected by wire coils or ribbon conductors embedded in some insulating material, generally enamel. In the "Prometheus" system no wires are used. The heating device proper consists of strips of mica on which a layer of metal has been mechanically deposited, or more correctly speaking "fired," the layer consisting of metals which do not oxidize and do not appreciably expand or contract with the rise or fall of temperature.

These "heating elements," as they are called, which can be made of any desired resistance or shape, are so attached to the apparatus themselves, whether they be pots, stoves, irons, radiators, etc., that they can be removed with the greatest ease and replaced by a new element in case of a breakdown, which, however, does not often occur, on account of the mechanical construction of the elements and their great carrying capacity. A new element costs but a few cents, and can be inserted into the apparatus by the most unskilled person.

PROMETHEUS ROUND AND ELLIPTICAL HEATERS

Besides this very desirable feature, ease of repair, the "Prometheus" elements possess the great advantage of a large radiating surface, and on account of this and their large carrying capacity, the heaters may be made very much smaller than existing heaters, and have the same heating capacity. The great flexibility of the system permits heaters to be constructed of any desired shape, and the circular, elliptical and panel types are especially attractive and commendable.

These heaters are now being placed on the market by The Prometheus Electric Company, of 60 Reade Street, New York.

PROMETHEUS PANEL HEATERS

Crocker-Wheeler Branch Office Managers' Convention

The Crocker-Wheeler Company held at its works at Ampere, N. J., on Sept. 25 and 26, its annual managers' convention. On the evening of the 25th, the annual banquet was held at the Engineers' Club. Those present were the officers of the company, Schuyler S. Wheeler, Gano S. Dunn, W. L. Brownell, Putnam A. Bates, C. N. Wheeler and F. V. Henshaw, and the branch man-

agers, Samuel Russell, Jr., Julian Roe, J. Hally Craig, Louis P. Hall, W. H. Wissing, Francis B. De Gress, Henry J. Sage, William A. Doble and Harold Lomas. At this dinner many interesting speeches were made by the branch office managers, and Francis B. DeGress, of the New York office, who has been in the service of the company longer than any of the other managers, presented to the general sales manager, Putnam A. Bates, in the name of the managers, a token of their esteem and an acknowledgement of his efforts in their behalf. Mr. Bates responded in his usual happy manner. The purpose of the convention is to bring all of the men closer together and give them an opportunity of comparing notes and planning methods for handling the largely increased business of the company.

New Open Cars for New Hampshire

The accompanying illustration represents a small shipment of open cars to the Massachusetts Construction Company, which is operating extensively in the State of New Hampshire. The cars were built at the Laconia Car Company Works, which have built several hundred cars for this concern. This particular lot repre-

OPEN CARS FOR NEW HAMPSHIRE

sents some of the fourteen-bench open cars, with enclosed ends, having three sashes in each end, arranged to drop into pockets. The cars are finished in white ash, with seats of white maple; ceilings of white birch, and fitted with curtains of Crown pattern running to floor of car. The cars are also equipped with double running boards the full length of car, and a lower step arranged to fold; also drop side guards and chains, and solid bronze trimmings throughout. The trucks used are the improved No. 9-B high speed Laconia trucks with cushioned swing bolsters, and heavy double plate wheels.

The Characteristics of Good Paint for Iron Work

There is perhaps no manufacturing material in these days which is subject to more adulteration, and when adulterated is as worthless, as paint for iron work. Adulterated paint is cheap in first cost, but railroad companies having in view the cost of maintenance of outdoor iron work for a term of years are not searching for the cheapest paint at first cost, but that which will give them the best results in the long run. It is to this class of work that Detroit Graphite Manufacturing Company caters. The basis for the graphite paint made by this company is a peculiar graphite obtained from a mine in Northern Michigan. This graphite ore contains about one-third pure graphite, the balance being silicates. When this graphite was first discovered attempts were made by the company owning the mine to use it for the various purposes to which graphite is usually put and to separate the graphite from the other matter. The mixture, however, was too complete to admit of this being done, but it was discovered afterward that it was remarkably well adapted for use as a paint. The percentage of graphite and various other minerals in this ore, when ground and mixed with oil, gives a paint of an extremely uniform composition. The company takes care to use none but the best boiled oil and maintains its own plant for boiling oil, as well as for grinding graphite ore and pigments for use in paint, and it is claimed that this ore mixture of silica and graphite, when ground to an extremely fine powder, makes a pigment for paint superior to pure graphite, which has not as great mechanical toughness. Perhaps the best recommendation for the wearing qualities of this paint is its use by companies desiring the best service obtainable from paint. The United States Government uses this paint for covering its warships. The first important order received by this company when starting in business ten years ago was from the Waldorf-Astoria Hotel for covering steel structural work. The architect for this hotel had orders to obtain the best material the markets of the world afforded, and, after investigation, selected this graphite paint as being not only durable, but uniform in composition and of honest manufacture.

Large Gift to the Library of the American Institute of Electrical Engineers

At the meeting last week of the American Institute of Electrical Engineers, President Scott announced a large gift to the library from C. O. Mailloux, stating that Mr. Mailloux had presented his check for $1,028.23 to pay for the cost and for rebinding, when necessary, of a number of valuable sets of French scientific *Transactions* and other books. This donation is in addition to a full set of *Comptes Rendus* from 1835 to 1897 (130 volumes) which Mr. Mailloux presented to the library about eighteen months ago, the cost of which, including new half-morocco binding, was $317. President Scott also announced that Mr. Mailloux will donate a sum of money, the annual proceeds of which will be sufficient to pay the future cost of subscription to such of the periodical publications that he has presented to the library that are yet current, and also to defray the cost of binding the same.

The books presented include the *Transactions* of the French Academy of Sciences from 1666 to 1900 (247 volumes) lacking the years from 1778 to 1816. It is understood that Mr. Mailloux has authorized the library committee to complete the set at his cost. The *Annales de Chimie et Physique*, a complete set from 1789 to 1900 (312 volumes). *Journal de Physique* a complete set from 1872 to 1900 (29 volumes). The *Transactions* of the Austrian Society of Engineers and Architects, complete from 1855 to 1901, including both the weekly and monthly editions. A complete set of *Zeitschrift fur Instrumentenkunde*, 1881 to 1901 (21 volumes). The gift also includes an abridgement in French, in 13 volumes, of memoires read before the leading European societies previous to 1770; an English abridgement of the Memoires of the French Academy of Sciences from 1699 to 1720 (5 volumes); a French abridgement of the transactions of the same society from 1666 to 1718, and a history of the French Academy of Sciences.

The Seattle-Renton line of the Seattle Electric Company, which follows the route of the Seattle-Tacoma Interurban Railway as far as Renton Junction, 10½ miles from Seattle, branching off to Renton, has been placed in operation, thus completing the company's suburban lines. The company is building two new car houses, one 55 ft. x 120 ft., and the other 120 ft. x 240 ft., and a paint shop 65 ft. x 120 ft. For the present the framework will be of wood, but the foundations will be built of sufficient strength to hold brick walls, the plan being to replace the wooden ones in the spring. The roofs will be permanent. The rush necessitating the subsequent change of walls is due to a shortage of space. Many of the cars recently received have been left on side tracks, and it is the desire of the company to get them under cover before the severe winter weather. The company has recently issued a neat little booklet entitled "Seattle Street Railways; How to Use Them." It tells where every line goes, how transfers are issued, and contains exactly the information that is most valuable to residents of the city, as well as to visitors.

Mr. William Wampler, formerly representative in New York of the Stuart-Howland Company, of Boston, has severed his connection with that company and has accepted one as sales agent of the Peckham Manufacturing Company, with which he was previously connected. Mr. Wampler has just started on an extensive trip through the far West and to the Pacific Coast in the interest of the Peckham Company.

Street Railway Apparatus in Detroit

While the type and manufacturers of a great deal of the street railway apparatus used in Detroit are mentioned in the articles on the different systems elsewhere in this issue, it was not found practicable to give credit in every case in these longer articles. It has been considered advisable, therefore, to publish below a list of some of the more important installations in Detroit not mentioned elsewhere, so that the visitor to that city can select what particular apparatus he desires to inspect, and for this purpose, as well as to give proper credit to the different manufacturers, classification has been made under the names of the different supply houses.

The Crane Company, of Chicago, furnished the complete equipment of valves for the Detroit Citizens' Railway, also for the Detroit Rapid Railway Company

The Billings & Spencer Company, Hartford, Conn., has furnished a large quantity of pure lake copper, drop-forged commutator segments to the Detroit street railway companies.

The R. Bliss Manufacturing Company, Pawtucket, R. I., has supplied many of its patent platform gates for Detroit street cars.

The Lehigh Car, Wheel & Axle Works, Catasauqua, Pa., have supplied wheels to some of the roads in Detroit and vicinity.

The power plant of the Detroit, Rochester, Romeo & Lake Orion Railway Company, at Rochester, Mich., which forms a part of the Detroit United Railways system, is equipped with engines made by the Ball & Wood Company, of Elizabeth, N. J.

The American Car Seat Company, Brooklyn, N. Y., has installed quite a number of its pushover seats, also longitudinal rattan seating, in the cars of many of the roads in and around Detroit.

Sand-boxes made by the Ham Sand-Box Company, Troy, N. Y., are in use on the cars of the Detroit & Pontiac Railway, the Detroit City Street Railway, and the Detroit, Rochester, Romeo & Lake Orion Railway.

Insulating material has been supplied to the Detroit railways by the American Vulcanized Fibre Company, Wilmington, Del., manufacturer of hard and vulcanized fibre.

The J. G. Brill Company, Philadelphia, Pa., has equipped 100 of the cars of the Detroit United Railways with its No. 27-F trucks, one of the cars of the Rapid Railway of Detroit being fitted with the company's No. 27 heavy, high-speed trucks.

Green fuel economizers, manufactured by the Green Fuel Economizer Company, Matteawan, N. Y., are in use in the plants of United Railways and Rapid Railway, Detroit.

Bristol recording voltmeters, supplied by the Bristol Company, Waterbury, Conn., are used by the Detroit United Railways.

The Van Dorn & Dutton Company, Cleveland, Ohio, has furnished almost all of the gears and pinions used on the cars of the Detroit United Railways system, and most of the cars of the suburban lines have been equipped with the company's track cleaners.

The Standard Traction Brake Company, New York, N. Y., has furnished brakes to the Rapid Railway system and the Detroit, Ypsilanti, Ann Arbor & Jackson Railway.

Track rails and fastenings have been supplied to the Detroit railways by the Pennsylvania Steel Company, Philadelphia, Pa.

The Star Brass Works, Kalamazoo, Mich., has supplied trolley wheels and harps to nearly all of the city and suburban lines in and around Detroit.

The Bullock Electric Manufacturing Company, Cincinnati, Ohio, has a contract for electrical machinery fot the Detroit, Rochester, Romeo & Lake Orion Railway.

The Heywood Brothers & Wakefield Company, New York City, has equipped some of the cars of the Rapid Railway system of Detroit with Wheeler walkover seats, and in Toledo, Ohio, the cars of Toledo & Monroe Electric Railway, the Toledo & Maumee Valley Railway, the Toledo & Western, and the Toledo Railways & Light Company, are equipped with the company's seats.

The Curtain Supply Company, Chicago, Ill., has equipped the open cars in and around Detroit with its special open-car duck curtains with rod at bottom, and the closed cars, B-43 Crown; Forsyth roller tip pantasote and Acme Cl. C. pantasote.

Transfer ticket punches made by the R. Woodman Manufacturing & Supply Company, Boston, Mass., have for the last seven years been in use on the Detroit United Railway throughout their system, where they have given satisfaction.

The Hoppes Manufacturing Company, Springfield, Ohio, has eight of its 300-hp live steam feed-water purifiers in service in the Detroit City Water Works, where they are used as separate units on boilers of the same power. Six of them, of 500-hp capacity, are also in use in the plant of the Detroit United Railways.

Many of the cars of steam roads entering Detroit have been equipped with heaters made by the Gold Car Heating & Lighting Company, New York, N. Y. Among these roads may be mentioned the Pere Marquette, Michigan Central, Cincinnati, Hamilton & Dayton, Lake Shore & Michigan Southern, Wabash and Grand Trunk.

The John Stephenson Company, Elizabeth, N. J., furnished some of the open cars used in Detroit.

That part of the Michigan Traction Company's system between Kalamazoo and Battle Creek, Mich., about 27 miles of complete road, was built by Smethurst & Allen, electrical engineers and railway contractors, Philadelphia, Pa.

Several trolley wagons supplied several years ago by J. R. McCardell & Company, Trenton, N. J., to the street railway companies of Detroit, are still in use, giving pronounced satisfaction.

J. G. White & Company, engineers and contractors, of New York, were interested in the construction of the Toledo & Monroe Railway, and in the Detroit, Rochester, Romeo & Lake Orion Railway, the former being described in the Street Railway Journal of Aug. 3, 1901, and the latter in the issue of April 7, 1900.

The Pittsburgh (Pa.) Insulating Company has supplied to the Detroit railways several grades of insulated cloth and paper.

The feed-water heaters and separators manufactured by the Harrison Safety Boiler Works, Philadelphia, Pa., are in use in several plants in and around Detroit.

Ties for the Lake Shore Electric Railway between Cleveland and Toledo, Ohio, were supplied by the Advance Lumber Company, of Cleveland.

At the power house of the Detroit United Railways Company there are four large tandem compound direct-coupled engines having cylinders 28 ins. and 52 ins. x 48 ins., each driving an 800-kw generator. They were installed by the Allis-Chalmers Company, Milwaukee, Wis., by whom, aside from street railway equipments, engines have been supplied to a large number of factories in Detroit; in fact, the company has supplied more engines to Detroit than to any other city of equal size.

To the city and interurban railway companies in and around Detroit, the American Steel & Wire Company, Chicago, has furnished large quantities of "Crown" rail-bonds, which are said to have been adopted as the standard for roads in that vicinity. Trolley wire, span wire, weatherproof electrical cables, and other portions of the wire equipment in use on these roads have also been supplied by this company.

Last season the Simplex Electric Heating Company, Cambridge, Mass., equipped the Toledo & Monroe Railway cars with about 200 of its enamel type car heaters, which are efficient, durable, and sanitary, being light, extremely compact, with a minimum number of parts. There are no receptacles for dirt, consequently no expense whatever for cleaning and overhauling.

The Hope Webbing Company, Providence, R. I., has supplied the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company with tapes and webbings, and the company's goods are used by other Detroit street railway companies, the material being purchased from dealers who handle such lines of goods.

The Duff Manufacturing Company, Allegheny, Pa., has supplied the Detroit street railway system with Barrett track and car jacks, which are used extensively and are said to be regarded as the standard in that section of the country.

Christensen independent motor-driven air brake equipments, made by the Christensen Engineering Company, Milwaukee, Wis., are in use on a considerable number of cars of the Detroit & Toledo Shore Line Railway Company, the Detroit, Lake Shore & Mount Clemens Railway Company, and the Rapid Railway Company, of Detroit.

The Morris Electric Company, with headquarters in New York, has supplied its rail-bonds to the following roads in Michigan in the vicinity of Detroit: Jackson & Suburban Traction Company, Jackson, Mich.; Wolverine Construction Company, Detroit, Mich.; Michigan Traction Company, Kalamazoo, Mich.; Detroit, Lake Shore & Mount Clemens Railway, Detroit, Mich. A large number of iron poles and brackets have also been sold by the company to roads in Detroit and vicinity.

The G. C. Kuhlman Car Company, Collinwood, Ohio, built most of the cars for the interurban roads controlled by the United Railways Company, of Detroit, and also some of the cars used in the city.

The Peter Smith Heater Company, Detroit, Mich., has installed car-heating equipments as follows: Fifty to the Rapid Railway system, the Detroit and Port Huron line; twelve to Detroit & Flint Railway Company; twelve to Detroit, Rochester & Romeo Railway Company; fourteen to Detroit & Pontiac Railway Company; twelve to Detroit & Northwestern Railway Company; ten to Detroit, Wyandotte & Trenton Railway Company; twelve to Detroit Shore line.

The Ohmer Car Register Company, Dayton, Ohio, has its registers in service on all the cars of both the Detroit & Wyandotte and the Detroit & Pontiac lines of the Detroit United Railways Company.

Nearly all of the line material used by the Detroit railways was supplied by the Ohio Brass Company, Mansfield, Ohio. The pole brackets supplied to the Detroit & Northwestern Railway Company, the Rapid Railway system and the Detroit & Toledo Shore Line Railway, are the company's well-known "Richmond" flexible pole brackets. The Detroit United Railways have also a number of these brackets in use, as well as the "Detroit" type of brackets, which, as their name implies, were designed especially to meet the requirements of the Detroit United Railways Company.

In the power plant of the Detroit, Rochester, Romeo & Lake Orion Railway, at Rochester, Mich., there are three engine-type railway generators, two of 200 kw and one of 400-kw capacity, made by the Crocker-Wheeler Company, Ampere, N. J. There is also a Crocker-Wheeler booster set of 400-amp. capacity at 150 volts.

The apparatus installed by the Electric Storage Battery Company, of Philadelphia, Pa., in Detroit for street railway purposes, consists of the three batteries for the Detroit United Railway. One battery, consisting of 276 elements, with a capacity of 2500 amps. for one hour is located opposite the power house; another battery, located at the Third Street sub-station, consists of 250 elements, having a capacity of 2000 amps. for one hour, and the third battery, located at the Ecorce power house, on the Wyandotte division, consists of 276 cells, having a capacity of 280 amps. for one hour. These batteries are all chloride accumulators, installed in lead-lined tanks, and are used for regulating the fluctuations and maintaining voltage on the line.

The Maltby Lumber Company, Bay City, Mich., states that every electric road centering in Detroit has been furnished with its cedar ties or poles, some of the roads every year since they began building, and others at various times in their history. A list of some of the roads are given below. Since the consolidation of the Detroit railways the company has furnished the Detroit United and the Rapid Railway system both poles and ties. Also the roads connecting Toledo with Detroit, viz., the Detroit & Toledo Shore Line and the Toledo & Monroe, the first-named with poles only, and the latter with both ties and poles. The company has a yard in one of the suburbs of Detroit, River Rouge. The following railways use material supplied by the Maltby Company: Detroit, Lake Shore & Mount Clemens Railway; Detroit & Pontiac Railway Company; Detroit, Plymouth & Northville Railway Company; Detroit, Rochester, Romeo & Lake Orion Railway; Detroit & Grand River Elevated Railway Company; Detroit United Railway Company; Port Huron, St. Clair & Marine City Railway Company; Wyandotte & Detroit River Railway Company; Toledo & Monroe Railway Company; Detroit Citizens' Street Railway Company; Detroit Construction Company; Detroit, Ypsilanti & Ann Arbor Railway Company.

The Babcock & Wilcox Company, New York, has installed water-tube boilers in the following plants in and around Detroit: United Railways, 12 boilers of 250-hp capacity each; Rapid Railway Company, 4 boilers of 300 hp; Detroit, Ypsilanti & Ann Arbor Railway, 8 boilers of 230 hp; Detroit & Pontiac Railway, 2 boilers of 230 hp; Toledo & Monroe Railway Company, 2 boilers of 230 hp each.

Brakes manufactured by the G. P. Magann Air Brake Company, Detroit, Mich., are being used on all the double-truck cars of the Detroit United Railway, Detroit & Wyandotte, Detroit & Northwestern, Detroit & Pontiac, and Detroit, Rochester, Romeo & Flint roads.

Large quantities of insulating varnish is supplied by the Sterling Varnish Company, Pittsburgh, Pa., to the railway and electrical trade in Detroit and vicinity, comprising the Sterling extra insulating varnish for the insulation of armatures, field coils, etc.; the Sterling extra black finishing varnish for the finishing coat to be applied to electrical apparatus to bring it up to a jet black, handsome, glossy appearance; the Sterling black air drying varnish for making quick repairs where there is not sufficient time to bake the coils before and after insulating, and the Sterling black core plate varnish for the insulation of armature discs.

The Wheel-Truing Brake-Shoe Company, Detroit, Mich., manufactures a wheel-truing brake-shoe which in a short period of three and one-half years is said to have found favor with upwards of 400 different electric railways in this and other countries, besides being adopted by steam roads. The roads in and about Detroit are using the device, of which shipments were recently made to Australia, South America, Portugal, India, Africa, Netherlands, Ireland, Scotland, England, and other foreign points.

Trolleys, gears and pinions made by the R. D. Nuttall Company, Pittsburgh, Pa., are in use on the following lines in and around Detroit: Detroit Citizens' Street Railway; Detroit, Lake Shore & Mount Clemens Railway; Detroit, Plymouth & Northville Railway; Detroit United Railway Company; Detroit & Toledo Shore Line Railway; Detroit, Ypsilanti & Ann Arbor Railway; Rapid Railway Company; Toledo & Monroe Railway Company; Wyandotte & Detroit River Railway Company; Detroit & Pontiac Railway; Detroit, Rochester, Romeo & Lake Orion Railway; Detroit Railway Company.

The Consolidated Engine Stop Company, New York, has installed its safety engine stop system in Detroit at the plants of Nelson, Baker & Company, manufacturing chemists; Ireland & Matthews Manufacturing Company, stove trimmings and sheet metal goods, and Stephen Pratt, manufacturer of steam boilers.

Practically all of the railways in and about Detroit use lightning arresters made by the Garton-Daniels Company, Keokuk, Ia. The Detroit, Ypsilanti, Ann Arbor and Jackson Railway Company use them throughout, while nearly all of the roads composing the Detroit United Railways system have a large number of the company's lightning arresters in use.

Merritt & Company, Philadelphia, Pa., has supplied to the railway companies in Detroit and vicinity a system of lockers which may be seen at the plant of the Detroit, Ypsilanti, Ann Arbor & Jackson Street Railway Company, and the Grand Rapids, Grand Haven & Muskegon Railway Company. Among other places in Detroit, the company's locker construction can be seen at the Lloyd Construction Company, Solvay Process Company and Detroit City Gas Company.

The 25-ton hand traveling crane in the plant of the Detroit Citizens' Railway was built by the Brown Hoisting Machinery Company, Cleveland, Ohio. The crane has a span of 60 ft., and its operations, including hoisting, trolley traveling and crane traveling, are performed by means of hand cranks from a platform attached to the under side of one end of the crane.

The Lorain (Ohio) Steel Company is said to have furnished practically all of the rails and special work in use in the Detroit Railways system, except that part of it which was built by the Pack-Everett syndicate.

In electric cars in and around Detroit three types of the cross-seats made by the Hale & Kilburn Manufacturing Company, Philadelphia, Pa., are used, viz., stationary seat No. 2, about 66 ins. long, with spring cushion and back, upholstered in plush, and also some upholstered in rattan. These are for cars having the aisle at one side, the arrangement of seats being practically the same as in open summer cars, the car, however, being closed at the inner end or side; stationary seat, No. 3, about 34 ins. long, of the same general style, but for use in cars having the aisle in the center, and always "running head on;" walkover seats, patterns Nos. 80½ and 99-E, with spring cushion and back, upholstered in plush, also some upholstered in rattan. These three types are used on the cars of the Detroit United Railway, Detroit & Pontiac Railway, Detroit & Northwestern Railway, Detroit, Rochester, Romeo & Lake Orion Railway, Rapid Railway, of Detroit, and Detroit & Toledo Shore Line Railway.

The advertising privileges in the electric cars of Detroit and vicinity are controlled by the Mulford & Petry Company, which has established an enviable reputation in the efficient handling of street

car advertising. The executive offices of the company are located in Detroit, together with the designing department and printing plant, where advertisments are prepared under the direct supervision of the company's officers. The Mulford & Petry Company has branch offices in New York, Chicago, Philadelphia, Cleveland, Toledo, Dayton, Indianapolis, Grand Rapids, Youngstown, Toronto and Montreal. It now controls the advertising privileges on a large percentage of the roads in Michigan, Ohio and Indiana, and is prepared to handle business in any part of the country.

The Le Valley-Vitæ Carbon Brush Company, of New York, is furnishing Le Valley-Vitæ carbon brushes to the Detroit & Lake Saint Clair Railway Company, Detroit United Railways Company, Detroit & Pontiac Railway Company, Detroit, Rochester, Romeo & Lake Orion Railway Company, Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company, Rapid Railway System, Toledo & Monroe Railway Company.

William C. Baker, inventor of the Baker hot-water, non-freezing car heater, of New York, has furnished hot-water heaters for the cars of Detroit, Lake Shore & Mount Clemens Railway, Detroit, Ypsilanti & Ann Arbor Railway, and Rapid Railway Company.

Sand-boxes manufactured by the De Witt Sand-Box Company, Troy, N. Y., are in use on the Mount Clemens (Mich.) & Belle Isle electric roads.

AMONG THE MANUFACTURERS

THE STANDARD POLE & TIE COMPANY, New York, are delivering a large number of poles at Toledo, Ohio.

W. G. A. MILLAR, formerly manager of the ornamental department of the American Bridge Company, has been appointed purchasing agent of that company, with offices at 250 South Fourth Street, Philadelphia, Pa.

C. H. BROWN & COMPANY, Fitchburg, Mass., manufacturers of the Brown engines, has furnished a 22 in. and 40 in. x 48 in. cross compound condensing direct-connected engine for the Houghton County Street Railway Company, of Hancock, Mich.

ROBINS' BELT CONVEYORS for handling salt are illustrated and described in an attractive four-page folder issued by the Robins Belt Company, of New York. Several views of conveyors in actual operation are shown. Copies will be mailed free upon application.

THE CRANE COMPANY, of Chicago, has just issued a new pocket catalogue of 164 pages. This book covers the company's complete line, including standard, medium, low-pressure; extra-heavy and hydraulic goods in brass and iron, engineers' supplies, tools and pipe. Copies may be obtained by writing the home office or to any branch house.

SEVERAL YEARS AGO Herschell, Spillman & Company, North Tonawanda, N. Y., amusement outfitters, installed a number of outfits in Michigan, and as they report that these have all gradually worked West and South, except a few that were taken to Canada, it would seem that Detroit and vicinity ought to be a good place to locate a merry go-round.

THE NEW HAVEN CAR REGISTER COMPANY states that it is expecting to make an especially large exhibit of registers and its other specialties at the Detroit convention, and will probably also exhibit at that time a new device for electric railway work. The company has not yet disclosed the nature of this apparatus, but it is understood that it is something of great value in railway work.

THE DETROIT GRAPHITE MANUFACTURING COMPANY, of Detroit, is doing an excellent foreign and domestic business in graphite. For instance, a recent mail brought two very large orders for graphite paint from Manila, P. I., and from San Juan, Porto Rico. The company has a force of machinists working constantly putting up new machinery and reports that its factory is working to its fullest capacity and overtime in taking care of current orders.

THE VALENTINE CLARK COMPANY, Chicago, Ill., carrying an extensive line of white cedar poles, of which a specialty is made, operates large yards and is prepared to execute orders promptly. An immense stock is carried in the yards, which are located at Pinconning, Mich., Green Bay, Wis., New London, Wis. and Prentice, Wis., all conveniently situated directly on railroad lines. The company issues an interesting eight page illustrated folder that will be mailed free upon application.

THE PECKHAM MANUFACTURING COMPANY has just received an order from the new Washington & Baltimore Railway for all the trucks to be used on that line. This is the new through line which has been referred to in several recent issues of the JOURNAL and is controlled by the same capitalists who own the Aurora, Elgin & Chicago Railway, on which line the Peckham trucks are also in use. The trucks will be of the same style as those employed on the latter railway, which is the largest high speed line in the country.

SOME OF THE RECENT ENGINE INSTALLATIONS made by the Baker Engine & Machine Company, Philadelphia, Pa., are as follows: J. B. MacAfee, for the Augusta & Aiken road, Augusta, Ga., two 600-hp tandem compound condensing Corliss engines, running at 150 r. p. m.; M. P. McGrath, Lansdale and Norristown, two 400 hp automatic engines, running at 200 r. p. m.; Tennis Construction Company, West Chester, Downingtown & Coatesville Railway, two 600-hp Corliss and one 400-hp automatic engines, Pennsylvania State Construction Company, Cumberland & Frostburg Railway, two 400-hp automatic engines.

JAMES W. COPELAND, of Denver, has been appointed sole agent for the State of Colorado for the Scaife and We-Fu-Go Water Softening & Purifying Systems, manufactured only by William B. Scaife & Sons' Company, Pittsburgh, Pa. Mr. Copeland was formerly located at St. Paul, where for a number of years he was one of the most successful manufacturers' agents of the city. He has recently opened an office in Denver to further the interests which he represents, and is well known throughout the West in mechanical and engineering circles. Mr. Copeland has always given the subject of water purification considerable attention, and is particularly well versed in this line.

THE OTIS ELEVATOR COMPANY has recently closed a contract with the Subway Construction Company for an escalator, or moving stairway, to be installed at the Manhattan Street station of the new rapid transit road. At this point the subway crosses the Manhattan Valley on a viaduct, the tracks being about forty feet above the level of the street. The escalator will carry passengers both up and down, the two tracks being arranged in the same vertical plane. The guaranteed carrying capacity of the device is 20,000 people per hour—10,000 in each direction. A motor of 25 hp will be sufficient to operate the mechanism when working at its maximum capacity.

THE STILWELL-BIERCE & SMITH-VAILE COMPANY, Dayton, Ohio, recently supplied to the Muskegon (Mich.) Traction Company a special cast-iron heater in connection with outside packed feed pumps and circulating pumps. This company also furnished the Chicago Edison Company, of Chicago, Ill., a 10,000-hp heater and is constructing for the Canton-Akron Company two vertical feed pumps. Some time ago the company supplied the Northern Ohio Traction Company with a combined jet condenser and vacuum pump and the Dayton & Covington Traction Company, West Milton, Ohio, condensing apparatus, feed and circulating pumps, heater and triplex electric pump.

JAMES B. CLOW & SONS, of Chicago, have just issued their new catalogue of supplies for water and gas works, railways, contractors, plumbers, steam and gas fixtures. Although comprising 840 pages, it is of a convenient size and will no doubt be one of the standard reference works on the desks of all who have anything to do with steam and sanitary matters. This company is thoroughly up to date in its business methods, as was recently outlined in these columns at the time a description appeared of this firm's new building in Chicago. This catalogue, and the many other attractive advertising schemes which emanate from this company, are due to Miss Helen Mar Shaw, advertising manager.

C. J. HUEBEL & COMPANY, dealers in cedar posts and poles, were incorporated twelve years ago. Their main concentration yard is at Menominee, Mich., from which orders of any ordinary magnitude can be shipped within twenty-four hours from their receipt. The firm has had the benefit of twelve years' experience and can naturally meet the wants of large customers, such as electric railway companies, in a very satisfactory way. It buys its own stumpage, and the customers are given the advantage of the fact that they do not need to deal through middlemen. In addition to the main concentration yards at Menominee, Mich., the company has seven branch yards from which to supply local demands.

THE JOHNSON COMPOUND & SUPPLY COMPANY, of Rochester, N. Y., is placing on the market the sumac elastic paint. This paint has been tested under the most severe conditions and found to give excellent results. It is especially adapted to give a durable and elastic coating to all metal surfaces, such as boilers, trucks, poles, bridges, etc. The manufacturers claim, among other points, that excessive heat, smoke, dampness, water or acid have very little effect on this paint. It never scales or falls off, no matter what the conditions may be. This is largely due to the fact that no coal tar or benzine are used in its composition. Right materials, compounded in the most careful manner, characterizes the sumac elastic paint.

JAMES G. CONNER & COMPANY, Philadelphia, Pa., manufacturers of varnishes and japans, has issued a bright red folder to which attention is attracted by a statement on the first fold which would lead one to think that the company was "doing a hell" of a business, but the second fold reveals the missing "o" of hello, so that the sentence reads "We are doing a hello business now in 'battery paint black,'" a compound which has given satisfaction in painting work in storage battery rooms and on all kinds of electrical and structural iron work, the manufacturers claiming it to be the best insulating and anti-rust paint made. The company is also sending out some attractively printed blotters, calling attention to some of the advantages in using battery black paint.

THE JOHN A. MEADE MANUFACTURING COMPANY, of New York, has just issued an extremely neat, attractively illustrated twenty-four-page catalogue descriptive of "something new" in the shape of belt conveyors. The catalogue not only shows the construction of the conveyor and its application, but it clearly defines the advantages which are inseparable from their use. Illustrations of the company's patent trolley and traction system and automatic radiating truck are also shown. This company's line of machinery covers automatic, steam shovels, unloading towers, automatic, shuttle and industrial cable railways, gravity bucket, scraping and belt conveyors, bucket and case marine elevators, etc., comprising a complete line of labor-saving machinery for unloading, storing, reloading and economically handling any type of material in bulk or package.

"MODERN WOOD PAVEMENTS" is the title of a forty-two-page cloth-bound book issued by the United States Wood Preserving Company, of New York City, describing the company's creo-resinate process of preserving timber and including a paper on "Recent Experiences with Wood Pavements," by B. T. Wheeler, superintendent of streets of Boston, Mass. The author of the book, Fred H. Kummer, C. E., Jun. A. S. C. E., has also prepared a pamphlet in which similar data is presented, and in a paper on "A Proposed Method for the Preservation of Timber," read by him before the American Society of Civil Engineers, together with the discussion elicited thereby, much interesting information is brought to light, nearly a score of the members having

talked on the subject. A reprint of the last-named paper is issued by the United States Wood Preserving Company, from whom any of the publications mentioned may be secured.

"THAT REGISTER WILL LAST AS LONG AS THE CAR" is what a candid street railway man said after examining the new Sterling No. 5, made by the Sterling-Meeker Company, Newark, N. J. There is some foundation for such exuberant praise. A register is a complex machine, and if it keeps a true record, with all the banging it gets, it should not be expected to last forever, yet every expert who looks into the No. 5 is impressed with the strength of every part and the obvious preparation for great and unusual durability.

THE STUART-HOWLAND COMPANY, of Boston, Mass., reports a very prosperous season in electric railway supplies. This company represents what can be accomplished in a few years by a thoroughly active and up-to-date business policy. It has salesmen and representatives in every section in this country, and has recently arranged with Theodore May to represent them in Paris. Mr. May is well known in electrical circles in England and on the continent. With salesmen and representatives in all parts of the world the Stuart-Howland Company keeps itself thoroughly posted on what is going on, and very few contracts for any kind of construction work are awarded without the knowledge of its managers. Since the first of January over 700 miles of road has been equipped with the Stuart-Howland overhead material. This material is meeting with favor among engineers and managers on account of its improved design, as well as the important features of strength and durability.

AMONG RECENT SALES of plows made by the Taunton Locomotive Manufacturing Company, Taunton, Mass. are the following: One heavy nose plow, Chicago, Harvard & Geneva Lake Railroad Company, Walworth, Wis.; one heavy nose, Citizens' Electric Railway, Light & Power Company, Mansfield, Ohio; one heavy nose, Pennsylvania & Ohio Railway Company, Ashtabula, Ohio; one Boston share, Chicago & Joliet Railway, Joliet, Ill.; two heavy nose, Houghton City Street Railway Company, Hancock, Mich.; one heavy nose, Illinois Interurban Construction Company, Rockford, Ill.; one snow sweeper, Cleveland, Painesville & Eastern Railroad Company; two heavy nose, Indiana Railway Company, South Bend, Ind.; one heavy nose plow and one snow sweeper, Cleveland, Berea, Elyria & Oberlin Railway Company; one heavy nose plow and one snow sweeper, Cleveland & Eastern Railway Company, Chardon, Ohio; one heavy nose plow and one share, Chicago Consolidated Traction Company.

ROBERT BELLAMY, the inventor and patentee of the Bellamy vestlette for conductors, which was formerly manufactured by the A. B. C. Manufacturing Company, of Cleveland, has incorporated a new company with paid-in capital stock of $20,000, to be known as the Bellamy Vestlette Manufacturing Company, and will continue the manufacture of this article, which is widely used by conductors on leading street railways of this country and abroad. The new company has a large factory especially designed for its work, and is now in position to fill orders in quantities. The vestlette is now being made from a new material which is so durable that, it is claimed, the garment will outwear six or seven uniforms. It contains nine large and convenient pockets, which are so designed that it is impossible for money or tickets to be stolen by pickpockets or in running to switches or jumping on and off cars. Since the organization of the new company it has been flooded with orders and inquiries, and the vestlette has been adopted by several leading roads as part of the regular uniform.

THE H. W. JOHNS-MANVILLE COMPANY'S exhibit at the Detroit convention will include a full line of overhead line material, comprising a number of newly designed devices, a working display of electric car heaters and Sach's "Noark" fuse protective devices. In this part of the exhibit an especially interesting feature will be a line of newly designed insulated and metallic crossings and section insulators, which embody a number of new features and which are claimed to eliminate the trouble experienced with other devices used for similar purposes. The line of subway fuse boxes to be shown represents the largest and most complete line of work ever built of this description and will be very interesting, together with the other new features in the fuse business that are also exhibited. Those present at the convention will be: I. W. Perry and J. E. Meek, of the New York office; D. T. Dickson, of the Philadelphia branch; S. H. Finney, of the Chicago branch; William A. Buddecke, of the St. Louis branch; also E. B. Hatch and Mr. White, representing the Johns-Pratt Company.

THE CHRISTENSEN ENGINEERING COMPANY, of Milwaukee, will distribute at the convention a booklet containing the names of the roads upon which its air brake apparatus is installed, together with the number of equipments on each road. This is in accordance with the Christensen Company's well-established policy of publishing the names of its patrons, so that any one who desires to consider the merits of the Christensen air brakes may know where to see the equipments in use under the severe conditions of actual service, which is the only satisfactory test for mechanical appliances. The company has also arranged an interesting exhibit at the convention, including a complete air brake equipment in operation. That the apparatus of this company continues to hold its high popularity is shown by the continual growth of its factory, made necessary to fill the demands for brakes. It was only recently that the company completed a very large plant in Milwaukee, but the demand for apparatus has already out-stripped its manufacturing facilities, and the company is now engaged on a 250-ft. extension to its present machine shop, which is 186 ft. in width. This extension, when completed, will therefore cover 46,500 square feet of ground space. In addition to the ground floor, 41,500 square feet more floor space will be provided by the galleries on each side and in the center of the building, which is three stories in height.

THE NEAL DUPLEX BRAKE is illustrated and described in a handsomely printed twenty-four-page catalogue issued by the United States Steel Company, Everett, Mass. A number of line drawings, together with several high-grade half-tone engravings, are given to show the application of the brake and the arrangement of the mechanism, of which there are two parts, viz., an axle-driven pump of ordinary construction and a cylinder holding about three gallons of a non-freezable oil. The cylinder, which is fastened to the sills of the car, contains two pistons that are connected directly to the regular brake levers. When the brake is not in use the oil is forced by the pump through one piece of a flexible hose, returning to the pump through another. The valve through which the oil leaves the cylinder can be closed by the motorman with one-quarter of a revolution of the ordinary hand brake, after which the brake remains on and the hand brake may be wound up as far as desired. Release of the brake is instantaneous. The brake cylinder valve is provided with graduated ports, thereby enabling the motorman to make either an emergency or a service stop, as occasion may require. This brake is the invention of J. H. Neal, who was for a long time associated with the Boston Elevated Railway Company. A copy of the catalogue, with further information, will be furnished free upon application.

C. J. HARRINGTON, 15 Cortlandt Street, New York, has just issued a very complete 128-page catalogue that will be of interest to every one connected with street railway, lighting and telephone companies. The catalogue is copiously illustrated, and a full stock of everything shown therein is carried, so that hurry orders may be filled promptly, the material being of first quality as regards metal, insulation and workmanship, none but experienced workmen familiar with the requirements of line work being employed in the manufacture of the goods. Mr. Harrington's personal experience in the electrical supply business has without question placed him in a position to understand the requirements of the trade at large. An instance of this is shown in his purchase of the well-known Medbury insulating plant, which has been dismantled and removed to the Harrington factory at Newark, N. J., where the same high grade of insulated material will be manufactured under the Harrington standard trade-mark, "Empire," instead of the Medbury name. In addition to the line of material manufactured, Mr. Harrington is the sole Eastern representative of several concerns that are well known in the railway and electrical trade, among them being the Banner Electric Company, Youngstown, Ohio; Heil Rail-joint Welding Company, Milwaukee, Wis., and the Scranton Fire Brick & Conduit Company, of Scranton, Pa. The Harrington exhibit occupied space No. 6 at the Detroit convention, also parlor E at the Hotel Cadillac, where friends were entertained.

THE GROWTH OF AN IMPORTANT COMPANY. Few persons realize the magnitude of the gear, pinion and trolley business of the R. D. Nuttall Company. A dozen years ago, when this company first began the manufacture of gears and pinions for street railway service, the demand for this class of material required the use of but one gear-cutting machine. Soon it was found necessary to add another machine and later advisable to increase the equipment by two additional machines. Since then new and improved machinery has been added from time to time, until at the present upward of seventy gear-cutting machines (the largest gear-cutting equipment in the world) are taxed to their utmost to supply the demand for the well-known "Nuttall make" of gears and pinions. Within the past few years foreign agencies have been established in many of the larger European cities, and the number and size of orders received through this source has exceeded all expectations. The almost universal adoption of heavy cars and powerful motors for high speed and interurban service has made it necessary to correspondingly increase the weight and improve the design of motor gearing, and this company, fully alive to these requirements, has placed in the market a very complete line of heavy design gearing for this particular service. A complete motor-bearing department has recently been added and a full line of all standard bearings will be carried in stock. Last, but by no means least, is the trolley department, in which are manufactured trolleys and trolley repair parts for every conceivable trolley service. Under the able management of F. A. Estep this company has attained an enviable position in the street railway supply business, and the reputable business methods to which the company's past success may be accredited are sure to be adhered to in the future.

THE ST. LOUIS CAR COMPANY has been very busy recently, having within the last few days shipped fifteen single-truck cars to the Dallas Consolidated Street Railway Company, ten double-truck cars to the Dallas Rapid Transit Company, both of Dallas, Tex.; ten single-truck convertible cars to the South Covington & Cincinnati Street Railway Company, at Covington, Ky., and twenty-seven single-truck cars to Birmingham, Ala. A shipment of six cars, completing an order of sixty, was sent to the Northwestern Elevated Railway and the Lake Street Elevated Railroad, of Chicago. The company has also recently shipped four long interurban channel-steel convertible cars to the Interurban Railway, of Des Moines, Ia., and the same number and same type cars to the Richmond Interurban Company, of Richmond, Ind. In addition to this, ten cars have been shipped to the Louisville (Ky.) Railway Company, completing an order for seventy-five cars, and the work of shipping fifty cars to Los Angeles, Cal., for service on the Pacific Electric Railway has been begun. Of the cars for the Pacific Electric Railway thirty are to be of the combination type and twenty will be high-speed cars for interurban service, geared to be run at a speed of 60 miles an hour. The company is also completing a shipment of cars to Akron, Ohio, for interurban service on the Canton & Akron Railroad. These cars, which are 60 ft. long, have three compartments, a regular passenger compartment, beautifully fitted up; a smoking compartment and a baggage compartment. An order of twelve cars for use on the East St. Louis & Suburban Railway Company, running between East St. Louis and Belleville, is being completed, as is also an order of ten cars of the same type for the Cincinnati, Georgetown & Portsmouth Railway, of Cincinnati. The company has secured from the St. Louis & Suburban Railway a large order for convertible cars. In these cars the windows, both upper and lower, can be lowered to a line with the seats, giving an unbroken view from the inside of the cars. These cars will be built and completed at once, and will be painted an olive green, the new color that the St. Louis & Suburban Railway has adopted, in order to distinguish them from the cars of the St. Louis Transit Company. Contracts are being let for the erection of the largest street car electric truck and blacksmith shop in the country, by the St. Louis Car Company. The buildings will be 600 ft. long and 377½ ft. wide, and will be built of brick.

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The Convention

The Detroit meeting will be remembered as being distinctively an interurban gathering, and remarkable chiefly because of the interest manifested in everything pertaining to the construction, equipment and operation of interurban lines. This characteristic might be explained by the growing importance of this branch of electric railroading and the additional fact that the place of meeting was a center of interurban operations. The members had an excellent opportunity of examining the practical operation of roads of this description during their visit to Detroit, and it is not too much to expect, in view of the interest that has been awakened in this subject, that a large number of railroad men will be attracted to the association who have heretofore held aloof from it. It is quite probable, too, that the suggestion of Mr. Vreeland, regarding the expansion of the scope of the association's work, shall take form and become a reality much earlier than he anticipated. It is certain that the interests shown at this time in interurban work far exceeds any that has been manifested heretofore in this important field.

In point of attendance and character the convention was large and representative and in every way thoroughly satisfactory. The exhibits were in keeping with the importance of the occasion. The only criticism or objection heard was due to the lack of sufficient facilities for showing the apparatus to the fullest possible advantage. This was not a fault of the management, but was due entirely to the fact that the demands for space were greater than could be accommodated in any hall in the city of Detroit. Under the circumstances it was generally admitted that the organization of the exhibition department was as satisfactory as could reasonably be expected. It seems that the organization hereafter will be confronted with a very serious problem in securing adequate accommodations for exhibitors who desire to bring their apparatus before the attention of members of the association. It certainly speaks well for the importance and representative character of the association, and is a practical recognition of the value of their meetings that there should be such competition among manufacturers of all classes of apparatus and fittings used in railway work to be represented on these occasions.

The meetings of the Accountants' Association, which were held at the same time as those of the Street Railway Association, commanded the undivided attention of this important element in street railway organization and management. It is gratifying to note that the interest in this association is unabated, and that the outlook for a continuation of the good work which it has undertaken is even more favorable than it was a year ago. The association has enlisted the support of the leading accountants of the street railway world, and the high standard of its work is universally recognized.

The meetings of both organizations were well attended, and much interest was shown in the papers presented. The report of Wednesday's proceedings of the American Street Railway Association is printed in this issue. The report of Friday's meetings, together with descriptions and illustrations of the exhibits, will appear in next week's issue.

Express and Package Delivery

The paper by Mr. Parker, which is presented elsewhere in this issue, was received with considerable interest at the convention, but the discussion was limited, as the experience of the interurban companies represented by Mr. Parker was not sufficient to justify him in presenting data that could be considered reliable upon the relative cost, receipts and investment in the operation of this service. There was a good deal of interest manifested in the methods employed in handling freight and express, as explained by the author, and the system of interchanging between roads entering the city from different directions. It was mentioned that the most important problem which confronted the Detroit management was the expense of handling freight prior to the consolidation of the electric lines and the establishment of a union

station. Before the present organization was effected there were three distinct companies engaged in this traffic, each maintaining a separate depot, employing an agent and staff and consequently involving a duplication of expenses in many branches. When the roads got together, however, it was soon determined to establish a union freight station, where all the freight could be handled. This arrangement possesses many advantages aside from the reduction in the expenses of clerical help and freight handlers. It eliminates the expense of cartage from one station to another and enables the companies to conduct their business along the same general lines as the steam roads. The experience at Toledo and other centers of interurban electric railroading is similar to that at Detroit, and the advantages of establishing union stations are now generally recognized. Another evidence of the extent to which this feature of electric railroading has been developed was manifested by the advancement that has been made in working out the details of operation and the adoption of forms for freight and express departments. Mr. Parker's paper contained a number of the forms which are used by the Detroit United Railway, and a great deal of interest was manifested in this feature of the subject by those who were engaged in the operation of similar lines.

* * * * * * *

The tendency to impose restrictions and taxes upon every development of the electric railway has already been manifested in many places where the local street railway company has extended its lines into suburbs or established interurban service. This is accounted for by Mr. Parker on the theory that, to the lay mind, the express and parcel business of the electric system appears to be merely another profitable use of the franchise, involving no additional expense beyond suitable rolling stock and the necessary train crews. There are, however, many additional expenses incurred, and an entirely new organization is often required for the proper handling of the business. But this is understood and expected by the companies engaging in this work. They do not, however, expect that they are to be confronted at the outset by unjust taxation, although they are often seriously handicapped by such measures. In the case of Detroit, for instance, an ordinance was enacted which prohibits the use of trailers and levies a tax of $1 per car per round trip, regardless of whether the car is empty or loaded. This, of course, is far from encouraging, and in many cases practically prohibits the proper development of this service, as many companies are not in position, and none are willing, to pay taxes on empty cars, even though they may feel that there is a splendid future for the enterprise. It should be appreciated by those who have the welfare of the city at heart that a service of this character can only be developed properly by providing for prompt and frequent collections and deliveries, and thus educating the people up to the point where they will depend upon them and feel safe in doing so. Of course the company will have to run empty cars for awhile, until sufficient patronage is secured, but in most cases it is willing to do this, and look to the future for recompense, but it should not be subjected to such conditions as the imposition of a tax like that at Detroit.

To Relieve the Bridge Crush

The latest plan for the relief of the present condition at the Manhattan terminal of the Brooklyn Bridge is described elsewhere in this issue. It is the result of careful study by an engineering commission appointed by Mayor Low to examine the several plans that have been submitted from time to time, and investigate the entire problem with the view of obtaining immediate relief as well as devising a plan for permanently increasing the transportation facilities. The commission first considered the plans prepared by Niels Poulson, which were described and illustrated in the STREET RAILWAY JOURNAL of Sept. 20, and went over the ground carefully with the engineers of the bridge department, but for several reasons, which are explained in detail in the report of the commission, it was found inadvisable to adopt Mr. Poulson's suggestions. This examination, however, led to the development of the arrangement of loops which it is now proposed to adopt as a substitute for the present terminal facilities. It is greatly to be regretted, though, that the commission finds it impossible under existing conditions to recommend a system which will at once greatly increase the carrying capacity of the bridge.

The committee does not advocate the adoption of this plan as a permanent measure of relief, but frankly admits that while the additional loops will afford the greatest relief possible under present conditions by reducing the congestion and decreasing the danger of accidents, the system will still retain, in a minor degree, at least, all of the defects of the present arrangement, and that its chief claim for consideration is the fact that it will afford better facilities for entering and leaving the cars.

There is one point, however, which the committee raises in this connection which must be faced sooner or later, namely, the desirability of obviating delays and annoyances now caused by the blockading of traffic during rush hours by reason of the large number of trucks and private vehicles that use the bridge. It is suggested that this vehicular traffic be restricted. The bridge is already overcrowded, and additional transportation facilities can only be afforded by removing a part of the present strain upon the structure.

The revised plan described in the committee's report has been approved by the Mayor and the Commissioner of Bridges, and it is announced that work on this improvement will be begun at once. It is hoped that before the first of the year the new plan will be in successful operation, and in the meantime the work of developing a permanent plan will be prosecuted vigorously.

Alternating Railway Motors

Mr. Lamme's institute paper on the electrical equipment of the Washington, Baltimore & Annapolis Interurban Railway, which was published in our last issue, marks a new phase of the struggle against the limitations imposed by direct-current distribution. The space at our disposal last week prevented us from doing more than publishing the paper itself. It will not, to use a frequent editorial phrase, "repay careful study," because a single cursory reading fully discloses all that the author at this juncture sees fit to make public, but the matter is interesting and may prove to be important. We have seen too many "new systems," carefully engineered and strongly backed, sink into merited oblivion, to get rashly enthusiastic over the present one before it is in commercial operation. Yet it deserves consideration by reason of its somewhat revolutionary boldness. The radical sometimes succeeds where the conservative is doomed to a dead level of failure, and every real advance in the art is radical until it is tried.

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The history of attempts to avoid the difficulties of long-distance distribution at 500 volts is not a long one, nor is it a story of brilliant achievements. When the electric railway had outgrown the normal and proper limits of its working voltage the trouble began. Chiefly by reason of the moderate output demanded on many of the longer lines, the obvious plan of separate generating stations has been tried less often than it deserves, and attention has been directed to alternating distributions. The present direct-current railway motor is so admirable a machine and possesses in virtue of the series parallel control so wonderful a degree of flexibility that there is little reason to expect anything better in the way of alternating-current motor. It was very natural then that electric railway engineers should turn to the rotary converter as the best way out of the difficulty. This immensely useful but somewhat overrated machine enables an alternating distribution to be used in connection with standard car equipments and the customary single low voltage trolley wire.

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Distribution with rotary converter sub-stations, however, involves so much of initial expense and operating cost that unless

power can be generated in the single primary station at a very low cost indeed, the total cost with rotary converters may be and often is greater than it would be were the line equipped with independent generating stations. Were this not so there would be little incentive to take up the difficult task of adapting alternating current motors to the severe requirements of railway service. An interesting flank movement on the difficulty was made by Leonard in this country and more recently by Huber abroad, involving the use of a single-phase rotary converter on the car, thereby carrying the alternating distribution one step nearer to the car axle. Of alternating current motors for the cars we have had a few of the polyphase variety, and recently Arnold's system of single-phase motor operation, which is to be tried on a road built expressly for this service. The weak points of the polyphase system for railway work are two: First, the need of two or more working conductors, and second, the difficulty of speed regulation. Of course a rheostat in the secondary of a polyphase motor enables speed regulation to be attained on just the same terms as in the case of early direct-current motors with rheostatic control, but these are out of the game for most purposes and are very seldom used for the class of work for which an alternating current distribution is desirable. Such polyphase motors are in fairly successful use on a few foreign roads, but the solution of the problem by this means is special, not general, and leaves much to be desired. The concatenated control, experimented upon by Steinmetz some years ago, and more recently put into service by Brown and by Ganz & Co., offers a somewhat more hopeful opportunity, but is likely to lead to a bad power factor. Ganz has been driven to a very low frequency by this limitation, and it yet remains to be shown that even by this means can the equivalent of a series parallel control be obtained. If the polyphase induction motor could have this facility of speed control, we do not believe that the use of a double-working conductor would remain a formidable obstacle.

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The new attempt formulated by Mr. Lamme involves, like the Ganz plan, the use of a very low frequency, but distributes single-phase current. This dodges the double trolley difficulty but loses somewhat in the efficiency of the transmission. It permits, however, a highly efficient voltage control on the cars and so dispenses with the need of series parallel connection to avoid serious losses at low speeds. But on the other hand, it necessitates the use of heavy motors with laminated fields and involves the serious and heretofore forbidding task of commutating in a synchronous apparatus a heavy alternating current. The series alternating motor with laminated fields is by no means a new machine, but one which has been unsuccessfully tried a good many times, even at low frequency. Mr. Lamme says, and this must count for considerable, that this formidable difficulty of commutation has been overcome, but vouchsafes no detailed information as to methods. If he proves to be correct a very great step forward has been taken quite irrespective of any question of railway motors. If it is possible to get sparkless commutation on a 100-hp motor, under the severe conditions of railway practice even at 16 ~, it should also by similar means be entirely feasible to operate series alternating motors of moderate size on alternating circuits of at least 25 ~ to 30 ~, and an entirely new solution of the general alternating-current distribution problem becomes at once available. There are inherent reasons for expecting great difficulty in effecting such commutation, and we must frankly say that appearances are greatly against it, but "the world do move," and improvements must logically be expected. Granting a successful solution of the commutating difficulty it still remains to be seen how the general system will compare in total economy with a well-organized rotary converter sub-station system and with that now under construction by Mr. Huber. There is some doubt in our minds as to whether the series alternating equipment at 16 ~ will not prove to be heavier and more costly in the long run than a rotary and its direct-current motors at a more conservative frequency. But, as in the case of every new system, the only real test comes with service on a commercial scale for a considerable period. We sincerely hope that the present innovation will fulfil the expectations of its designers, for, as we have just pointed out, it involves great general usefulness quite apart from the electric railway side of the matter. It is certainly high time to infuse some new ideas into railway practice lest the foreigners get ahead of us in our own game, and we shall await with impatience further details of what promises to be a most important and interesting experiment.

Pennsylvania Tunnel Franchise

The action of Mayor Low in reopening the discussion of the Pennsylvania tunnel franchise and calling a public hearing on the proposed measure was a disappointment to those who are interested in securing this great measure of relief for New York's congested transportation facilities. The delay that will result will not, however, be the greatest evil growing out of this sudden change of front on the Mayor's part. The encouragement which this practical recognition of an irresponsible band of politicians gives to those who hold up public improvements will prove discouraging to corporations which are ready to undertake large enterprises of this kind that redound to the benefit of the entire community. If they are to be hampered, harassed and restricted by such conditions as it is sought to impose in the tunnel franchise, they will find it impossible to proceed with their plans, no matter how much they may desire to do so themselves. Such a condition must seriously affect the commercial prosperity and retard the growth of any community.

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In spite of the Mayor's action, the Rapid Transit Commission readopted at Thursday's meeting the proposed franchise in the form in which it was first granted, that is, without an eight-hour clause, a prevailing rate of wages clause, or an arbitration clause. The Mayor was present at the meeting which took this action, and he offered no objection, as he had been informed by the Pennsylvania Company that it would not accept the franchise if the obnoxious conditions were insisted upon. At the same meeting, a letter was presented from President Cassatt, of the Pennsylvania Company, in which he reiterated the statement that while the company was very anxious to proceed with the improvement, it would have to abandon the project entirely if the city adhered to the purpose of imposing the restrictions dictated by the labor unions. It was announced unofficially by the Mayor that the company was not unfriendly to the method of settling labor controversies after the manner adopted by the Rapid Transit Subway, but that it would not make any such condition a part of the franchise. It became evident, therefore, to the members of the commission and to the Mayor and Comptroller, who had advocated the amendments, that the city had reached a point where it would be necessary to determine whether the whole franchise should be thrown overboard or granted without the labor clauses, and, under the circumstances, it was unanimously decided to pass the franchise in its original form. Of course, this action is not binding upon the Board of Aldermen or upon the Mayor when he comes to exercise his power of veto, and the tendency which he has displayed to cater to the labor leaders since this controversy began, makes it uncertain what his final position may be. In any event, it is evident that the work on the tunnel will be greatly delayed because of the vacillating policy of the city administration, as the opponents of the measure have been encouraged by the weakness displayed by the Mayor and others, and will keep up their fight as long as possible. But the Rapid Transit Commission is to be commended for performing its duty fearlessly, and the Pennsylvania Company likewise for standing out for its rights under the law. It now devolves upon the Board of Aldermen to determine whether this great improvement is to be completed or sacrificed for political purposes.

New Fireproof Rolling Stock for the Central London Underground Railway

Several references appeared in this paper about a year ago to the vibration which was noticed in the buildings along the streets in London under which the Central London Underground Railway runs, and which was attributed to the operation of the trains on that line. The matter was considered so serious that it was brought before Parliament, and the company was requested to take steps to reduce the disturbance. At that time the road was being operated by locomotives in which the motors were mounted directly on the axles, and it was thought that the vibration was undoubtedly due to the pounding effect on the rail joints of this uncushioned load. Owing to the restrictions imposed by the size of the tunnel it was at first thought that the best solution to the problem would be a geared locomotive, and one was built. At the same time a motor-car train was also put in experimental service. The result of the trial showed that while the geared locomotive reduced the trouble considerably the use of the motor train eliminated entirely all noticeable vibration, and the latter type of train equipment was consequently adopted.

Another reason for the adoption of the motor-car train idea was to increase the acceleration. The old locomotive train had a maximum acceleration of 1.4 ft. per second per second and an average acceleration of 0.7 ft. per second per second, while the motor-car train has a maximum of 2½ ft. per second per second and an average acceleration of 1 ft. per second per second.

The difficulties in finding room for the disposal of the motors and their equipment in the narrow space available in the tunnel were considerable, but were overcome by the engineer of the company, H. F. Parshall, by the design illustrated herewith. Sixty-four of these cars have been ordered from the Birmingham Railway, Carriage & Wagon Company, and Brown, Marshall & Company, of Birmingham, and two motor cars will be used per train, one at each end, with five trail cars, making a seven-car train. With the acceleration mentioned above the company expects to make the run between the terminals at the Bank and Shepherd's Bush in 20 minutes, and to operate cars on a headway during the rush hours of 2¼ minutes.

Another important feature of the cars is the fact that the motormen compartments and all parts in the vicinity of the motors and controlling apparatus are absolutely fireproof. This was considered very important for trains running in a subway 30 ft. or more underground, and it was the desirability of removing all possible danger of fire that was one reason for the original decision to use separate locomotives.

The fireproof motorman's compartment mentioned is bolted to the frame work of the car, and can easily be detached from the rest of the body when desirable. Through the courtesy of Mr. Parshall this paper was supplied with plans and specifications of the motor cars and other parts of the equipment. An abstract follows:

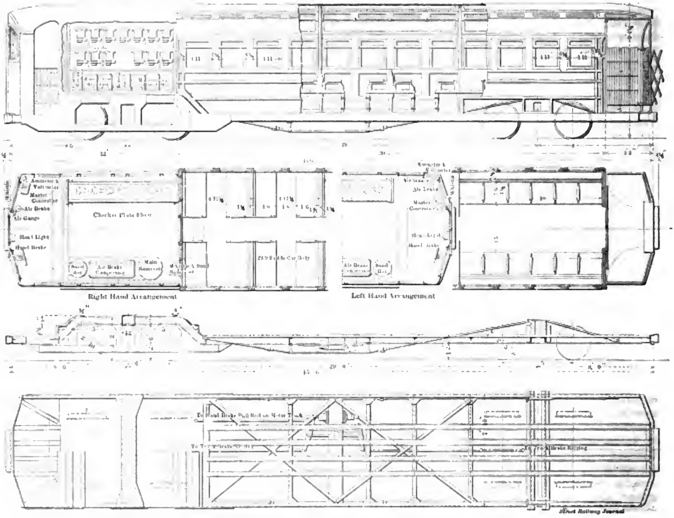


FIG. 1.—LONGITUDINAL SECTION AND PLAN OF CAR AND OF FLOOR FRAMING

The motor car bodies are divided into three portions—motor cab, passenger compartment and rear platform—as shown in the engraving. Since the drawing was completed, however, the number of cross seats in the middle of the car have been reduced from ten on each side to six on each side, and the longitudinal seats have been extended in consequence.

The under frame is of rolled channel steel, and the four center sills and the head stocks are filled in with oak. The body bolsters at the motor end are of channel section, and at the trailer end of Z section. The frames are trussed by means of iron rods with turn-buckle. With the exception of the cab, the whole of the body framing is of teak, mortised and tenoned together and bound with strong wrought-iron knees. The side framing is trussed with diagonal braces and strap bolts, and the side of the body is tied by means of six ⅜-in. tie-rods carried through the longitudinal framing and cant rail. The bottom of the side frame is secured to the under frame by twelve ⅝-in. and eight ½-in. bolts.

The passenger compartment is panelled inside on the ends and sides. The framing is of light-colored teak, and the panels are of yellow pine, veneered with white sycamore, with teak mouldings

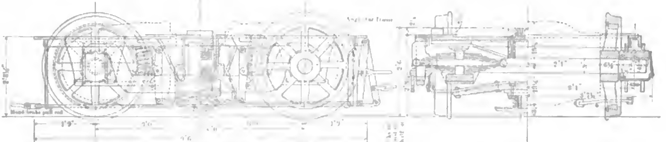
around each panel. The roof is in three panels longitudinally, and covered with ¼-in. mill board, each panel having an ornamental lincrusta border and lincrusta moulding on the edges to match the present rolling stock. The strap rail is to be of teak. The floor boards of the passenger compartments and also of the platforms are of 1-in. red deal, laid transversely and protected by wearing slats of rock elm. The seats are to be of perforated bent wood.

The cab, which consists of the front platform and switch compartment, is a self-contained steel structure, and is bolted to the under frame and the car body, so that when desired it can be removed bodily without disturbing any of the apparatus contained in it. The framing is of angle steel. The front screen is of sheet steel, glazed in the upper part and provided with double sliding door, also glazed in the upper part, which is suspended by rollers on a steel rail. The sides of the cab are closed for a portion of their length by swing gates secured by snap locks without outside handles. The remainder of the side is of sheet steel with louvres in angle steel sliding frames, suspended by rollers on steel rails. The rear partition is also of sheet steel and provided with an opening which is closed by a sheet steel door. This door is lagged with ⅛-in. uralite or asbestos on the side nearest the passenger compartment and covered with uralite panels veneered with sycamore and framed in teak to match the passenger compartment. The rear partition of cab is 1 in. clear from the nearest part of the body end panels, the space being filled in with fire-resisting material. A sheet of ⅛-in. uralite or asbestos is placed over the whole rear partition, between it and the body framing. The floor of the cab is composed of chequer plates, except on the front platform, which is the same as the passenger compartments. The open spaces under the rheostats are covered with iron wire gauze, so as to exclude dust as much as possible. The roof of the cab is of sheet steel and the rear platform is closed by automatic gates in the same way as on the old rolling stock. There is an iron grill screen 4 ft. 6 ins. high round the end of the platform, and a collapsible iron screen is provided at one side for coupling on to the trailer car. The roof over the passenger compartment is continued to form a canopy over the rear platform of ¾-in. deal, and is supported by steel ribs. The rear end of the passenger compartment is fitted with sliding doors, of which the frames and mouldings are of teak and the lower panels of white sycamore. The upper panels are glazed.

Each cab is provided with a tool chest, arranged to hold three spare fuses of each size; two control switch contacts of each type, and all necessary tools, oil cans, etc. Each motor car is also provided with an air blast sand-box arranged to sand all four wheels of the motor truck. These boxes are in the switch compartment with the controlling air valve, arranged in close proximity to the driver's brake-valve. The ends of the sand pipes are of flexible hose. Air whistles are also used.

The principal dimensions of the under frame and body are as follows:

Length over head stocks	45 ft. 6 ins.
Length between truck centers	29 ft. 0 ins.
Width over side sills	7 ft. 10 ins.
Height of floor from track	1 ft. 10 ins.
Side sills	7 ins. x 3 ins.
Center sills (channels)	4½ ins. x 2 ins.
Cab width	7 ft. 11 ins.
Cab lengths outside	12 ft. 0 ins.
Cab height in center of platform	7 ft. 6 ins.
Cab height in center of platform switch compartment	6 ft. 1½ ins.
Passenger compartment, width inside	8 ft. 0 ins.
Passenger compartment, width outside	8 ft. 6 ins.
Passenger compartment, length inside	29 ft. 9 ins.
Passenger compartment, height in center	7 ft. 9 ins.
Passenger compartment, width of gangway (maximum)	3 ft. 5 ins.
Passenger compartment, width (between cross seats)	1 ft. 7 ins.
Rear platform, length	3 ft. 3 ins.



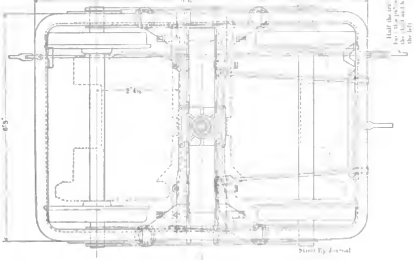


FIG. 2.—SIDE ELEVATION, SECTION AND PLAN OF MOTOR TRUCK

The cars are lighted by twenty-two lamps each, arranged in the following manner: Three circuits of five lamps each, giving fourteen lamps in the passenger compartment and one under the rear canopy. One circuit of five 16-cp lamps, one in switch compartment; one portable lamp in a protected holder, with 10 yds. of heavily insulated flexible cord, and three instrument lights. One circuit of two 32-cp lamps on headlight.

Each circuit is provided with a switch and fuse arranged on a fireproof base and cover. The four switches and fuses for the body circuits are under the rear canopy, the remainder being in the switch compartment on the switch panel. The lighting circuit is supplied from the motor circuit through a 15-amp. quick-break switch, and 15-amp. non-arcing replaceable fuse in a fireproof case, located on the main switch panel. The lighting cable is paper insulated and lead covered, and the main circuit is carried in an iron pipe outside the car roof.

Each motor car is fitted with a hand brake and an air brake of the Westinghouse quick-acting type, for the operation of which a main air reservoir of 8 cu. ft. capacity is carried in the switch compartment. The driver's valve is located on the front platform, and there is also an emergency valve provided under the canopy of the rear platform. The air pipes are made of iron of the best quality. The brake rigging is composed of best hammered scrap, and the pins and joints are case hardened.

The motor truck used is the Peckham M. C. B.-30, with non-tilting equalizing bar, and is to be supplied by Robert W. Blackwell & Company. The main dimensions and general arrangement can be seen in Fig. 2. This truck is an improvement on the M. C. B. ordinary form of construction, inasmuch as it is non-tilting and has considerably more strength. The diamond frame construction used in this truck has been for many years the standard for freight-car trucks in the United States, and the use of the Peckham patent swing bolster allows this frame to be made very deep, and consequently of great strength and stiffness. This swing bolster also gives very easy riding. As will be seen, the main body of the truck consists of rolled angle steel bent and welded into a rectangular frame with round corners. The pedestals for the axle-boxes

are of cast steel, bolted to the frame, and have a deep cavity for receiving a coil spring on either side of the journal box, the springs being carried by a saddle supported by the journal box. Enough lead is carried by the coil springs to prevent the diamond frame from tilting on the short-base equalizing bar springs. There are two wrought-iron equalizer bars on each side of the truck, the ends resting on the axle boxes. The truck frame is supported upon helical springs carried on the equalizers, through the medium

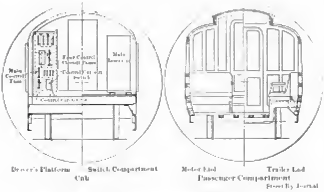


FIG. 3.—END SECTIONS AND ELEVATIONS OF CAR

of cast-steel caps secured to the frame and equalizers. A horizontal tie-bar is carried along the truck and secured to the under side of the pedestals.

The transom, which is of channel steel, is secured to the side frames by means of ½-in. stiffening plates and gussets. Diagonal braces extend from the frame to the under side of the transom. The truck bolster consists of two rolled steel plates ¾ in. thick, separated by steel distance pieces, and is supported at either end on double elliptic springs on wood blocks carried on steel-plate brackets riveted to the transom. The center and side bearings, which are of cast steel, are bolted to the bolster, the center bearing being constructed to contain a good supply of lubricant, with means of renewing the same from the inside of the car body. The motors are carried upon spring supports, as shown. The axle boxes are of cast iron with hinged water-tight fronts; they can easily be taken out by removing the bottom tie-bars and jacking

The brake blocks are of cold blast iron, and do not press on the flanges. Each truck is provided with a walnut board for the collecting shoe. The chief dimensions of the truck are given below:

	Foot.	Inches.
Length over all	9	6
Width over side frames	6	5
Width over axle boxes	7	2½
Wheel diameter	2	10
Wheel base	6	0
Axle diameter in center, wheel seats and motor bearings	0	5
Diameter of axle journals	0	4⅛
Length of axle journals	0	8

The brake-shoes are of the Corning type, which is the standard on the Central Underground Railway. These shoes have been found in service to have an average life of four months, against three weeks for cast-iron shoes and six weeks for chilled-iron shoes.

Each motor truck is equipped with two motors of G. E.-66 type similar to those used on the Manhattan Railway, of New York. Each motor, it is specified, will be capable of giving a tractive effort of 2500 lbs. at the wheel tread and a speed of 18 miles an hour, with a current of 200 amps. at 500 volts, with 80 amps. at 500 volts; the tractive effort is 650 lbs. and the full speed 27 miles on hour. The motor is capable of running in either direction, with a current of 300 amps. at 500 volts, the brushes being fixed, without injurious sparking. The magnet frame consists of a single steel casing with bored openings at the ends, which are closed by machine heads carrying armature bearings. The axle bearings are carried in lugs cast on the frame. The laminated pole pieces are bolted to the frame, and each pole has a field coil, the coils being form wound and interchangeable; they are insulated with asbestos fire and waterproof insulation and are wound on metal spools. The insulation is specified to stand a test pressure of 4000 effective volts alternating, applied between the coils and the frame.

The armature is of the projection type, with form wound interchangeable coils, mica insulated. The commutator is of hard-drawn copper with mica insulation, the end insulation being of hard quality, but between the segments it is softer, so as to wear equally with the copper. The armature bearings, as mentioned above, are carried in the frame heads, and are lubricated with oil and waste. The brasses consist of a single sleeve, with openings at the sides; drip cups are provided for the waste oil.

The armature insulation is specified to stand 3000 effective volts, alternating between coils and core for five seconds; the commu-

FIG. 4.—SECTIONS AND HALF PLAN OF TRAILER TRUCK

up the truck. Cork dust shields and woolen lubricating pads are provided. The bearings, which are of bronze, consist of semi-cylindrical sleeves overlying at the ends to take the end thrust, and also coming well down at the sides to take the side thrust due to the motors.

The axles are of mild forged steel with the journals ground. The shape of the wheels, which are bored for a press fit on the axle of over 60 tons, is shown in Fig. 2. The centers are of wrought iron with steel tires shrunk on and held in place by fastening rings. No keys are used to fasten the wheels.

tator to stand 4000 effective volts, alternating between segments and shell for five seconds and 500 volts between adjacent segments. The dimensions of the armature and axle bearings are as follows:

Armature bearing, pinion end	4 ins.	x	4	ins.
Armature bearing, commutator end	3½ ins.	x	6⅜	ins.
Axle bearings	5 ins.	x	10½	ins.

The axle bearings are bolted to the lugs on the field-magnet frame, and contain wells packed with oil and waste.

The gear is of steel, machined with a 5-in. face. The wheel is

cast in two halves, which are bolted together and keyed on the axle. The pinion is of hammered steel, with a taper fit on the motor shaft, and is secured with a nut and key. The whole gear is inclosed in a grease and dustproof case provided with an opening for lubrication.

The trailer truck is of the dimensions and arrangement shown in Fig. 4. The frames are of pressed steel, with cross members of channel steel, and were manufactured by the Leeds Forge Company. The frame is supported from the axle boxes by semi-elliptical springs, the eyes of which are forged solid with the back plates.

Company, and which consists essentially of a number of electromagnetic control switches, which can be simultaneously operated by a master controller, of which there is one on each motor car. Normally, as stated, the trains are made up of two motor cars and five trailers.

Tests have been made with a train equipped with two motor cars and also with the old gearless locomotives, and the results of these tests are indicated in the accompanying table:

While the watt-hours per ton-mile have averaged higher with the motor cars than with the locomotives, the total watt-hours per trip

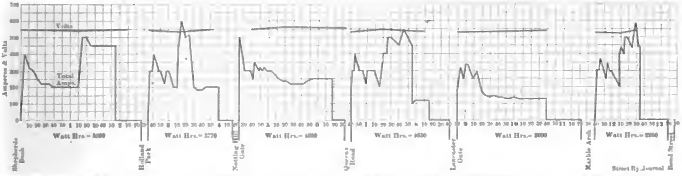


FIG. 5.—CURRENT AND VOLTAGE CURVES OF LOCOMOTIVE TRAIN RUN FROM SHEPHERD'S BUSH TO BOND STREET

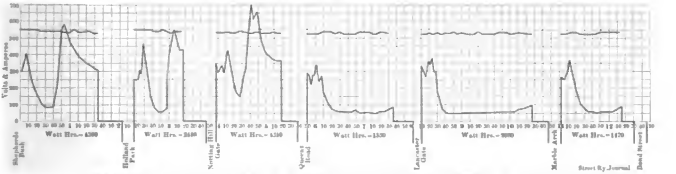


FIG. 6.—CURRENT AND VOLTAGE CURVES OF MOTOR TRAIN RUN FROM SHEPHERD'S BUSH TO BOND STREET

Spring hangers are attached to wrought-iron brackets, riveted to the side frames, and fitted with Spencer's rubber springs. The transom is of pressed steel, securely riveted to the side frames. The bolster is also of pressed steel, supported at either end on nests of spiral springs, each nest consisting of three springs, the interior spring being stronger than the outer ones. The axle boxes are of cast iron, and are provided with cork dust shields and woolen lubricating pads in steel frames. The bearings are of bronze. The axles are of mild forged steel turned throughout with the journals and provided with collars as shown. The wheels are of the pattern shown in the plans, and with wrought-iron center and steel tires. The main dimensions of the truck are as follows:

Length over all	8	ft. 7	ins.
Width over side frames	5	ft. 9¼	ins.
Width over axle boxes	6	ft. 10	ins.
Wheel diameter	2	ft. 5	ins.
Wheel, width of tire over all		5¼	ins.
Wheel base	5	ft.	
Axle diameter between hubs		4	ins.
Axle diameter in wheel seat		4¼	ins.
Axle length in wheel seat		6⅜	ins.
Axle diameter in journals		3	ins.
Axle length in journals		6	ins.

SPEED CONTROL

The train is operated on the General Electric control system, which is handled in Great Britain by the British Thomson-Houston

	With Locomotives		With Motor Cars	
	Bank to Shepherd's Bush	Shepherd's Bush to Bank	Bank to Shepherd's Bush	Shepherd's Bush to Bank
Weight of train, tons	134	148	105	105
Distance, miles,	5.75	5.75	5.75	5.75
Ton, miles	765	850	605	605
Watt h urs	33,300	36,000	25,300	27,700
Watt per ton mile	43.5	42.3	41.9	45.8
Watt per seat mile	20	18.6	16.1	15.7

were considerably less for the same schedule speed. Some diagrams of current consumption for the same run with two equipments are given on this page.

The Waltham Location Decision

The Massachusetts Railroad Commissioners have dismissed the petition of the Waltham Street Railway Company for extension of franchise into the town of Lincoln. The board rules that while a railway may be deemed to be "constructed" within the meaning of the law when a crossing over a railroad remains to be built, as it can be operated by a change of cars, and while it does not think construction to a town line is necessary to bringing in a petition, even though involved in the final scheme, it is problematical whether the road can show a railway substantially constructed in Waltham. But even assuming that it could, its purpose is not to build directly into Lincoln from Waltham, but indirectly through Weston; and a location for a route through Weston has been refused by the Selectmen of that place. Feeling aggrieved over this, the order recites that it is the purpose of the petitioners to secure the right to extend into Lincoln, secure a location there, and then come to the board for a grant in Weston under the "missing link" law. But the board thinks it would be idle to give a right of extension into Lincoln unless there is a way open by which it can reach Lincoln. The only way contemplated is through Weston. This is now closed under the action of the Selectmen, with apparently no prospect of a change on their part. The board sees no excuse for action by it which would prejudge the question or determine that the Selectmen were not justified by their action, thus deciding an issue which can only be determined under a different statute—the one under which the petitioner would have taken the next step had the decision on this petition been favorable.

So popular has the "sightseeing" street car service proved with the visitors at Washington that the Cab & Carriage Drivers' Union is said to be considering the advisability of engaging a lawyer to test the right to operate this "sightseeing" service.

Relief for Brooklyn Bridge Congestion

Mayor Low last week received a report from the committee to which he had referred the plans prepared by Neils Poulson, and submitted by the Manufacturers' Association, of Brooklyn, for the improvement of the terminal arrangements at the Manhattan end of the Brooklyn Bridge. These plans were described and illustrated in the STREET RAILWAY JOURNAL of Sept. 20, and they have since been carefully examined by the committee, which was composed of William Barclay Parsons, George B. Post and J. C. Breckenridge. Mr. Poulson personally explained to the committee the details of the proposed alterations, and the members examined the present arrangements at the bridge so as to see to what extent Mr. Poulson's plans could be adopted. The Commissioner of Bridges, Mr. Lindenthal, the engineer and superintendent of the bridge, Mr. Martin, and the assistant engineer, Mr. McLean, also appeared before the committee, and submitted the plans of the existing arrangements, and aided the committee by their advice and suggestions.

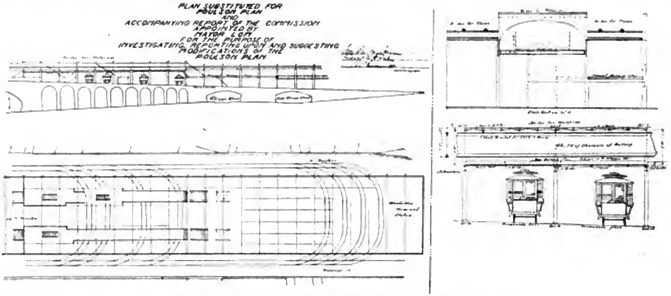
Mr. Poulson's plans, it will be remembered, were two in number; one looking to a change in the switching arrangements of the bridge and elevated trains, and the other proposing a new method of operating the trolley cars.

The present arrangement of switching the bridge trains is to have the loaded trains discharge their passengers onto an island platform on the north side of the bridge terminal, and immediately after run over two tail tracks west of the platforms, and then return by switching to another island platform on the south side of the station to take on board passengers for Brooklyn. By the arrangement now in vogue it is possible to handle two trains simultaneously, and to separate entirely incoming and outgoing passengers, and to do all switching with empty trains. Mr. Poulson's arrangement would do away with the tail tracks and have each train discharge and load simultaneously. This, however, involves a grade crossing for all incoming trains at a time when they are loaded with passengers. A similar arrangement was at one time tried on the bridge, but was condemned on account of the danger involved and the consequent delays to trains. On this point the committee says: "It is the experience of railroad men that all crossings of loaded trains at grade should, as far as possible, be done away with, and that switching by tail tracks is much more expeditious than switching by the head-house arrangement as suggested by Mr. Poulson. For these reasons we are of the opinion that the present arrangement should be continued pending such radical reorganization of the train service as is now under consideration by the bridge department and the railway company."

The committee pronounced Mr Poulson's plan "a very ingenious arrangement for the handling of the trolley cars," and added that at first sight it seemed to promise great results, but it was finally disapproved.

The present method of operation is to run all the trolley cars around four parallel loops at the west end of the bridge terminal. This produces great congestion, and, also, great inconvenience and positive danger. Mr. Poulson's plan would substitute one loop for the four to be used solely for the turning of cars. In the space between the present loop and the east end of the station Mr. Poulson proposed five parallel tracks, two on the north side and three on the south side of the building. One of each of these sets was to be a main running track, but connected with the adjacent tracks by frequent double switches, which were to be arranged so that cars could be run from the main track to the side tracks, in order to discharge passengers on one side and load on the other. Fixed stopping places would be established for each line of cars. As at first proposed Mr. Poulson's plan necessitated the rearrangement of the switching of the bridge trains in order to provide sufficient overhead space for the trolley cars. At the suggestion of the committee Mr. Poulson submitted a third plan, by which the trolley car scheme could be put into effect independently of changing the method of switching bridge trains, but in order to do this Mr. Poulson was compelled to narrow the bridge train platforms at the east end and to adopt other changes in the station construction.. The committee's opinion of the plan explains why it was finally rejected:

"His plan calls for not less than nine grade crossings of loaded cars and forty-two junction switches, each one of which becomes a point of congestion, and in addition it compels the turning of all the cars around a single loop of very small radius. In order to provide access to the loading and unloading tracks Mr. Poulson proposes to extend the station building so as to include that portion of the bridge roadway now occupied by the trolley tracks. This will reduce the width of the roadway to 8 ft., an inadmissable figure. If the roadway is left of reasonable width, then the passageway at the side of cars becomes so narrow as to render congestion absolutely certain. For these and other reasons, which it is not necessary to detail at length, we are of the opinion, much to our regret, that Mr. Poulson's plan would not provide satisfactory relief."



IMPROVING FACILITIES FOR HANDLING BROOKLYN BRIDGE CROWDS

The committee continued to investigate the subject, under direction of the mayor, and, as a result, formulated a plan which it believes is entirely practicable, and which it declares will afford the maximum relief to trolley passengers without an entire reconstruction of the bridge terminal. This plan also has the merit of simplicity, and can be put into execution at the minimum of cost both in time and money.

As will be seen by the accompanying diagram it is proposed to construct four more loops at a point about midway between the present loops and the end of the station. By moving the galleries, which now connect the mezzanine floor with the several stairways leading to the bridge platforms, to the space directly beneath the bridge platform, it is possible to raise them so as to give sufficient head-room for trolley cars to pass beneath them. It will thus not be necessary to interfere with the means of access to the bridge trains above. These new loops can be located as to give more intertrack space than is afforded by the present loops. There are seventeen lines of trolley cars crossing the bridge, which, under the present arrangement, means more than four lines to each loop. Under the new arrangement there will be but two lines on each loop, except on one loop, where there will be three lines. This will permit cars to stand upon a loop until the next succeeding car arrives, so that passengers will always find a car ready

to be entered or one about drawing in. The only work necessary to be done to carry this plan into execution will be to widen the roadways from the end of the present widening to the curve of the roadway at the east end of the station, and to move the galleries, as already described, and to lay the track. The principal delay will be in changing the roadway and getting the special track work for the loops. It is believed, however, that this work can be done in sixty days from the time that the order is given. The committee estimates that the improvement can be completed at a cost not exceeding $50,000. This plan, therefore, is pronounced reasonable in cost, and possesses the additional advantage that it can be carried into execution within the minimum of delay, and will afford the maximum of facility. In making this suggestion, however, the committee admits that while these additional loops will afford the greatest relief possible under present conditions, in the reduction of congestion and decrease of danger of accident, the system will still possess, in a minor degree, all of the defects of the present arrangement, that it will afford but slightly increased carrying capacity, though providing more facilities for entering and leaving the cars, and that, therefore, the improvement must be considered as a temporary expedient only. As a means of increasing immediately the carrying capacity of the bridge, the committee suggests that this could be effected by prohibiting the use of the roadway for trucks between the hours of 5 p. m. and 7 p. m., and says that while it is of course objectionable in any way to limit the vehicular traffic of the city of New York, the question to be considered in this particular case is which is the less important of the public services to be interfered with—the passenger travel or truck traffic. Inasmuch as the bridge is already sadly overcrowded, and inasmuch as even the improvement herein proposed will at best be but a temporary makeshift, the committee recommended that the whole question of transportation over the Brooklyn Bridge be studied by those in authority and those whose function it is to operate the railway so as to provide a permanent increase in facilities, which are absolutely essential.

In conclusion the committee recommends that whatever plan is finally adopted for the furnishing of facilities, the opportunity will be utilized to develop the approach to the bridge so that it will become an ornament to the city and not an eyesore, as at present, and provide a fitting gateway to the bridge, which of all the great bridges of the world carries the greatest traffic.

Bridge Commissioner Lindenthal, to whom the report was referred by Mayor Low, has examined the plans submitted and approved the recommendations of the committee. It was announced by Mayor Low that the work would be begun immediately, and it is expected that the improvement will be completed before the first of the year. The expense of the changes will be borne by the Brooklyn Rapid Transit Company.

Plans for the Philadelphia Subway Announced

The Philadelphia Rapid Transit Company has made public the plans for the construction of the Market Street subway. A loop will be built around the business section of the city, bounded by Broad, Fifth, Walnut and Arch Streets, and a two-track subway will be constructed in Market Street, from the Delaware River to Fifteenth and Market Streets, where the tracks, forming a loop, will turn in. Four tracks will be continued underground to Twenty-Second and Market Streets, at which point they will merge, and after having been carried over the Schuylkill River, by an elevated bridge, they will be continued as an elevated system to Sixty-Third and Market Streets.

This part of the subway system will be the main artery of travel. In the loop system the line will extend in Market Street from the Schuylkill River to City Hall. At Broad Street the loop will be carried underground to Broad and Walnut, down Walnut to Fifth Street, north in Fifth Street to Arch, west on Arch to Broad, south on Broad to Filbert Street and thence to Market Street. In brief, the loop will be a continuous line from West Philadelphia, around the wide area where most traffic is now handled.

With the double system now decided on the idea will be to run over the loop such of the West Philadelphia surface cars as are to be turned into the Market Street subway at Twenty-Second and Market Streets. From there to Broad Street there will be four tracks as described. On the middle pair will be operated the in-bound and out-bound three and five-car express trains, which will run the whole length of Market Street.

The lines, for which plans are now announced, will be built by the company under the charter of the Market Street Elevated Passenger Railway Company, which was granted a franchise by the Council on April 9, 1902. The ordinance which the company holds is flexible enough to permit either an elevated or subway, and also authorizes a subway to Twenty-Second and Market Streets, whence an elevated may be built to Sixty-Third and Market Streets. According to the plans decided upon the company authorize the necessary legal steps to be taken to carry out the revised plans, and application will be made at Harrisburg for the charter amendments required by the new route.

A Course in Street Railway Engineering Practice

It is announced that the engineering department of Lewis Institute, Chicago, which has already done much excellent work in the way of practical engineering education, both by day and night school courses, will give, in addition to the night courses heretofore instituted, one in street railway practice. Classes begin Oct. 7, to be held Tuesdays and Fridays. The course will be in charge of H. M. Wheeler, of the engineering department of the Chicago Union Traction Company. The course will take up track construction, types of rails, bonds and welds, paving, cost of 1 mile of double track, overhead trolley construction, feeder calculations, costs of overhead work, rolling stock, motors and motor troubles, hand, air and electric brakes, controller connections, heaters, tests of cars for speed and current consumption, electrolysis, the power house, steam and electrical machinery, switchboards, etc.

The Strike at New Orleans

The strike of the employees of the New Orleans Railways Company, declared Sept. 27, was no nearer a settlement on Oct. 7 than the day of its declaration, all the efforts of Mayor Capdeville, the police board and a committee of merchants to settle the dispute by a compromise having proved futile. The Mayor, through whose good offices the strike of April last was settled, is thoroughly disgusted with the course pursued by the strikers, and now announces his determination to use extreme force to suppress the rioting and establish the running of cars, and has notified Governor Heard of his intention to call for the aid of the militia in putting down the lawless element.

On Thursday, Sept. 25, the officials of the company were notified by the employees that all former and existing contracts between them and the company are declared abrogated, the employees stating that the company had failed to live up to the agreement entered into in April of this year. With this notice of the abrogation of the existing contracts was presented an entirely new tariff of wages and time and schedule of work. Among the demands of the men were that ten consecutive hours shall constitute a day's work; that all runs under five hours shall be considered extra runs; that wages of motormen and conductors shall be 25 cents an hour; that when men are laid off to look up evidence, or settlement of cases, they shall be paid at the rate of salary; that any man taken off for any cause and proving his innocence, shall be paid for loss of time; that no employees be discharged on account of their connection with the Street Railway Employees' Association; that employees shall be free to join any association they may see fit; that the company meet and treat with a committee of Division 194 of the Amalgamated Association of Street Railway Employees, composed of employees of the company; and that head pitmen shall receive $80 a month; pitmen, $70 a month; pitmen's helpers and dopers, $60 a month; car washers, $50 a month, and curve oilers, $50 a month. The company was asked to answer by 3 p. m. on Saturday, Sept. 27.

To these demands of its employees for a new arrangement of wages and a new contract for service the company replied on Friday, Sept. 26. In this reply the claim was made that the men are already bound for one year by the agreement of April 1. This contract or agreement the company claimed to be still binding, maintaining that under it the employees have no right to ask for a new schedule of wages and hours of labor. To the several charges made by the employees that the former agreement had been violated by the company, specific answer and denial were made. The company, always ready to discuss, fairly and fully, all grievances brought forward relative to the contract of April 1, demanded that the old contract be adhered to until violations were proved, and that the men return to work pending an investigation of the grievances.

This firm stand of the company had some effect, for on Thursday, Oct. 2, the men modified their demands. They agreed to return to work on the basis of the new demands—eight hours and 25 cents an hour—then submit all other grievances to arbitration, stating that if arbitration failed to prove violation of the existing contract they would serve out the April contract. Of course it was out of the question for the company to allow the men to resume work under these conditions.

PROCEEDINGS OF THE A. S. R. A. CONVENTION

President Vreeland called the convention to order at 11:15 A. M. and introduced the Hon. William C. Maybury, Mayor of Detroit, who delivered an address of welcome, in which he said:

MAYOR MAYBURY'S ADDRESS

Mr. President, Ladies and Gentlemen.—Your good president has said that I have consented to deliver a few words of welcome to you upon your visit to this good old city; but I beg this privilege of changing that word, consent, by saying that I have craved the privilege of welcoming you to this city. To say welcome, to ladies and gentlemen like you, is not a matter of consent, it is a privilege. I have been waiting for several months for this privilege, and I am glad that the time has come when I can avail myself of it.

You occupy a very close place in the relations which bear upon the comfort and convenience and well-being of our people. We have here a city that is so laid out as to be peculiarly adapted to street railway service. Here we have a converging of all lines from the suburbs into one center, practically, and that also is the plan of the city itself; for it was laid out about a century ago, after the plan of the city of Washington; in fact, the plan was brought here, and, as far as it could be made applicable to the new city of Detroit, you have a reproduction of the capital itself. If you will take the city hall as the capitol, the radiating streets and avenues are identically the same as in Washington; but the persons who laid out the city, the territorial governor and judges, had little knowledge of what Detroit was to be. Perhaps, I ought not to say that, as they gave us a good city, yet, they laid out the city with the streets radiating for a distance much less than a mile from the center, and from that point the plan is discontinued. Now, I say that you come close to the well-being of our people, and in the city of Detroit the conditions are most favorable for the prosecution of your particular business. Our avenues are wide; our people ride in the cars, and they want to get the best conveniences in the matter of transportation that are possible, and we believe we have them. We are after the best and do not want anything short of the best. Not alone that, but we have no hills to contend with. Aside from the slight rise from the river, which is scarcely to be considered, Detroit is practically almost flat, just rising enough towards the North to give fair drainage; but in every other way I think the conditions in Detroit are peculiarly favorable to the successful operation of a street railway. I desire to say, in spite of the modesty of our railroad management in Detroit, that we are proud of the splendid operation of our street railway, of the cleanliness of our cars, the gentlemanly conduct of those in charge, and everything that goes to make the operation of a street railroad substantially successful and complete.

My dear friends, the notable thought that comes to us in a convention like this is the fact that the world is growing so catholic and so broad. You may say the men upstairs who have inventions and apparatus to display are here for commercial reasons. I grant you that the inventor is worthy of a proper return for his genius, as the laborer is worthy of his hire; but in the broadest sense those exhibiting appliances that are meant to make the operation of the cars safer and more rapid and to insure greater comfort and cleanliness in them are inspired by other reasons. These men give these things to you and to the world, actuated not alone by commercial considerations, but in order that the cult which you are connected with shall be a great success. For it is a grand thing to stand up in the race of men, as some individuals do, like mountain peaks that are themselves above the ranges about them; and it is a pleasure for most of us to belong to something in this world, some organization or association, that we are proud to say, for example, "I belong to the cult of railway operators, the men who supply the railway appliances and the railway systems in the great cities of this country." You are proud to say that you belong to such an organization; you are proud of it because the connection with such an organization is one which places honor on any man; and a measure of any man's usefulness in this world is not what he can do for himself alone, for the meanest man you can think of is the man who has some secret that belongs to the world, and yet tries to hide it.

These conventions are significant of the age in which we live, and the world will not be poorer, but richer, because, once discovered, inventions are committed to the children of men for their good and go on for all time. The world will continue to be enriched as long as the children of men dwell upon its surface.

Coming with such thoughts and purpose, why are you not welcome to Detroit? We have not a very abundant supply of coal, but possibly after the convention of to-morrow, we may have a good deal more. I believe many of these things are as we think they are. Just imagine that it is warm. It is not October; it is July; and reach out, wrap yourself with a blanket of the hospitality of these good people of our city, and you cannot be cold, coal or no coal.

President Vreeland.—Mr. Mayor, on behalf of the officers and members of the American Street Railway Association, I tender to you our hearty thanks for your very cordial address of welcome. We represent a body of practical, hard-working men; our industry has more to do with the comforts and conveniences of the daily lives of the seventy millions of people of the United States than is represented in any other industry. We have to carry this great mass of people safely over city streets to the suburban areas; to the home and the school; and we are most important factors in the social and business life of every community in the country. The stores, the manufacturing industries, in fact, all of the daily life of the city is dependent upon the regular and orderly conduct of our business; and if our system is interrupted it means inconvenience and loss to every city.

On behalf of the executive committee and the officers of the association I desire to express our thanks for the large and representative attendance we have this morning on the opening of the convention. This is certainly a larger attendance at our first day's meeting than I have ever seen in the many conventions I have attended. It devolves upon the president each year to deliver what is known as the "President's Address," and for the first time in speaking to a body of railroad men I am going to read an address. There are some points connected with it that are rather novel in connection with the work of a street railway association, and I want to be careful in what I say.

President Vreeland then read the following address:

PRESIDENT VREELAND'S ADDRESS

It is exceedingly appropriate that the twenty-first annual meeting of the American Street Railway Association should be held in the beautiful city of Detroit, for, while the city street railways of the country have not been idle during the last year, the greatest development in electric railway work since our last convention, and in fact for several years, has been in the direction of interurban electric railways, and in this class of road Detroit railway enterprise has always been prominently identified. Radiating from this city can be found some of the largest and most modern of interurban railways, and Detroit ranks with Cleveland, Indianapolis, Cincinnati and Dayton as the important centers in this country of the interurban railway industry. It is connected by high-speed electric railways with Port Huron on the north and Toledo and Cleveland on the south and east, while the lines to the west extend with only a slight break as far as the eastern shore of Lake Michigan, and will probably before long find entrance into Chicago.

The interurban railways have long since passed the stage when they could be considered simply as suburban extensions of city lines. They are doing a through business, which is constantly growing, and the later and more ambitious examples of roads of this class are built with a track construction inferior in no respect to the best practice of the steam railroad companies. They operate usually for the greatest part of their distance over private rights of way, and attain speeds which enable them to compete successfully with their steam railroad rivals for nearly every class of traffic except long-distance passenger and freight business. This extension of the electric railway has introduced new problems of discussion, such as fares, transportation of freight, etc., into the operating department, as well as the exercise of the most advanced electrical engineering methods, not only in the transmission of the power at high voltage necessary to operate the cars, but in the car equipment as well. Up to the present, direct current has been used on the trolley wire or third rail, but if the experiments with single-phase motors, which it is announced are soon to be tried, prove successful, the possibility of the direct application of alternating current to railway work will remove some of the inconveniences which now exist in the present system.

I will not take the time of the convention to give the statistics showing the advances made in street railroading during the last year. Some of them will be brought out in the papers to be read, and statistics on the subject are published in the technical press from time to time. It is interesting in passing to note, however, that eleven years ago there were about 1800 miles of electric railways in the country, while to-day there are between 24,000 miles and 25,000 miles, and that against an investment eleven years ago in street railways of about $75,000,000, the total capital in-

vested to-day is in the neighborhood of two billion dollars. These figures show that the time has come when we should no longer apologize for our existence, but shoud take a stand individually and as an association for the protection of our rights as a corporation.

It is a venerable saying that corporations have no souls, and, perhaps, the credit that has attached to this aphorism accounts for the evident belief of the public that they have no feelings. We are here as members and managers of a class of corporations which is more intimately related than any other to the comfort, convenience and success of the people who live in cities and towns. Upon the orderly operation of a street railroad depends substantially everything else that goes on in a thickly settled community. It is true that what we are operating is a valuable privilege granted by the public, but its value depends chiefly upon the sufficiency with which the public is served, and the public was moved to grant it solely from considerations of its own comfort and interest. The contract between the public and the street railroads, therefore, is a contract of partnership and the interest of the partners is identical. What the public wants is the best possible service, and only by giving the best possible service can we obtain the largest possible returns for our money.

And yet, despite this close association of interest, it is the experience of all of us that there is scarcely any limit to the impositions which the public will permit, and rather cheerfully permit, to be laid upon street railway corporations. Legislatures and boards of aldermen seem to regard street railroads as fair game to be hit at as often and as viciously as anybody chooses, and the public newspapers, so far from taking into account the service we are rendering and protecting us against the schemes of demagogues, are rather inclined to regard injuries so inflicted with amused indifference, if not with positive favor.

In every other form in which property manifests itself, except in shares of corporate stock, it has well defined rights and valuable privileges. One thousand dollars invested in bank notes or government bonds, or even in real estate mortgages, are surrounded with legal safeguards to maintain their value, and if the hand of the despoiler for one moment seems to menace them everybody begins to talk about the sacred rights of property. That is just as it should be. But money lent to the government at a comfortable rate of interest is no more directly employed upon the public business than that which is represented by the stock of a street railroad, and it is no answer to the claim that it ought to have fair treatment, that it ought not to be the object of special prejudice and attack, to say that it is particularly valuable. Its value is strictly measured by the public service it renders. The contract, of which our charters and certificates of incorporation are the witnesses, authorizes us, as the universal law of business authorizes every one, so to employ our abilities and resources as to obtain from them the greatest possible result to ourselves, and if, in recent years, street railroad shares have been especially good income earners, it is beccause the street railroad companies are meeting the public ends for which they were organized, because they have studied and facilitated the public interests and needs, because they have put themselves in advance of the development of the cities and towns they run through, because at vast expense they have introduced new methods, new machinery, swifter, more frequent and improved accommodations, and it has never been laid down by the courts that a contract could be broken and new conditions imposed because either of the parties to it had done better than was anticipated, and certainly not because both had. And yet the contracts between the public and the street railroad companies are being continually infringed upon by the imposition of new taxes and new requirements, and it has come to be considered almost an impertinence for a corporation so injured to offer ever so mild a protest.

In the theory of the law a corporation is an individual, but apparently only for the purpose of enabling it to be got at. It has all the obligations of individuals, but of their rights few. The politicians of all parties talk themselves hoarse with eloquent protestations of their love of individual liberty and individual rights, and so well have their laws justified these pretensions that no man in this country is so idle, so worthless, so bereft by his own acts of character, property or position but that if he contrives to keep out of prison he has a vote and the opportunity of making his equal influence felt in the determination of public questions. But a corporation, even such a corporation as is organized to serve the public convenience, may neither vote nor in any other way participate in making the laws by which it must be bound. The proposition before the public on which an election is to be held and a policy defined for future legislation, may be one which vitally concerns the interests, even the life, of a corporation, but if it were to undertake to express its views from a public platform or to influence the votes even of those persons who derive their means of livelihood from its operations, the very foundations of social order would seem to be attacked. It must stand by on such occasions in submissive silence. It must affect an attitude of indifference, and if it does not actually proclaim to its employees their title to vote as they please it becomes at once the object of suspicion and prejudice.

Wars have been fought and governments formed to vindicate the principle that there shall be no taxation without representation, but if a corporation should ask to be represented in a public body that had the power of taxation and was proposing to exercise it upon corporations, its action would be observed with indignation and amazement. Even in the courts its standing is prejudiced, and before a jury sworn to render an impartial verdict upon the facts, its first and constant care is to remove from the minds of the jurymen a frankly admitted antagonism.

It is not remarkable that in this situation the law should discriminate against corporations. The failure to assert rights when they are threatened is always taken as a confession that they do not exist, and encroachment follows encroachment with ruthless certainty. Timid counsels have so far prevailed among the street railroad companies in the adjustment of their affairs with the public that in many States there is a gross discrimination in the taxing laws against such corporations. When by Federal legislation it was proposed to tax the incomes of individuals, although a limit was placed which protected the poorer classes, public protest made itself felt so powerfully that the Supreme Court of the United States, after holding that an income tax was lawful, proceeded to reverse itself and to find constitutional objections that absolutely killed the income tax law. And yet an income tax upon the earnings of corporations is found upon the statute books of many of our American commonwealths, and corporations with which a State has made definite contracts fixing and limiting the obligations on either side are required, notwithstanding these contracts, to pay other and additional taxes upon their gross earnings.

When money is invested in a public franchise upon terms and conditions expressed in a charter or a certificate of incorporation under a general act, the shareholders have a moral, and it ought to be a legal, right to understand that what they are to pay and to do in making their franchise effectual is nothing more than or different from the conditions of which they had notice and to which they agreed. The rule that there can be no impairment of the obligations of a contract is to be found in the fundamental law of the United States and of every State, and in controversies between individuals no constitutional guarantee is more carefully protected by the courts. And in a contract between the State and a corporation there is no trouble about holding the corporation. If it violates its contracts, or if it does not give the promised service or duly make the promised payments, the Attorney-General is authorized to institute proceedings for its dissolution. But the rule of performance does not work both ways. It appears to bind only the corporation. The State can pass new laws imposing new conditions and the corporation will have its pains for its protest.

I look forward to the day when the shareholders in street railway corporations will stand up for their rights as shareholders in the same sturdy spirit which they would at once bring to the defense of their rights as individuals. The great street railway properties of this country, and even the little ones, are no longer in the hands of a few rich men. They are distributed in hundreds of thousands of shares ranging in par value from five dollars to a hundred dollars among a countless body of the people. The heads of these properties are no longer in any material degree their owners. They are, and are coming more and more to be, simply the salaried employees of a great number of shareholders. They conduct the business of these properties as a trust, and they have nothing to do with the stock market. Their one concern is to earn a dividend for their shareholders and pay it where it belongs. Every shareholder is as much interested to protect the property against unjust discriminations in the laws and to protect its reputation as a business organization as are any of us who are placed for the time being in charge of the property. It is no less their duty than it is ours to insist that public officials shall treat these corporations equitably and honestly.

It will not be denied that inasmuch as our opportunity to earn money proceeds out of a public privilege we should pay to the public a fair return for what we get. But what we give in the way of service and what it costs us to give it are elements just as much entitled to consideration in the making of the contract as any other; and when the contract is once made it ought to be as little subject to repudiation or change as any other contract. The faithful discharge of our obligations requires a continually increasing investment, the constant incurring of new risks. It is not enough that we shall meet the demand as it exists from day to day; it is necessary that we should anticipate it. And if the profits upon our investment prove in the end to be considerable,

that is the reward to which intelligent foresight, courage and good management are always entitled. The spirit that seeks to confiscate anybody's legitimate earnings is unfair and reprehensible, and honest-minded men should be strong to oppose it.

This association has served an honorable and useful purpose for twenty-one years, but the time may be at hand when the scope of its usefulness can be materially increased. I have already pointed out the injustice which is done corporations by municipalities and the need for public enlightenment, not only on the equity of their cause, but also on the service which they are rendering the public. There is one other point to which, however, I would like to direct your attention, and that is in connection with the broader field of electric railroading which this country will certainly see during the next decade.

I have already referred to the immense mileage of interurban electric railways which has been built during the last few years, especially in the Middle West. Many of these roads are hauling freight, and it is a matter of great importance, not only to these roads themselves, but to the cities and towns which they serve, that the facilities which they should enjoy as regards the interchange of freight with the steam railroads should be as free as those between the steam railroads themselves. The first point requisite to this end is to have convenient connections with the neighboring steam railroads, so that the freight cars can be passed from one to the other. The right of the electric company to demand this has only recently been decided in New York State in a case which was contested between the Hudson Valley Railway Company and the Boston & Maine Railroad Company, in which the Court of Appeals reversed the decision of the Appellate Division and rightly decided that an intersection and connection of the electric road and the steam road should be made in the interests of the local shippers. This right should be of great advantage to the electric railroad company, but the full benefit to the local shippers will not be derived until the full privileges of an interchange of freight cars between the two systems shall be as universally recognized as they now are between steam railroads, so that freight can originate on either the steam or electric road. Heretofore in many cases, the steam railroad companies have shown an unwillingness to interchange freight with the competing electric roads, on the plea that the latter were not responsible in the same degree as the steam railroads, and by this means considerable freight transportation has been diverted from the electric railroad.

The points just mentioned indicate the broader problems which are being forced upon the electric railway interests of the country, through the large increase in interurban electric railway companies, which naturally look to this association as the exponent of their interests. This is only natural because while these lines do not operate upon the streets, the electrical equipment problems connected therewith, as well as many of the other questions which arise in connection with their operation are the same as those which interest "street railway" managers proper. And while it may appear inadvisable to change the name of the American Street Railway Association to accord with the broader field of electric railroading in which many of its members are engaged, it should be understood that the association is not merely a street railway organization, but its scope covers the entire field of electric railway transportation. More than this, it may seem desirable to welcome the participation of all companies engaged in electric railway transportation, for the reason that there is no organization in the country which has accomplished so much, or at its annual conventions and exhibitions can afford anywhere near the same opportunity for instruction to those interested in electric transportation in its different phases. Heretofore no manager or engineer of a trunk line company which is contemplating or has installed a system of electric traction could join this association except as a representative of some street railway company; but in view of the interest which is being taken in electric railway equipment by some of the large trunk line interests and the undeniable future which electric power will have for such transportation, especially for terminal and suburban work, the question will arise in the near future, if it has not already done so, whether the benefits which this association can confer are available for companies which are not now eligible to membership.

I will not attempt to suggest an answer to this question, but all signs indicate that it will be an important one during the next few years, if it is not so already.

Upon motion of Col. Heft a vote of thanks was tendered President Vreeland, and it was ordered that the address be spread upon the minutes, and that the secretary be instructed to have it printed for distribution.

President Vreeland.—Gentlemen, I thank you for that expression. Those of you who are connected with electric railroads in the Eastern section of the country have heard expression of such sentiments from me a number of times. I felt that it was a duty I owed to the street railway interests of the United States to take a stand on this question, as I did in the East a few months ago. The problem we have confronting us, as I have indicated in the address, is not the problem that confronted the managers of street railroads ten years ago. The man who ran street railroads at that time usually owned a large part of the capital stock and dictated the policy with a hand on the pocket-book. The policies of the street railroads of to-day are dictated by men who are technically and scientifically educated in the methods of management and control and operation of these large corporations. The character of the service which is rendered to the public throughout the country, the development going on in the hands of men who have nothing to do with the financial questions connected with the property, is what has brought the electric railroad properties up to their present state. The electric railroad system has no history back of it. The man who works in this field is a pioneer, whether he is an operating manager, or the electrical engineer or mechanical engineer. All experience in connection with this work must be obtained by hard work, and the hard knocks that come from the actual operation of these properties. That electric railroading has advanced to the stage in the world's transportation that it represents to-day, particularly in the United States and Canada, is an evidence of how hard we have worked and how well directed our efforts have been, and how ably we have been supported by the great electrical and mechanical equipment companies in this country. They have spared no expense and no pains in the developments which have had to do with the success of our industry, and it is but fair to them to say in this convention that they have had just as much to do with placing the electric railway on the high pinnacle of advancement it occupies to-day as any distinctly operating or mechanical men in the country.

The next order of business is the report of the executive committee.

EXECUTIVE COMMITTEE'S REPORT

The secretary read the report, which consisted, as in past years, of the minutes of the several meetings held during the year, including the provisions made for the annual convention and exhibition. On motion the report was received and filed.

President Vreeland.—We will now hear the report of the secretary and treasurer.

REPORT OF SECRETARY AND TREASURER

The secretary read his annual report, which contained the following statement of the affairs of the association:

Cash in bank October 1, 1901		$10,128.08
Receipts to October 1, 1902.		
Annual dues	$4,675.00	
Rent of space exhibit hall, 1901	1,848.50	
Rent of space exhibit hall, 1902	1,669.50	
Interest on deposits	185.85	8,378.85
		$18,507.53
Expenses to October 1, 1902.		
Printing and stationery	$1,807.27	
Postage	264.20	
Salaries	1,500.00	
Miscellaneous expense	50.00	
Executive committee, 1902	647.45	
Twentieth annual convention, 1901	3,341.11	
Twenty-first annual convention, 1902	548.41	
Committee on standards	311.06	
	$8,559.50	
Cash in bank October 1, 1902	9,948.03	$18,507.53

NEW MEMBERS

The following companies acquired membership at and since the last meeting.

Altoona, Pa., Altoona & Logan Valley Electric Railway Company.
Ashtabula, Ohio., Pennsylvania & Ohio Railway Company.
Atlanta, Ga., Atlanta Rapid Transit Company.
Atlanta, Ga., Georgia Railway & Electric Company.
Austin, Texas, Austin Electric Railway Company.
Belleville, Ill., St. Louis & Illinois Suburban Railway Company.
Boston, Mass., Boston & Northern Street Railway Company.
Boston, Mass., Old Colony Street Railway Company.
Canton, Ohio, Canton-Akron Railway Company.
Cleveland, Ohio, Cleveland & Eastern Railway Company.
Cleveland, Ohio, Lake Shore Electric Company.
Columbus, Ga., Columbus Railroad Company.
Denison, Texas, Denison & Sherman Railway Company.
El Paso, Texas, El Paso Electric Railway Company.

Exeter, N. H., Exeter, Hampton & Amesbury Street Railway Company.
Florence, Col., Florence Electric Street Railway Company.
Hancock, Mich., Houghton County Street Railway Company.
Holland, Mich., Grand Rapids, Holland & Lake Michigan Rapid Railway Company.
Jacksonville, Fla., Jacksonville Street Railroad Company.
Kenosha, Wis., Kenosha Street Railway Company.
Little Rock, Ark., Little Rock Traction & Electric Company.
Maynard, Mass., Concord, Maynard & Hudson Railway Company.
New Orleans, La., New Orleans Railways Company.
New York, N. Y., New York & Port Chester Railroad Company.
Oneida, N. Y., Oneida Railway Company.
Pittsburgh, Pa., Pittsburgh, McKeesport & Connellsville Railroad Company.
Plymouth, Mass., Brockton & Plymouth Street Railway Company.
Pottsville, Pa., Pottsville Union Traction Company.
Providence, R. I., Providence & Danielson Railway Company.
Richmond, Va., Richmond Passenger & Power Company.
Richmond, Va., Virginia Passenger & Power Company.
San Antonio, Texas, San Antonio Traction Company.
Savannah, Ga., Savannah Electric Company.
Utica, N. Y., Utica & Mohawk Valley Railroad Company.
Wheeling, W. Va., Wheeling & Elm Grove Railroad Company.

MEMBERS WITHDRAWN

Atlanta, Ga., Atlanta Railway & Power Company.
Atlanta, Ga., Atlanta Rapid Transit Company.
Bridgeport, Conn., Bridgeport Traction Company.
Brockton, Mass., Brockton Street Railway Company.
Brookfield, Mass., Warren, Brookfield & Spencer Street Railway Company.
Detroit, Mich., Detroit, Rochester, Romeo & Lake Orion Railway Company.
Detroit, Mich., Detroit & Pontiac Railway Company.
Fall River, Mass., Globe Street Railway Company.
Highwood, Ill., Chicago & Milwaukee Electric Railway Company.
Kansas City, Mo., East Side Electric Railway Company.
Lowell, Mass., Lowell, Lawrence & Haverhill Street Railway Company.
Lynn, Mass., Lynn & Boston Railroad Company.
Meridian, Miss., Meridian Light & Railway Company.
Mobile, Ala., Mobile Street Railroad Company.
New Haven, Conn., Winchester Avenue Railroad Company.
New Orleans, La., New Orleans & Carrollton Railroad, Light & Power Company.
New Orleans, La., New Orleans City Railway Company.
Pittsburgh, Pa., Monongahela Street Railway Company.
Port Huron, Mich., City Electric Railway Company.

MEMBERSHIP ACCORDING TO STATES

Arkansas	1	Kansas	3
Delaware	1	Tennessee	3
Louisiana	1	Virginia	3
Maryland	1	Wisconsin	3
New Hampshire	1	Georgia	4
Nebraska	1	Iowa	4
Oregon	1	Connecticut	5
Utah	1	Indiana	5
South Carolina	1	Missouri	5
Alabama	2	Texas	7
Florida	2	Michigan	8
Kentucky	2	New Jersey	9
Montana	2	Massachusetts	12
Mississippi	2	New York	17
Minnesota	2	Illinois	18
Maine	2	Ohio	19
Rhode Island	2	Pennsylvania	22
Washington	2	Mexico	1
West Virginia	2	Porto Rico	1
District of Columbia	2	Canada	5
California	3		
Colorado	3	Total	191

RECAPITULATION OF MEMBERSHIP

October 1, 1901		179
New members since last meeting		35
		214
Withdrawn	21	
Suspended	2	23
		191

Mr. Bean, St. Joseph, Mich.—I move that the report be received and placed on the minutes.

The motion was carried.

President Vreeland read letters of regret because of inability to attend the convention from Hon. H. C. Payne, Milwaukee; Robert McCullough, Chicago, and Charles S. Sargeant, Boston.

E. C. Foster, of Boston, presented the report of the committee on memorials, in which minutes were made of the demise of the following-named gentlemen: Walter V. Crouch, New Orleans, La.; Dell H. Goodrich, Omaha; J. Bannister Hall, Baltimore; C. C. Howell, Knoxville, and Winfield Scott Stotten, Colorado Springs.

President Vreeland.—The first technical paper is on the subject of the "Registration of Transfers," by C. D. Meneely. This is an important subject to the members of this association, as evidenced by the many letters I have received within the last year asking about our practice in New York regarding transfers and the opinion of the management of the company on this question.

In the absence of the author, H. A. Robinson, of New York, read the paper, which is printed in full elsewhere in this issue.

Mr. Root, New York.—I agree with Mr. Meneely partly when he says that the non-registration of the transfer does not eliminate entirely the cash value, but that the non-registration of transfers does eliminate this value to as great an extent as is possible; in other words, there still remains the possibility of the conductors giving away tickets to other conductors or to their friends, which still remains if you register the transfers. Eliminating that point, it seems to me the only thing to be decided in the question of this registration or non-registration is whether the cash value given a transfer by its registration balances the possibility of the difficulty which the secret service men have in detecting the non-registration of transfers. It has been our experience in New York, which is contrary, apparently, to that which Mr. Meneely has had in Brooklyn, that the non-registration of transfers does not make the conductors steal the cash fares—it has not that tendency, and, on the other hand, it does not in any way confuse our secret service men. This is perhaps peculiar to New York on account of the great number of short riders. With us our secret service men pay absolutely no attention to whether the number of passengers on the car corresponds with the number of passengers indicated on the register, for the reason that a car starting at any terminal of the road may take on ten passengers, five of whom will get off within a half-mile. This is more common in New York on account of the great number of short riders than in any other city in the country, probably, and for this reason more than any other we are very emphatic in our opinion that the non-registration of transfers is the best for our system; but personally I am of the opinion that for interurban and suburban roads, where they carry passengers for long distances and have few riders and check to a large extent the honesty of their conductors through a comparison of the number of passengers in the car with the number registered, the registration of transfers may be advisable.

Mr. Harrington, Camden, N. J.—We had been operating for some years without registering our transfers, and last summer we had reason to believe there might be some trouble in connection with it. We started to register the transfers last summer and did it for three months. Our secret service department showed such a wholesale trading in transfers that we stopped it.

H. M. Sloan, Chicago.—It seems to me if transfers are to be registered at all it should be done by a double register. My company was one of the first to put in the double register, and I was anxious about the outcome. I thought the conductors might register the cash fares on the transfer register, and the inspectors were given particular instructions to watch that point, which they could easily do on our road at the transfer points. I found to my astonishment that there was very little of it.

Mr. Connette, Syracuse, N. Y.—The conductors of the Syracuse Rapid Transit Railway Company are required to register transfer tickets. It occurs to me that a non-registration of the transfer ticket only eliminates the value of the ticket to the conductor. It does not prevent the conductor from giving away transfer tickets to people along the road or to agents at the points where they may be sold at a reduced price. The registration of transfers, of course, gives them the same value as a 5-cent fare, and we use, as a rule, a single register. The advantage in registering the transfers, as we have discovered, was that if there was any peculation on the part of the conductors it occurred to a great extent when the cars were crowded, and even when inspectors were on the cars it was a very difficult job for them to detect whether the passenger paid his fare with a transfer or with coin. The trading of transfers can, to a large extent, be detected without very much expense by proper clerical help. If there is any wholesale trading between the conductors, the conductors are bound to maintain the sequence of time in which the tickets are issued, and from time to time we check the transfer tickets that are turned in with a view to seeing whether or not the time limit on the tickets is

punched with regard to the sequence of time; then, if there is any trading between conductors, they must observe the sequence of time in which the tickets are issued, otherwise they can be detected when the tickets are checked up.

Mr. Beggs, Milwaukee.—I thoroughly believe in giving to the transfer and every other evidence of a right to ride on the cars all the value that is given to a nickel paid on the car. Under our system the transfers are deposited in boxes at the terminals of the lines every trip. The conductor does not keep them until the end of the day, but they are placed in envelopes and dropped at the terminal points. He likewise does not keep his pad of transfers, but turns it over to the man who takes his run when he exchanges cars. If transfers are to be registered, I believe it should be done upon a double register; that does not necessarily mean two registers in a car, but a double dial. In our own practice, some four years ago we adopted a double register, which showed the number of passengers carried on any particular trip on one disk. We have, after four years' experience, arranged for an exchange of registers which will show the two classes of fares gathered on each trip as well as the two totals. It is surprising to what extent the public notes the character of fare as indicated on the dial. We have some fifty transfer points on our system—fifty points at which transfers are given and to which they are given—consequently I do not believe it would be possible for any inspector to detect whether a passenger, particularly at the crowded hours, had paid his fare with a transfer or whether he had used one of the various types of tickets we have. As Mr. Root said, the system in New York is peculiar because of the large number of short-riding passengers, and the small amount, I presume, of anything but nickel fares. Our system, controlling all of the interurban lines centering in the city of Milwaukee, has ten or twelve possible commutation rate points, the tickets of which are given on our city lines to carry the passenger out into the suburbs, the tickets being sold to represent the commutation rate. Instead of two straight fares of 5 cents each, we may have a combination fare of 7½ cents, the passenger getting a transfer beyond the first fare point, consequently on one of the disks transfer tickets and 3-cent fares are shown by a light-colored disk and the 5-cent fare is represented by a red flag. In this way the public is to a certain extent a detective as to whether the conductor is ringing up the class of fare which has been paid. To our trainmen the transfer has all the value of a cash fare, and is treated as such. They never know when a particular line may be checked up, as the work may be done either in regular order, or, if there is some suspicion, messengers may bring in the transfers at various times during the day. I am thoroughly convinced in my own practice, for the ordinary road, outside of cities like New York, that it is necessary to give to the transfer the same value that attaches to a cash fare or a regular 5-cent ticket sold by many roads.

Mr. Tarkington, Council Bluffs, Ia.—We have also registered transfers. We cannot understand why any one should ride and present something for his fare which the conductor is not required to ring up. We require every passenger who crosses the bridge from Iowa into Nebraska over the Missouri River to pay 10 cents. If he has paid 5 cents on the local line and is given a transfer we want the conductor to ring up that transfer. If the passenger has a commutation book which entitles him to a ride for 5 cents we want the conductor to ring twice for that 5 cents if the passenger crosses the bridge. If the passenger has a ticket to a summer resort that costs 25 cents we require the conductor to ring twice for the coupon which carries the passenger over the bridge, or vice versa. We are thoroughly convinced that it is to our interest to have the conductors ring up for every class of ticket which they accept. We have put in a double register, and our experience has been that the passengers themselves take an interest in noticing what class of fare the conductor rings up. As the bells of the register have different tones, the men who do the checking are enabled to tell by the tone of the bell what class of fare is rung.

Mr. Connette.—I would inquire if the transfer has the same value as a 5-cent piece what advantage there is in ringing them up on separate registers or double registers; and even if the passengers do know that a conductor makes a mistake and rings a transfer for a 5-cent fare, or vice versa, what is the difference?

Mr. Sloan.—The line of demarcation as to whether it is better to register a transfer or not is so fine that it is oftentimes only a matter of opinion; but my conclusion, after having put the system in and used it for four or five years is that the transfer is registered very accurately and that a conductor very seldom collects a nickel and rings up a transfer. I watch the matter very closely. Sometimes conductors believe that the passenger is watching him. A register is a monitor. If the conductor supposed that nobody but an inspector was watching a register the peculations would be very much increased.

Colonel Heft, Meriden.—We are using now on our system a duplex transfer which is printed in pads of 100, numbered consecutively, and these pads are charged to a conductor when he goes out on his run. He is required to punch the transfer, tear off the duplex, return the original in his envelope and pass the other to the passenger, punching in the time limit. When the passenger boards the car to which he is transferred the conductor of that car is required to punch the time that he received the transfer. We have been unable to find more than one way by which the conductor could successfully beat this transfer ticket and that would be at a transfer point where he had an understanding with the meeting conductor, who would punch up about the number of transfers he thinks the conductor would sell for cash fares on the other car. That is risky business, because the spotter on the car would detect it very quickly.

The meeting then adjourned until 3:15 p. m.

AFTERNOON SESSION

President Vreeland read a letter from Walton H. Holmes and a telegram from John M. Roach, expressing regret at their inability to attend the meetings, and announced that the paper on the "Steam Turbine" had been laid over until Friday, at the request of the writter and two or three gentlemen who desired to discuss it, but could not possibly be in attendance the first day.

President Vreeland.—The next regular paper will be presented by Mr. Root, of New York city, entitled "The Street Railway Mutual Benefit Association." You all have copies of it. I will ask Mr. Root, in a general way, to present some of his points without reading the whole paper, and then we will take it up for discussion.

Mr. Root gave a synopsis of the paper, which is presented in full elsewhere in this issue.

Mr. Connette.—The Mutual Benefit Association of the Syracuse Rapid Transit Company was organized in 1898. The admission fee is $1. The monthly dues are 50 cents. The joining of the association is entirely voluntary on the part of the employee. The association has paid out in the last two years, according to the financial statement, in sick claims, $1,945.50; in death claims, $600, making a total of $2,545.50. Upon Sept. 1 of this year the association had to its credit $952.17, $500 of which was invested so that it was getting an interest return. They also have as a special fund, as a contingent fund, for the purchase of such things as they may need to make their rooms more pleasant and agreeable, $349.48 which they have secured by holding entertainments from time to time. They have rooms equipped with pool and card tables, and reading rooms, with all the weekly and daily periodicals, where the men can meet at times when they are not on duty and enjoy themselves. The association is entirely controlled by the employees, the board of trustees being composed of members of various departments of the system. Membership is limited to the employees and the heads of the departments and the officers of the company. We have a meeting once a month, including the employees, the heads of departments and the officers of the company. We not only discuss matters pertaining to the Mutual Benefit Association but from time to time we take up subjects of interest to the railway company, such as accidents, for instance.

We bring out what is in the minds of the employees themselves. You will find, or at least we have found, that this benefit association does not wholly result in the discussion of the sick and the afflicted and the bereaved families of the employees; but it results in a friendly relationship between the employees, the subordinate officers and the management of the company; and by reason of that close relationship, which is brought about by the intermingling at the meetings of this association, we learn to know each other better. We learn to feel an interest in each other's welfare, in the management of the property; and it has been impressed upon the employees that the success of the company does not depend entirely upon the management, but that every employee imparts his share to the success of the enterprise. It has been a means of bringing about a co-operative feeling between the management and its employees, and we feel that the mutual benefit association, so far as our company is concerned, is a great success. The fees are deducted each month by the auditor of the company when the men are paid off, and the amount is turned over to the treasurer of the association and deposited to its credit by him. All checks that are payable for sick and death benefits have to be approved by the general manager of the company before the checks can be paid by the bank, so that there is no possible way for any defalcation or for any diversion of the funds of the association. The board of trustees, which is composed of the employees of the company, are allowed a half day each month to assemble in the association rooms to discuss matters in connection with the management of this association, and to arrange for its monthly meetings. The secretary, who is one of the conductors on the road, is allowed two days each

month, on pay, for the purpose of arranging his books and making up his checks to pay death and sick benefits. Altogether we feel that the Mutual Benefit Association of the Syracuse Rapid Railway Transit Company is a success from every standpoint.

Mr. Haggerty, Michigan Traction Company.—I would like to ask whether in case an employee is a member of the association and leaves the company's service, he loses his membership?

Mr. Root.—As soon as a man severs his connection with the company he severs his connection with the association.

Mr. Haggerty.—Does he get any return for the money he has paid in?

Mr. Root.—No, sir.

President Vreeland.—The question asked by Mr. Haggerty is a question that has been asked very frequently. The Pennsylvania Railroad Company, which you know by their relief system, handles over $300,000 a year, put every case in a question and answer form and their proposition is that it is exactly the same as if you buy a traveler's insurance policy for 25 cents to protect you twenty-four hours, and you get that twenty-four hours' protection. They have done their duty and you get your return for your money. The Pennsylvania has always conducted its system that way, and it has been sustained in the law. It is among the oldest and largest associations in the United States.

Mr. Beggs, Milwaukee.—I would like to ask Mr. Root what policy the Metropolitan Company pursues as to the care of the funds of this pension expenditure, which naturally will grow greater as time goes on. I would like to ask, as a matter of finance, whether the Metropolitan Company has made an appropriation to its pension fund the revenue from which will meet these pension demands as they accrue. Or whether it has made an annual charge against operation. I ask this because I am myself interested at the present time in formulating the rules of a similar pension fund. I would like furthermore to know what the experience of Mr. Root is with the Metropolitan Company, and likewise Mr. Connette, of Syracuse, as to men laying off a day or so in order to obtain sick benefits. Many years ago I gave a great deal of time to a number of beneficial organizations in the State of Pennsylvania, among which was the Odd Fellows and Knights of Pythias and kindred organizations. I believe they would have been wrecked ultimately had it not been for the principal adopted by us about twenty years ago whereby a man had to be incapacitated from work a certain length of time before the weekly sick benefits began to accrue to him. I was wondering whether in these organizations any experience of that kind had been encountered; whether there were, as there are in nearly every body of men, a certain number who feel they must get square with the organizations to which they are paying funds; whether or not it has shown any tendency to have men lay off a day or so each month or at periodical times, in order to know that they had a certain amount which they would receive anyhow. I would like, furthermore, to ask what is the rule when a man is injured in the company's service. We, in our organization, usually take those cases and deal with each individually. If incapacitated by injury in the proper performance of the company's service, we usually make the employee an allowance of his wages.

Mr. Root.—The directors of the Metropolitan Company have authorized the officials to go as far as $50,000 to pay this pension allowance. There is a provision in the regulations themselves which permits the board of trustees at any time when they consider the payments under this system excessive, to make a revision of the ratio of payments, so that they are not bound by anything they do to-day a year from now. In fact, when they consider it to be excessive they can revise the ratio at which the employees who retire under this pension system are paid.

Mr. Beggs.—You have struck just the point I wanted to get at. Aren't you running them somewhat upon the plan of a great number of these assessment associations that have been formed throughout the United States in the last two years? In the early stages they were well able to meet the accounts payable, but as the number of members increase, as they will twenty-five years from now, and an effort is made to reduce the amount that you have paid to employees before that time, will that not be a source of dissatisfaction and a feeling of injustice, that if they had been able to retire a few years earlier they would have received 40 per cent, whereas you may be compelled to reduce the amount that they will receive to 30 per cent or some other per cent, or something much lower than their fellows receive? That likewise raises the point, in my mind, whether it would not be well to exact from them, let the amount be very small but some amount, to be paid into this permanent pension fund to be invested, the revenue from which would provide a guarantee for the payment of these amounts in the years after your men have grown old in your service. That has been the complaint against many organizations that have been attempted in this country with very good intentions but which were found to be impossible to carry along. I raised this warning twenty years ago in orders where we were compelled to increase the amount exacted from members. I am throwing out a number of suggestions, and some I would not have thought of myself, without Mr. Root's suggestion, because I take it there are a great number of companies throughout the country that are feeling the results that were felt by these companies. It seems important that before it goes too far it should be well considered. There should be rules standardized to govern the employees and to standardize these beneficiaries of the companies for the benefit of their employees.

Mr. Root.—I do not consider that the danger of overrunning the allowance is apt to arise, because I believe if employees get to that condition where the payments shall be greater than the amount that we have now appropriated the benefits the company has received through length of service will be proportionately greater, and that the company can in that same proportion fairly pay them at the same rate as they do now. That was merely put in as precaution, because this thing has not been worked out. We are, I think, the pioneers in the street railway world. We have got a good deal of precedent from Germany and England, where they have done a great deal of this pension work, and they have found there that where the superannuated body contributed themselves, it has not been as satisfactory as where the government has taken the thing entirely in its own charge. This is a matter, however, which only time can work out. We have not the experience, but we are going into it now and making such regulations as we deem proper. When these things arise ten or fifteen or twenty years from now, as Mr. Beggs suggests, we will have to work it out then. Regarding the suggestion about the men attempting to defraud this association through laying off when they are not sick, our regulations provide that any employee may receive $90 in one year, that is at the rate of a dollar a day, but his benefits do not begin until he has been sick for seven days, unless he is injured in the service of the company. If in the service of the company it begins from the day on which he was injured. There can be very little question about a man when he is injured in the service of the company. The association's physician is, of course, very reliable, and upon his judgment we place entire confidence. There is no one who receives any benefits from the association unless he makes a prompt application to the secretary and is examined by the association's physician. Even if a member elects to have his own physician he is not paid any benefits from the association until the association's physician himself makes an examination and reports to the secretary that he is entitled to this benefit for which he has made a claim.

Mr. Beggs.—I do not think the seven-day clause appears in your paper.

Mr. Root.—No; I do not think it is.

Mr. Connette.—As far as our association is concerned, the by-laws specifically state that the benefits do not commence until a member has been disabled for seven days. Furthermore, the association employs its own physician, and when a member is sick that physician must wait upon the member, and the association pays the doctor bill.

Mr. Tarkington, Council Bluffs.—The laws of the State of Iowa are very stringent in regard to assessment insurance companies. An organization has been formed in Iowa along the line suggested by Mr. Beggs. Those assessment companies which have a very rapid growth and have no reserve fund are now confronted with a possibility of a great deal of trouble by not having anything to pay claims with. The new company provides a reserve fund from the beginning. If you join at the age of twenty-five, and die at the age of 34, your expectancy of life would be based upon the tables of the old line insurance companies and the estate would be required to pay the assessments to the limit of your expectancy which, perhaps, might be fifty-five years; so that out of the amount of money which the estate would receive the company would deduct the amount of the assessment from thirty-four to fifty-five years, and lay it aside as a reserve fund, the accumulation of which, it is believed, will take care of this.

Mr. Root.—Mr. President, I intended to say that the board of directors authorized the officials to expend $50,000 in any one year in payment of these allowances, and that will be considered as an operating charge and will be charged up just as if these men were working in their regular duties.

Colonel Heft.—I understand that it does not become a charge against the operating expenses of the corporation until such time as you are required to make payment.

Mr. Root.—That is correct.

THE ST. LOUIS EXPOSITION

Mr. Lang, of Toledo, offered the following resolution:

"Whereas, The American Street Railway Association, in con-

vention assembled, has learned with much gratification of the extensive plans that have been made by the Louisiana Purchase Exposition for the proper presentation at the exposition of the American street railway interests.

"Resolved, That this association extends to the Transportation and Electricity Departments of this international exposition assurances of its hearty interest in the work they have undertaken, and its hope that the plans will be brought to a full realization."

The resolution was adopted.

Mr. Lang also asked that the convention give five or ten minutes to Professor Goldsborough to speak upon the work of the exposition. The invitation was extended, and Professor Goldsborough delivered a brief address, describing the aims of the exposition and asking the co-operation of the members.

President Vreeland.—Mr. Parker has prepared a paper on the "Transportation of Light Express and Parcel Delivery," which he will outline. (The paper is presented in full elsewhere.)

Mr. Parker said the paper which he had prepared was really a digest of the conditions existing in Detroit, and he explained the salient features of his contribution.

Mr. Connette.—I would inquire if the original franchise contemplated the hauling of freight through the streets of Detroit, and if not, what conditions did the city impose when it granted this right?

Mr. Parker.—The original franchise, as I understand it, did not allow the Detroit United Railway to carry freight through the streets of the city but an ordinance was passed granting that privilege. The original franchise did not specify anything, if I remember correctly, about carrying freight, but the electric express and freight system was started, and while it was not satisfactory at the beginning, the City Council passed an ordinance prohibiting us from loading or unloading on the streets, compelling us to put up a depot of our own, and still further taxing us $1 per car per round trip, whether the car was loaded or empty.

Mr. Wasson, Cleveland.—I would ask whether the business increases month by month.

Mr. Parker.—It is only a year ago this month, as I remember, when the express service was started. The business shows some increase.

Mr. Crafts.—I would ask if any material increase in the business of the passenger service, due to carrying packages and light express matters, is noticeable?

Mr. Parker.—Yes, there is; it always has a tendency to increase the business.

Mr. Crafts.—You think it gives you a marked advantage in carrying the package business, that is, that you gain in your passenger service?

Mr. Parker.—Yes, sir.

President Vreeland.—I invited the president and general manager of the express company in New York city in the annexed district to be here, with some statistics which would answer many questions regarding this subject, but some local business conditions have made it impossible for him to come. Under the conditions of operation that we have there the company has nothing to do with the express service. The express company has a contract with the street railway company for operating on its tracks, and the business is only limited by the facilities which the express company has been able to establish at the present time. In other words, they have all the time at least 30 per cent more business offered them than they have had facilities to take care of. No matter how fast they have increased the facilities the business has increased in larger ratio. As far as the question of the division between the actual cost and receipts, based upon percentages—in the original operation of the system, including the operation of fifteen or twenty cars for the first six months to establish the business, the average of the whole would more than pay for the operation of the cars, and the interest on the investment is paid by the express company, so that answers your question as far as we are concerned. There has been no expense entailed on our company in the operation of this service, even in its infancy.

MASTER MECHANICS TO ORGANIZE

Secretary Pennington read the following letter: "Will you kindly announce that there will be a meeting of all master mechanics at the power station A, at 3 p. m. Thursday. This meeting is called for the purpose of organizing an association of master mechanics of the different street railway companies." The letter was signed by Thomas Farmer, superintendent of motive power, Detroit United Railway.

Mr. Beggs.—I presume this invitation includes the superintendents of maintenance of way and all others connected with the mechanical department as well as master mechanics. I desire to impress upon the presidents and general managers who may be present the importance of urging on their mechanical staff an attendance, as requested by Mr. Farmer. I think there are some here who recollect that at the last two meetings I have suggested the very thing which is contemplated in this communication, a matter which is of great importance to our industries, namely, an organization of the master mechanics of the companies. We all know how important it has been in steam railroad practice. We have had an illustration ourselves of what has been accomplished by the Accountants' Association, those in charge of that branch of our business. I believe that even greater good will accrue to the several companies by the organization and the annual getting together of those charged with the design, with the construction, and with the maintenance of the mechanical elements entering into our business.

President Vreeland.—Seven topics for papers and discussions were arranged by the executive committee, and we have gone through three of them, with all the rest of our association business to-day, and it leaves four papers for Friday. It is getting rather late, and is hardly worth while this afternoon for us to take up another paper.

As your presiding officer, I want to thank you for your attendance and the interest you have taken in the association meeting to-day. The discussions that go with these papers and the work of the association, can only be an advantage to the members of the association if the purposes of the executive committee in arranging for meetings are carried out. The association work, club work, etc., in connection with the railroad interests with which I have been connected for the last twenty years, has indicated the value of these associations to the industries we represent, but much good cannot be gotten out of the meetings of an association, especially this association, unless there is an interest taken in it by the members from all parts of the country, and more particularly in interurban railroad questions at the present time.

Following out the lines of Mr. Beggs' suggestion, I may mention that I have been for four years president of the New York Railroad Club, which takes in all of the transportation, mechanical and operating men of the whole Eastern section ot the country, the Middle States, and, in fact, portions of the entire country. That club has a membership of over 1200. The average attendance of each monthly meeting last year was over 200, and went as high, in some instances, as 450, men coming from Chicago, St. Louis, Boston, and numerous points in the East to attend these meetings. The discussions which we have had during the last year have had an important influence in connection with transportation and mechanical problems. Suppose a superintendent of motive power is considering the question of compound locomotives, for example. He has had no experience with them and has no data bearing on the subject, and is brought face to face with the problem of what he shall do in regard to the matter. It has probably been suggested to him by his general manager that he attend a meeting of the club, and he gets up and asks if any member of the association will give him the benefit of his experience with compound engines. We have in our club the engineers of the New York Central, the New Jersey Central, the New Haven road and the Erie road, who are always ready to give every member of the club the benefit of their experience, and the superintendent of motive power in question goes home the next day equipped to talk to his manager. This information makes him a better man in the eyes of his management and shows what is going on. He not only gets the information in a general way, but gets actual data from these men. He probably would not have any other means of getting it so easily as at a meeting of the New York Railroad Club.

As far as your association work is concerned, the young men who are connected with the various street railways in the country cannot overestimate the value of this association to them in their work and in bringing themselves into prominence. Any young man who reads a paper at one of these meetings which shows intelligence and ability to analyze and good judgment is bringing himself before every man who is connected with prominent street railroad systems of the United States. I take this opportunity, as president of the association this year, to call these special things to your attention, in the hope of creating an interest in the minds of young men in this particular work. In my twenty-five years of railroad experience I have been able to place a great many men in steam and street railroads, and the first knowledge I had of the capabilities or possibilities of the ability of these men was in listening to them before the American Society of Railroad Superintendents, the American Railway Association, the New York Railway Club, the American Street Railway Association or the New York State Street Railway Association. You may work earnestly in your own city and feel that you are somebody there and attracting some attention, but the United States is large and there is a good

deal going on in it. It is only by bringing yourself prominently before a large association that the young men may hope to gain a reputation among the managers of the country, at least in the majority of cases.

NOMINATING COMMITTEE

President Vreeland.—I will appoint as the committee to nominate officers for the ensuing year the following gentlemen: R. S. Goff, Fall River, Mass.; N. F. Heft, Meriden, Conn.; R. McCulloch, Chicago; C. Goodrich, Minneapolis, and D. B. Dyer, Augusta.

The meeting then adjourned until Friday morning at 10 o'clock.

Newly-Elected Officers

At Friday's meeting, the nominating committee made its report and the following officers were elected: President, J. C. Hutchins, of Detroit; first vice-president, W. Caryl Ely, of Buffalo; second vice-president, W. K. Schoepf, of Cincinnati; third vice-president, P S. Arkwright, of Atlanta; secretary and treasurer, T. C. Penington, of Chicago. The executive committee consists of the officers and H. H. Vreeland, of New York; R. T. Laffin, of Worcester; A. Radel, of Bridgeport; W. H. Read, of Salt Lake City, and W. J. Hield, of Minneapolis.

The association received an invitation from Chattanooga to hold its meeting there next year, but it was determined to leave this subject open, and it was referred to the executive committee. The committee was instructed to visit Chattanooga and find out whether adequate facilities could be had for holding the meeting and exhibition in that city.

The Visiting Delegates

The attendance at the opening session of the Detroit convention was the largest in the history of the organization. The visiting delegates from all parts of the country were received by the local committees and provision was made for their accommodation and entertainment. The Eastern delegation arrived on Tuesday morning, and included representatives from New York, Pennsylvania and the New England States, in a special train over the New York Central. The New York section of this train comprised a Pullman buffet, smoking and drawing-room, dining car and several sleeping cars. It carried the largest delegation that ever left New York for a Western convention of the American Street Railway Association. The New England delegates came over the Boston & Albany and met the New York train at Albany, but owing to the fact that the New York train was already very heavy it was found necessary to proceed to Detroit in two sections. The accommodations were very satisfactory, and every provision was made for the comfort and convenience of the travelers.

The Wabash Special from Chicago

A jolly party of eighty-one boarded the Wabash special convention train for Detroit from Chicago at 1:30 p. m., Oct. 7. N. C. Keeran, the popular assistant passenger agent of the Wabash Railroad, was in charge and made every one feel comfortably at home. The run from Chicago to Detroit was made in the quick time of seven hours. A fine lunch and dinner were served on the dining car, and the time passed agreeably and quickly. The Christensen Engineering Company, through Mr. Eldredge, distributed boxes of candy to the ladies of the party. The following were on the train:

H. B. Abbott, Street Railway Journal, Chicago.
Dennis Aper, president Coal Belt Electric Railroad, Marion, Ill.
J. M. Atkinson, Chicago.
R. G. Arnold, treasurer Arnold Electric Power Station Company, Chicago.
G. H. Atkin, Electric Storage Battery Company, Chicago.
J. H. Brett, general manager Electrical Installation Company, Chicago.
T. P. Bailey and wife, General Electric Company, Chicago.
F. L. Brown and wife, auditor Omaha & Council Bluffs Railway & Bridge Company.
Max A. Berg, Porter & Berg, Chicago.
F. N. Baylies, superintendent track and overhead, Rockford & Interurban Railway Company.
B. C. Beckman, Standard Paint Company, Chicago.
A. W. Ballard, General Electric Company, Los Angeles.
R. N. Baylies, president Rockford & Interurban Railway Company.
George Cutter and wife, Chicago.
George W. Conover, Chicago.
A. B. Conover, Jr., J. A. Roebling's Sons Company, Chicago.
Charles Lawton Case, Chicago.
Robert F. Carr, vice-president Dearborn Drug & Chemical Works, Chicago.
E. L. Draffen, Gould Storage Battery Company, Chicago.
C. N. Duffy, secretary and auditor Chicago City Railway.
A. H. Charles Dalley, Under Feed Stoker Company of America, Chicago.
John E. Eldred, Jr., Christensen Engineering Company, Milwaukee.
H. T. Edgar, manager El Paso (Tex.) Electric Railway Company.
D. J. Evans, Lorain Steel Company.
J. E. Gavitt, Federal Supply Company, Chicago.
Thomas G. Grier, American Circular Loom Company, Chicago.
E. S. Grace, Wheeler Condenser & Engin.ering Company, Chicago.
C. G. Goodrich, vice-president Twin City Rapid Transit Company, Minneapolis.
R. M. Heskett, secretary Knox Engineering Company, Chicago.
Edgar H. Hammond, American Electrical Works, Chicago.
Charles L. Hull, general superintendent Chicago General Railway Company.
E. J. Hunt, Aurora, Elgin & Chicago Railway, Chicago.
J. C. James, Christensen Engineering Company, Milwaukee.
A. L. Kalas, Q. & C. Company, Chicago.
Charles D. Knight, Christensen Engineering Company, Milwaukee.
E. L. Kirk, general manager Sioux City Traction Company.
George W. Knox and wife, Chicago.
W. E. Keily, editor Western Electrician, Chicago.
R. B. Kent, manager Atlas Railway Supply Company, Chicago.
N. C. Keeran, Wabash Railroad.
F. S. Kenfield, Street Railway Review, Chicago.
James W. Lyons, Allis-Chalmers Company, Chicago.
A. S. Littlefield, president North American Railway Construction Company, Chicago.
C. E. Lund, civil engineer, Chicago City Railway.
L. E. Myers, Chicago.
J. G. McMichael and wife, Atlas Railway Supply Company, Chicago.
Richard McCulloch, assistant general manager Chicago City Railway.
W. R. Mason, Garrigus Mechanical Boiler Cleaners, Chicago.
E. R. Mason, Porter & Berg, Chicago.
E. S. Nethercut and wife, chief engineer Paige Iron Works, Chicago.
Michael O'Brien, master mechanic Chicago City Railway.
H. K. Parsons, Pennsylvania Steel Comany, Chicago.
Albert M. Patten, Topeka Railway Company.
C. D. Porterfield, Atlas Railway Supply Company.
F. L. Perry, Western Electrician.
Fred A. Poor, Weber Railway Joint Manufacturing Company, Chicago.
W. S. Patterson, master mechanic Consolidated Railway & Power Company, Salt Lake City.
J. W. Porter, Porter & Berg, Chicago.
W. P. Read, general superintendent Consolidated Railway & Power Company, Salt Lake City.
G. F. Rooke, Pana, Ill.
Donald Rawstron, superintendent Allen & Morrison Brake-Shoe & Manufacturing Company, Chicago.
J. C. Shainwald, Western sales manager Standard Paint Company, Chicago.
G. W. Spear and wife, Dearborn Drug & Chemical Works, Chicago.
W. B. Tarkington and wife, general superintendent Omaha & Council Bluffs Railway & Bridge Company.
C. K. Thomas, American Electrician, Chicago.
William Walmsley and wife, superintendent South Chicago City Railway Company, South Chicago.
Herbert Warren, general manager Duluth-Superior Traction Company.
A. C. Willis, Street Railway Review, Chicago.
R. A. Whelan, A. Booth & Company, Chicago.
F. M. Zimmerman and wife, superintendent Elgin, Aurora & Southern Traction Company, Aurora, Ill.

PAPERS READ AT WEDNESDAY'S SESSION

Street Railway Mutual Benefit Associations

BY OREN ROOT, JR.,
Assistant General Manager Interurban Street Railway Company, New York.

While the purpose of this paper is to discuss mutual benefit and assessment insurance associations as applicable to street railway employees, it will be well, before treating of that special subject, to say a word on the general topic of mutual benefit associations and assessment insurance, the main features of which must be embodied in any plan intended to benefit the class we have under consideration.

The history of assessment insurance, when extended beyond a single and continually recruited class, is not encouraging, and insurance practice demonstrates it to be, at its best, more expensive and uncertain than ordinary corporate insurance by strong companies.

Assessment insurance, however, when applied to particular crafts, which in the very nature of things must be continually recruited, has shown phenomenal results, especially when accumulated surplus has been invested for the benefit of the insured and not dissipated in executive salaries.

I take a street surface railroad in a growing community to be in the indicated class where assessment insurance can be, so far as the beneficiaries are concerned, profitably applied, as is evidenced by a case in point—the Metropolitan Street Railway Association of New York, with whose workings I am familiar and concerning which some details may be of interest.

This association was organized in the spring of 1897 by the employees of the company at their own suggestion, and was so planned that any employee between the ages of 21 and 45, who had been in the service of the company three months, was eligible for membership upon the payment of an initiation fee of $1 and dues of 50 cents per month.

In return for these payments the association guarantees to its members:

1st. In case of sickness the payment of $1 a day for a period not exceeding ninety days in any one year.

2d. In case of death the payment of $300 to any beneficiary named by the insured.

3d. The free service of a physician who devotes his entire time to the members of the association.

4th. The use of reading rooms, which are supplied with weekly and monthly papers and magazines, technical journals and a library consisting of over 2000 volumes.

5th. Use of ten pool tables, for which 1 cent per cue is charged.

6th. Free monthly lectures and entertainments during the winter months at the association rooms.

7th. Eligibility for pension under the pension regulations of the Metropolitan Street Railway Company.

The association started with thirty members, and from that time it has steadily grown until to-day it has a membership of over 4500.

The association is operated with absolutely no expense beyond the stipulated salary of a physician, as all of the officers of the association are officers of the company and their services to the association are given gratuitously. The association rooms are given rent free by the company; the library and pool tables were donations from individual stockholders and directors.

This plan, which I believe with slight modifications is applicable to almost any railroad property of considerable size, has worked out, in its financial details, some surprising results; for instance, we found that the amount of the tax, 50 cents per month, is a trifle more than is necessary to pay sick benefits and supply a life insurance of $300, but it is so small, in each individual case, as to make an exact adjustment both inconvenient and impossible, and hence there has grown up in this association a practice of investing the surplus in securities of the property on which the members are employed. And so we have in this association the unique feature of every member contributing monthly, in an infinitesimal way it is true, to a proprietary interest in the property he helps to operate.

Before going further into the details of the workings of the association and discussing the beneficent results it has accomplished for the men and owners of the property, I must, in order to be thoroughly understood, say a few words about certain human agencies, account of which cannot be taken in any written rules of practice.

The success of the Metropolitan Street Railway Association is primarily due, not so much to its sound economic features as to the personal relationship established and maintained between the responsible head of the railway company and its employees.

All of us who have to do with masses of men are aware of the fact that it is not always easy to induce them to do that thing which is obviously for their betterment, whereas experience shows that when their sympathies are stirred and their feelings appealed to they can be and have been induced to the most suicidal courses.

The phenomenal success of the Metropolitan Street Railway Association is due primarily to an intelligent, sympathetic relation fostered and encouraged between the manager and his men who early realized that they were under the discipline of a man who was in thorough accord with them as a class and whose life experiences had been along the very lines they themselves were traveling.

The fusing influence of this relationship, which is as active to-day as at any time since the formation of the association, has welded the membership into a body, the tremendous force of whose loyalty has been frequently tested in critical emergencies.

The impetus thus given to this association is great enough to assure its permanence beyond the accidental loss of the influence of the individual who is responsible for its present energy.

I have said this much in order that I may not be misunderstood as imagining so vain a thing as that the mere formulation of a beneficent plan is sufficient to secure its success. In the application of social benefits, as in everything else of human devising, some vivid personal influence is necessary to success, and this success, believe me, cannot be achieved by mere formal approbation or endorsement. If you want to make a concern of this kind go you must give it your time and thought, and above all you must be convinced at bottom that it is the right thing to do and that it will succeed.

If I might presume, before proceeding to further discuss the results of associations, to make a suggestion to those contemplating an experiment in this direction, it would be to avoid patronizing the men. Many good things are spoiled by being overmagnified, and it is my experience that among American and Americanized working men there is a resentment of official patronage. The quickening influence of the idea that you and your men are engaged on the same job but in different capacities, when once fixed, is surprising. It would be well, too, not to lose sight of the fact that the benefits arising from helping your men to take care of themselves are not all one-sided.

This thought brings me to a consideration of the benefits arising from associations.

These benefits may be divided into two classes: First, those derived by the employees, and second, those derived by the employer. There is nothing which appeals more strongly to the large majority of people, certainly to those who have worked for a living, than those things which yield a direct or indirect financial return. No one can fail to see the great benefit which the distribution of from $20,000 to $25,000 a year means to the men who are working for wages, and without reserves to draw upon in cases of sickness or other disaster. The services of a physician, the free use of a library, the opportunity to play pool or billiards in a well-lighted and well-ventilated room at a nominal cost, are indirect financial benefits as well as pleasures which are assuredly appreciated by any body of intelligent workmen, such as are employed by street railway companies. There is a benefit not so apparent but equally real in the creation and strengthening of a common spirit—"esprit de corps;" a realization of common interest in a work of many details but of common end. The gain is the greater as all employees are included, from the helper to the manager. The perfection of army organization is where the soldiers have entire confidence in the leader, and the leader absolute trust in the soldiers. When something of the strength of all goes into the work of each, tasks are more easily done; there is more careful attention to details, a common interest taking hold beyond the working hours gives heart to labor, when the time comes. A street railway touches the public at numberless points; the work of its employees is at each of these points; work with something of heart in it is easier and better than mere hand and head work.

When one remembers that in such a scheme as I suggest there is no demoralizing taint of official charity and that the men are gradually realizing that in truth they are doing all the helpful work with their own money, he will realize that the moral uplift far exceeds any of the material advantages.

The benefits of the second class from these associations—those to the employer or stockholder—are not so tangible as those received by the employee, but, nevertheless, exist to a large extent and are apparent to those who are in close touch with the work-

ings of such associations and their bearing upon the management of the company's affairs. It may be difficult to demonstrate to an outsider, or to put your finger upon particular cases where the use of the library or the association rooms or the pool tables accrues to the advantage of the company. It is unquestionably true in my mind, however, that all of these things create a certain sentiment in the mind of the employee favorable to his employers, and which in times of labor troubles, when the misguided and unscrupulous agitator attempts to cause dissatisfaction, crystallizes into a feeling of loyalty toward the company which could not have been gained in any other way.

At the monthly meetings of the Metropolitan Association, which are held in the association rooms and at which men of prominence and officers of the company speak to the men, the employer, as represented by the officials of the company, is brought into a personal relation with his employees, not as employer and employee, but as man and man, and in this way there is established a personal relation between them and a feeling of friendliness which certainly, in a large company like the Metropolitan, is not possible in any other way. I believe, as illustrated in the late trouble in Ohio which a large manufacturing company had with its men, that it is possible to overdo this kind of work. When you begin to wet-nurse and patronize working men you are offending them and making trouble. The idea is to teach them to help themselves.

As an illustration of what opportunity for amusement means to working men, one of the pool rooms, located at Fiftieth Street and Seventh Avenue, takes in on an average of $45 per week. Several games of pool, at a cent a cue, must be played in the course of a week to make the receipts $45.

There are, to my mind, three dominant problems in the handling of a street railway property. First, is the relation of the management to its employees; second, its relation to the public and the press; and third, its relation to the State and city officials. Of these, the relation of the management to its employees is of the greatest importance. Fair, considerate treatment of men's natural rights, the establishment of friendly and harmonious relations between it and its employees, is a railway company's most valuable asset. The great successes in the street railway world have been made by ability to successfully handle men.

However unjust it may be to the responsible head of any street railway property, how often has it been the case that the faithful and efficient work of years has been practically forgotten and nullified by differences which have arisen with the company's employees. The fact that a manager has been able to operate his road at a less cost than ever before and has brought the standard of equipment and the roadbed and the entire physical condition of the property to a higher level, is apt to be overlooked by the company's directors and stockholders in case serious labor difficulties arise. The stockholders of a property not only look to the management for a return upon their investment, but values once established they look for their stability and permanence. To assure this stability and permanence, moral forces must be set to work and carefully fostered until they gradually become traditional with the concomitant result of loyalty and efficiency of service.

I believe that the interest the employees take in a financial investment of 50 cents a month in an association and the enjoyment of the opportunities afforded by the libraries, pool rooms and entertainments, etc., together with the personal contact between the employees and management, bring about a relation between them similar to that which the millions deposited in the savings banks bring about between citizens and their government. I think, with rare exceptions, that there will be found among savings bank depositors but few anarchists, socialists, or those dissatisfied with existing conditions. The millions of savings bank depositors are among the strongest influences toward the proper government of the country, and I believe that the financial and other interests of employees in a street railway company through their association are equally strong influences for good.

We are living in an age in which no industry had made more rapid strides than the street railway. What was considered ten years ago a liberal policy on the part of street railway companies toward their employees would be considered penurious to-day. The methods of ten years ago cannot be used effectively at the present time.

The relation of capital and labor, as represented in street railway properties, has undergone a radical change in favor of the condition of labor. The betterment of labor conditions has been just and fair, and, in my opinion, any street railway management will do well to recognize it and meet it with liberality. There is no better way of keeping abreast of this movement than the encouragement and fostering of mutual benefit associations.

There are many things that are necessary to establish proper relations between the management of a company and its employees, but I believe that the most potent factor of all is the benefits received by the employees through a voluntary association and the relations which the social side of such an association establishes between the management and its men.

Registration of Transfers

BY C. D. MENEELY
Secretary and Treasurer Brooklyn Heights Railroad Company

Regarding the registration of transfers there is wide diversity of opinion in the street railway world. While there is a large contingent which advocates the registration of transfers, there is a numerous body which strenuously opposes it, and many who have studied the problem have been unable to reach a definite conclusion concerning it.

No mathematical solution of the problem has yet been offered, nor will I attempt any, but will here briefly outline for discussion the chief arguments for and against the registration of transfers with a view to determining, if possible, the weight of evidence from which to draw a conclusion.

Those who advocate the non-registration of transfers place great stress upon the contention that this course divests the transfer of its cash value, and focuses the attention of the conductor on the collection and registration of the real revenue, namely, the cash fares.

On the other hand, the advocates of registration are equally insistent that the non-registration of the transfer does not eliminate its cash value, except to the extent of preventing trading between conductors, and the consequent substitution of transfers for cash fares.

First, does non-registration divest the transfer of its cash value? Undoubtedly, the fact that the transfers of other lines cannot be turned in at a cash value prevents the conductor from obtaining fraudulently, either directly or through an intermediary, the transfers of intersecting and transferring lines, and converting the transfers so obtained to his own dishonest gain. Nevertheless, while the non-registered transfer may not be used by the conductor in this particular manner, its value has not been one whit diminished to the traveling public, to whom the conductor may, within limits determined by the accounting, either sell or give away rides on the company's cars, which would otherwise go to swell its earnings; for no accounting method has yet been devised which will accurately check the issue of transfers on a large system without undue expense.

Moreover, the non-registration of transfers renders so easy the appropriation of cash fares by conductors that many conductors, who would otherwise be indisposed to take the risk of open stealing, become dishonest. This has been forcibly illustrated on the Brooklyn Rapid Transit Company's system. In the summer of 1900, during the months of May, June and July, conductors were instructed to discontinue the registration of transfers. On August 1 of the same year the registration of transfers was resumed, and, coincidently therewith, a large number of supposedly reliable conductors, long in the service, were detected stealing the company's revenue. The increase in the number of old conductors, previously possessing excellent records, who were at that time discovered appropriating fares was so marked as to lead to the conclusion that during the preceding three months the ease and safety with which the company's revenue was plundered had tempted these men to steal, and, that upon the resumption of the registration of transfers, the exercise of the habit then formed proved too strong to be deterred by the added chances of detection.

Second, as to the registration of transfers.

It will be conceded, I think, by all practical street railway men that the ideal method of obtaining revenue, assuming one uniform rate of fare and a sure method of preventing transfer trading, would be to register all fares and transfers upon a single register.

Under the assumption noted the advantages of such a method are obvious. The query naturally arises, do these advantages more than compensate for the loss occasioned by transfer trading? On the Brooklyn Rapid Transit system we think that they do.

By taking transfers out of the hands of conductors and placing transfer agents at points where cars from the same depot intersect and transfer, thereby preventing conductors from trading directly with each other and compelling the use of an intermediary, we endeavor to keep this evil in check and supplement it by the vigilant watchfulness of our inspectors and secret service operators. Our system of stationing uniformed register inspectors between all principal terminal points and the first transfer intersection practically protects the revenue between the outer transfer and terminal points, and enables us to concentrate our secret ser-

vice in the central portion of the system to locate register shorts and detect transfer trading.

Further to limit the risk of trading to the day of issue we introduced and, I believe, were the first to use a daily dated transfer ticket, which has since been adopted by many of the principal systems in the country.

Doubtless, a further check upon transfer trading is provided by the turning in of transfers by trips and the subsequent checking of line exchanges by the accounting department.

Were it not, however, for the lottery law and a certain demoralizing effect that distribution of property by chance has upon the community by inculcating the gambling spirit, it would be possible to offer such inducements to street railway patrons as would absolutely check the cash fares received and the transfers issued. Such a governing inducement would be, to offer cash prizes of a large amount monthly, which would yet form in the aggregate only a small fraction of the amount which is now diverted from the company's revenue by conductors.

In addition to carrying a pad of transfers the conductors would be provided with a pad of numbered cash-fare receipts, each one of which receipts would bear on its face an injunction to hold until the end of the month, when the bearer might be entitled to any one of a number of prizes, determined impartially by a drawing; the prizes consisting of a capital sum, together with lesser sums graded down to a large number of small premiums, which would distribute the cash prizes as far as possible.

The operation of the above plan would involve the issue of a transfer *only* for a cash fare. In practice it would work as follows:

A passenger, boarding a car, would be asked by the conductor, upon payment of fare, if he wished a transfer. Upon receiving an affirmative reply, the conductor would issue a numbered transfer to the passenger from his pad, and upon turning in his pad would have to produce one cash fare for each transfer ticket detached from his pad.

All passengers who desire transfers are sure to get them, as they are needed for a ride on the transferring line, and conductors would, therefore, not be able to again issue detached transfers.

On the other hand, if a passenger, upon paying his fare, stated that he did not wish a transfer, it would become the conductor's duty to detach a cash fare receipt and hand it to the passenger. For every cash fare receipt so detached the conductor would also be held accountable for one cash fare.

The inducement for a passenger to take a cash fare receipt would be even stronger than in the case of a transfer ticket, as it might mean a large sum of money in case the number of the ticket drew a prize, and when a passenger, ignorant of its possible value, refused to accept his fare receipt, others would eagerly seek its possession.

Assuming that both transfer tickets and cash fare receipts were taken by passengers for all fares paid, the stubs returned by the conductors would accurately indicate the number of fares collected and would ensure the turning in to the treasury of all the revenue collected on the cars.

Several marked advantages would follow from the adoption of this plan, as for example, the reduction in the number of transfers used, since many persons, who would ordinarily take a transfer for a short ride after a long one, would prefer the chance offered by the cash fare receipt and decline the transfer, which carried with it no chance for a prize.

Moreover, the number of short-riders would, probably, be increased to an extent that would realize a larger sum than the aggregate of the prizes offered, and again, the trading of transfer tickets between conductors would be rendered absolutely impracticable, for each transfer detached from a conductor's pad would mean a corresponding cash fare to be turned into the company's treasury, and he would, therefore, be debarred from substituting transfers from other lines for cash fares.

While, according to the opinion of counsel, the operation of this plan would not violate the letter of the lottery law, inasmuch as no consideration is asked or received for the cash prizes distributed, yet the decisions under the federal lottery law, which absolutely prohibit the circulation of notices of drawings through the mails, in the opinion of counsel renders the operation of the plan inadvisable.

While, perhaps, the adoption of this plan might stimulate a speculative spirit in the community, it is unfortunate from the point of view of street railway companies that some similar scheme for the absolute protection of revenue could not be devised that would not contravene State or Federal laws.

So long as street railways continue to operate there will be more or less dishonesty on the part of conductors, which no mechanical appliances can wholly prevent; but while the careful choosing of material; fair and considerate treatment and the encouragement of a spirit of honesty and integrity will always be the best safeguards for the protection of revenue; at the same time the study of improved methods of protecting the revenue by mechanical, or other means, should not be neglected, for, though perhaps an uncomplimentary commentary on human nature, it is none the less true, that many men remain honest only because of the fear of detection, and to such men it should be our object to minimize the opportunity by all means in our power.

Electric Express and Package Delivery

BY GEORGE PARKER,

General Express and Passenger Agent, Detroit United Railway Company

The establishment of the electric service is a boon to interurban towns, to which lines are being rapidly extended in all directions within a radius of from 75 miles to 100 miles, and in a great many cases reaching towns and villages which have never heretofore enjoyed a railroad connection, or at the best, in a roundabout way entailing great delay and almost prohibitive expense. Electric service has also made next-door neighbors of communities between which, before its establishment, even wagon communication was not satisfactory or feasible, so that the electric service may justly be regarded as the chief factor in suburban progress, though not yet a decade old.

To the lay mind, the express and parcel business of the electric line or system would appear to be an additional and profitable use of the franchise, involving no additional expense beyond suitable rolling stock and the necessary train crew, but my experience has been that the operating expense tends to become greater than that of the passenger service, for the latter calls for no local stations or agents, the company assuming no responsibility before the passenger has been sighted, and after he alights, while it does become an insurer of freight or express from the moment of the giving of a receipt until it has taken one, thus necessitating a salaried agent and suitable depot facilities, stationery, etc.

In addition to the foregoing handicap to a profitable operation of the express service, I find myself confronted in Detroit by an ordinance which prohibits the use of trailers, and, worse still, which levies a tax of $1 per car per round trip, regardless of whether the car is empty or loaded. This tax is a radical departure from the good old days, when the town or its public-spirited citizens gladly raised a bonus to encourage a railroad connection, and then considered themselves highly favored.

The management of a system should show a proper appreciation of the importance of the express department and its bearing on the continued and increasing prosperity of the system in the building up of an interurban patronage, for it seems a necessary conclusion that the out-of-town dwellers will avail themselves of the mail-order and telephone facilities of the large city stores because of the convenient and speedy electric express car delivery to their doors, and the habit once formed of sending their shipments or orders via the electric express car must eventually result in more frequent trips on passenger cars for personal and wider selections of their requirements.

But it must not be assumed that all branches of the system, or even all towns and villages on a branch, warrant the establishment of an electric express service. The population, situation, products and future of each individual place, and the competition of existing steam roads, if any; also the old-established express companies, must be carefully weighed, or that terrible ledger must be faced at the end of the year.

ROUTING ORDER

Form 77 2512

Detroit United Railway,
RAPID RAILWAY

....190 ...

....

Until further Advised Please
Ship All My Orders Via

ELECTRIC EXPRESS

....

....

SAMPLE OF A ROUTING ORDER

To secure and hold the favor of the public I have found it necessary to insist upon and maintain high-class service, which means all the little details of careful handling, prompt transit and courteous treatment. This naturally calls for the co-operation of the entire management, especially in the operating department, and the personal attention of the general express agent and his assist-

ant at all hours in all kinds of weather and the ability to avert disaster when least expected. But he must not at any time neglect his office, to which all matters pertaining to the handling of express should be referred, and from which all instructions as to rates, claims, complaints, etc., should issue. The best results can only be obtained by the employment of a traveling express agent, whose special duties should be the soliciting of business and the securing of routing orders from consignees on shippers, which routing orders are instructions to shippers to forward all shipments in connection with the electric express.

The traveling express agent should have an open ear for all complaints, diplomacy and a knack of handling people so he can always retain their friendship. In addition to the above, the traveling express agent should have the oversight of the local agents who are usually subject to frequent lapses by reason of inexperience. He should, moreover, be capable of acting as trainmaster in the proper distribution of rolling stock, especially in case his road or system should be so unfortunate as to be in the vicinity of the sugar-beet business, or in close proximity to freight of that character.

Where the system includes leased or other lines, in addition to its own, a central freight or express depot and a joint agent are absolutely necessary as a measure of economy and the proper handling of the business. At Detroit, the most important thing to contend with has been the expense of handling, which, prior to the consolidation of the electric lines, was cared for through three separate depots. For instance, express from the Rapid Railway system was handled through one depot; that from the Detroit & Pontiac, Detroit & Wyandotte, Detroit & Northwestern and the Detroit, Rochester, Romeo & Lake Orion roads through another depot, and that express for the Detroit, Ypsilanti, Ann Arbor & Jackson Railway through yet another. This entailed an expense for each depot of an agent and staff, which till only recently has been changed and the stations consolidated in one large joint depot, now located on the corner of Fifth and Congress streets, in close proximity to depots of steam roads and navigation companies, thus also decreasing cartage expense where interchange is necessary.

The building is 45 ft. x 195 ft. On one side is the team track or driveway, where freight is received and delivered. On the east side of the shed there are double tracks with accommodations for four cars on each track, with ample room for switching. The interior of the shed is clear of all posts, thus giving ample floor space necessary for promptly receiving, sorting and loading the express and freight. There is also cold storage for the protection of perishable goods during the winter months.

The joint express agent who would have charge of a depot of this kind must of necessity be an experienced railroad man, also an accountant of no mean ability, as the duties covered are manifold, from the handling of a truck on a pinch, in the depot, to the settlement of his station accounts, which latter job becomes complicated at times from various reasons, such as change in rates, errors of agents, careless checking and handling of freight, etc.

It may be asked to what class of freight or express should an electric service be confined? In this part of the country the electric express service may be said to have its origin in the transportation of milk, which was originally handled in the small compartment on passenger cars, reserved for baggage, but which has now grown to such proportions as to tax daily the capacity of entire cars.

In the handling of milk our experience has been that the best results are obtained by the issuing of milk tickets, which are consecutively numbered and taken into account through the cashier's office. These tickets resemble our ordinary shipping tag; they are perforated in the middle, the lower portion being detached by the conductor carrying the cans when filled, and the other portion being left on to pass the empty cans on return trip. This ticket, as per sample, you will notice, shows the point of shipment, shipper, destination and to whom consigned; this information being on both portions of ticket, eliminates the possibility of errors in delivery of cans when either filled or empty. These milk tickets are charged for at so much per ticket, according to distance the milk is to be carried, and by their use assures protection from loss through bad accounts.

Form No. 240 **No. 3446** 2266

IF FILLED forward to

....

....

IF EMPTY return to

....

....

Shipper must fill out this ticket in full before forwarding can

Northville 10

No. 3446

VOID IF DETACHED.

Form No 240

Detroit United Railway

Good for transportation of one can milk, said to contain 10 gals. or less

10

George W. Parker,
Gen'l Ex. & Pass. Agent.

Northville 10

It may be added that the conductor, when accepting shipments of milk, notes carefully that there is a ticket for each can. After the shipment is loaded he detaches the lower portion and encloses the same to the auditor at the end of his trip with regular way bill showing full particulars of cans loaded, ticket numbers, consignees' names, etc., who in turn checks over the number of tickets enclosed, and if any irregularities, promptly advises the general express agent, who takes the matter up with the conductor for explanation.

Form 158

2161 **Detroit United Railway.** *Pro. No.......*

Car No.. .. Init.....

WAY-BILL of Express Forwarded from........To.........190..

Conductor .... Time ....Via....... W. B. No......

Consignor	Consignee and Destination	No. Pks	Description of Express	Weight	Rates	Charges	Advances	Prepaid	Total to Collect

Form No. 248

Detroit United Railway. *G. E. A. Pro. No.......*

.... Station ....190.. Agent's Pro. No.......

Report of Express over, short, damaged, or wrongly consigned.

From ......Way-Bill No.......Date.....Car No......Initial.....

Transferred by ....From Car....to Car....at.........

Condition as noted at transfer..

...

Was Car left or Express unloaded from Car?.....................

2161

Received from Car No...Date....190

Conductor..........................

State whether Over, Short or Damaged. Give Full Particulars.

Consignee, Marks and Destination	ARTICLES BILLED

..................Agent

FORWARDING AGENT ANSWER FOLLOWING QUESTIONS

By whom and in what condition loaded?..

By what Car?......................Conductor..........................Forwarded?

For what other Stations did you load similar freight?..............................

What other Cars loading at same time?...

Destination of same?...

If OVER express is from you, furnish billing and advise.............................

Are you short, and on what billing?..

Have you any record of express over?...

Was express properly and securely stowed?..

NOTE—Agents must make a separate report of each consignment, and send one each to Billing Station and General Express Agent by first passenger train.

Report for General Express Agent to be filled out with copying ink, but do not copy.

.... Agent.

When delivering the full cans on arrival at destination, the upper portion of ticket is left on the full can, which must be on the can when it is to be returned for refilling, otherwise the conductor should not accept it until a ticket is provided. These instructions are necessary on the return empties, otherwise there is possibility of your service being imposed upon through unscrupulous milk dealers sending their milk in by wagon or steam road and leaving your line to carry the empties back free of charge.

The question may be asked, what is done with the last portion of the ticket? This portion is left on the can until the conductor starts to distribute cans along the line, when this portion is detached and also returned to the auditor at the end of trip, and handled in the same manner as the first portion.

Tapping a great deal of territory that has hitherto had no railroad connection has necessarily thrust upon the electric express service at Detroit a class of freight that ought not to be carried in equipment of that character, and which cannot be discriminated against, the rates charged being governed by railroad tariffs for

similar class of freight, and are in some cases insufficient, and, therefore, unsatisfactory from the revenue standpoint.

It may be interesting to know how the express is handled on the system in this vicinity, so the following is a brief outline: For use in this service a full set of blanks has been designed and prepared with care. The shipper fills in the receipt, showing the date, from whom received, to whom consigned, destination, and a complete list of articles making up the shipment. This receipt is made in duplicate, a carbon copy being taken. The Detroit United Railway receives the property "subject to the conditions on the back hereof," which are in the form usually adopted by common carriers.

When express is received at the depot it is checked in on this shipping bill or that part of the form marked "duplicate." If the shipment agrees with the shipping bill the original is receipted by the checker signing agent's name with the checker's initials. This receipt is retained by the shipper and the duplicate is kept by the company and the shipment rechecked into the car, thus giving the company a double check on each shipment. Any exceptions as to shipment being in bad order, etc., are noted on these shipping bills, thus enabling the company in case of claim to know the exact condition the goods were in when received and forwarded.

After goods have been received and loaded into express cars they are then billed out on a way-bill, this form being printed in three sizes—quarter sheet, half sheet and full sheet—the latter being 12½ ins. x 16 ins. The way-bill is the same as express and railroad way-bills, forwarding point, destination, date of shipment and way-bill number showing in proper places. The way-bill numbers are arrived at by commencing with number one the first of each month, and numbering them consecutively until the end of the month. This way-bill number is used as reference in all correspondence relating to any particular matter coming up in regard to any shipment covered by this particular way-bill. The facts shown on the way-bill are designated by the headings of the various columns, which includes consignor, consignee, number of packages, description, weight, rate, charges, advances, amount prepaid and total to collect.

The rate is taken from the company's regular express tariff, which is governed by the rules of the official classification.

The rate on the different commodities handled are according to the value, dimensions and weight of each article. For example, shipment of glassware, furniture or any articles liable to damage from breakage are given a much higher rating than articles that are packed in such a manner as to occupy less space in the express car and which will weigh more than the articles first mentioned.

After this way-bill is complete, it is then copied in a tissue book one extra tissue being taken. These extra copies are forwarded to the auditor daily, who checks the weights, rates and extensions, and files the tissue copy for future reference.

On arrival of the shipment at its destination the receiving agent checks the various shipments billed to his station from the original way-bill, noting exceptions, if there be any, as to condition of express when received from car. In case of there being any articles damaged, over or short, the receiving agent makes report of the fact on a special form, filling in the information called for in the various blank spaces. The form is made out in duplicate, the original being sent to the forwarding agent for his report, on that portion of this form designated "forwarding agent answer following questions." This enables the forwarding agent to advise the receiving agent to correct, in case of error in billing, and what course to pursue in case of overs and shorts. This form is 9 ins. x 8¾ ins. and is shown reduced in Fig. 1.

The duplicate of this form is sent to the general express and passenger agents' office, where it is recorded in what is known as "the over, short and damaged register." These records remain open until the matter has been finally settled, thereby making it impossible for either the forwarding or receiving agent to allow the matter to drag along without receiving the prompt attention due such matters.

Form 181 2353

EXPRESS ORDER

Detroit United Railway.

....190

Received from ....

By DETROIT UNITED RAILWAY, the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated below, which said Company agrees to carry to the said destination, if on its road, otherwise to deliver to another carrier on the route to said destination.

Marks, Consignees and Destination	DESCRIPTION OF ARTICLES	WEIGHT Subject to Correction

.............................Agent

Detroit United Railway

Express Received Account ....**Station,**........................**Week of**............ ....**190.**

Way-Bill		Car No.	From	Weight	Prepaid Express			D. U. Ry. Charges	Advance Charges	Total of Way-Bill	Con'cts		Consignee (Initials)	Pro. No.	Total of Each Expense Bill	Reference Folio	Uncollected	Remarks
Date	No.				D. U.	Due O. R.	Ref.				Dr.	Cr.						

FIG. 2

Statement of Express on Hand at.................................**Station,**.................................**190..**

When Way-Bill was Received	Date of Way-Bill	No.	Station from which Express was Billed	Local Charges	Advanced Charges	TOTAL		From Whom Due	Description of Goods	Why Uncollected
						Prepaid	Collect			

FIG. 4

Report of Express Forwarded and Received at....... ....**Station for Month of**.. ....**190..**

EXPRESS RECEIVED				STATIONS	EXPRESS FORWARDED			
WEIGHT	Express Charges	Advance Charges	Prepaid Charges		WEIGHT	Express Charges	Advance Charges	Prepaid Charges

FIG. 5

Form 181

EXPRESS RECEIPT

Detroit United Railway.

....190

The DETROIT UNITED RAILWAY will receive and carry the property marked, consigned and destined as indicated below to the said destination, if on its road, otherwise will deliver to another carrier on the route to said destination.

Marks, Consignees and Destination	DESCRIPTION OF ARTICLES	WEIGHT Subject to Correction

..............................Consignor

SHIPPING RECEIPT

Form No. 248

Detroit United Railway. *G. E. A. Pro. No.......*

.... *Station* ....190.. *Agent's Pro. No.......*

Report of Express over, short, damaged, or wrongly consigned.

From ......Way-Bill No.......Date.....Car No......Initial.....

Transferred by ....From Car....to Car....at.........

Condition as noted at transfer....................................

....

Was Car left or Express unloaded from Car?....................

Received from Car No...Date....190

Conductor..................

State whether Over, Short or Damaged. Give Full Particulars

Consignee, Marks and Destination	ARTICLES BILLED	
		Agent

FORWARDING AGENT ANSWER FOLLOWING QUESTIONS

By whom and in what condition loaded?..

By what Car?......................Conductor......................Forwarded?

For what other Station did you load similar freight?.........................

What other Cars loading at same time?...

Destination of same?...

If Over express is from you, furnish billing and advice.........................

Are you short, and on what billing?...

Have you any record of express over?...

Was express properly and securely stowed?.......................................

NOTE.—Agents must make a separate report of each consignment, and send one each to Billing Station and General Express Agent by first passenger train.

Report by General Express Agent to be filled out with copying ink, but do not copy.

....*Agent*

FIG. 1

The way-bill is then entered by receiving agent in his "express received" book. The pages of this book are 16½ ins. by 22 ins., and the column headings are shown in Fig. 2.

The keeping of this book correctly is the key to what is known as a station balance, as the various amounts shown under the headings of "weight, prepaid, express, advance charges, total of way-bill," etc., must agree with the corresponding columns of the "abstract of way-bills received." This form is, as its name designates, an abstract or summary of the totals of all way-bills received, and is made up for periods ending 7th, 14th, 21st and last of each month, and a like abstract of "way-bills forwarded" is made up on a similar form.

The abstracts of way-bills forwarded is compiled from the tissue book copies, and shows date, way-bill number, weight, freight, advance, prepaid.

After the particulars have been entered in the express received book an "expense bill," shown reduced in Fig. 3 (original size 9 ins. x 6 ins.), is made out, a carbon copy being taken. When the shipment is delivered the consignee's receipt is taken on the duplicate and the agent receipts for charges on the original. Collections are made on delivery unless the consignee has a regularly authorized ledger account.

When money has been collected by the receiving agent he makes an entry of it in his cash book. Agents make daily remittances of money collected, holding in the cash drawer only a small amount for change.

At designated times a balance sheet, form No. 166, is made out by the agent; the particulars of the debits and credits are shown opposite the various numbers on this sheet, and are arrived at from the totals of the different forms and books already described.

Form No. 166 is a double sheet 13½ ins. x 8¼ ins. when folded once. The balance sheet is on the first page. The second and third pages show statements of express on hand, forwarded and received, arranged under the heads in Figs. 4 and 5. On the fourth page is a statement of the remittances for the month.

This sysem for the express service on electric lines radiating from Detroit was adopted with a view to handling express and all accounts relating thereto in as simple, practical and systematic a manner as possible.

Baggage is no longer carried in and out of Detroit on regular passenger cars, but follows on the next express car at a uniform rate of 25 cents per piece not exceeding 150 lbs.. Where the actual weight exceeds the latter mentioned minimum, the first-class rate named in the express tariff is applied from and to the point to which baggage is going at actual weight. This arrangement was necessary on account of the additional expense

Form No. 180 Detroit United Railway.

Consignee .... *Station,* ....190..

.... *Pro* ....

Destination ...., *Via* ....

To Detroit United Railway Dr.

For Charges on Express

	No. Pkgs.	ARTICLES AND MARKS	WEIGHT	RATE	CHARGES
From	.....	....	....	.....	......
Date	.....	....	....	.....	....
W. B	.....	....	....	.....	....
Car No	.....	....	....	.....	....
Initials	.....	....	....	.....	....

Delivered the above property *Received payment for the Company.*

Make check Payable to **Det. United Ry.**

Back Chge

.... Check Clerk ....*Agent* Total,

Original paid expense bills should accompany all claims for overcharge, loss or damage.

FIG. 3

involved in the handling of baggage and the low passenger rates in effect, which would not allow of a free checking system.

It is still an open question whether compartment cars could not handle both baggage and passengers during certain light hours of the day, thus giving baggage early preference and more suitable care.

Under our present arrangement of checking baggage a passenger can have his baggage checked from any point on our system at which we have agents, which arrangement, if the passenger is coming to Detroit, includes delivery to all hotels, steamboat landings, railroad depots and residences, is working out admirably in connection with the Detroit Omnibus Line Company. It might be added that this company (D. O. L. Company) has representatives to meet all trains and boats, so that the passenger coming to Detroit can, by turning over his checks to one of these representatives, be relieved of all responsibility in connection with his baggage in case he desires to avail himself of the frequent electric service.

There is a future in the parcel feature of the business, if properly conducted, which problem we have not yet been able to solve to our satisfaction, owing in a measure to the peculiar conditions existing at this point. Under our present arrangement we are accepting parcels weighing from 1 lb. to 50 lbs. for a minimum charge of 15 cents, going to points within a radius of 40 miles, and a charge of 25 cents when going to points beyond 40 miles. This charge, it must be understood, is for the electric express service only, with a slight additional charge for cartage in case the consignee wishes package delivered.

Another Toledo Interurban Road

The Toledo & Indiana Railway Company, which was incorporated in June, 1901, to build and operate an electric railway from Toledo to Bryan, Ohio, a distance of 55 miles, has already made considerable progress in the construction work. The officers are: Charles P. Griffin, president; George G. Metzger, vice-president and treasurer, and C. H. Masters, secretary. The road is being constructed by the Toledo & Indiana Construction Company, whose officers are: Charles P. Griffin, president; E. B. Smith, vice-president; C. H. Masters, secretary, and George B. Boone, treasurer.

At the present time 23 miles of grade has been completed, about 6 miles of poles erected, and by Dec. 1 it is expected to have the 23 miles from Toledo city limits to Delta, Ohio, completed and in operation. For the present a temporary arrangement for power will be made, as the power house has not been completed. The roadbed is being constructed along the most approved steam railroad plans and in every way is first-class, the maximum grade allowed being 1 per cent, and a 70-lb. rail being used throughout. All bridges are of steel with abutments of concrete, and all arches are of concrete.

Private right of way two rods wide is followed absolutely, and all construction is being done with the view of changing to a double track in the future, and consequently the track now being laid is at one side with the pole line located so as to be between tracks when doubled.

The country passed through is very thickly settled, and the towns along the line are all first-class and flourishing.

After leaving Holland, Ohio, the road parallels, with right of way immediately adjoining, the air line division of the Lake Shore & Michigan Southern Railroad, and so continues to parallel it the remaining distance to Bryan, except where it has been found advisable to leave this course a sufficient distance to pass through the center of towns.

The civil engineering on this road is being done under the supervision of Riggs & Sherman, consulting engineers, and the electrical and mechanical engineering by Mark H. Griffin.

Metropolitan Street Railway Association

The sixth anniversary of the Metropolitan Street Railway Association was observed at the Metropolitan Opera House on Saturday evening, Oct. 4, when the usual entertainment was provided for the members of the organization and friends who are interested in the work of the association. The objects and methods of this organization are already familiar to the readers of this journal, and they will not be surprised, therefore, to learn of the enthusiasm that was shown on this occasion, as well as the general interest that was excited by this illustration of the harmonious relations that exist between the Metropolitan Street Railway Company and its employees, who comprise the members of the association. On Saturday evening the seating capacity of the Metropolitan Opera House was tested long before the hour appointed for the beginning of the entertainment, and it was found necessary to close the doors of the theater sometime before the performance began, owing to the crush of those who desired admittance. There was a large number of friends of the management present on invitation, but the body of the house was occupied by the members of the organization and their families, and all thoroughly enjoyed the entertainment. Mr. Vreeland opened the proceedings with a speech, in which he referred to the work of the association and its influence upon the pleasant relations existing between the company and its employees. The lesson he drew from this example is worthy of the closest study on the part of workmen as well as large employers of labor. The key note to the situation is unquestionably the fair and considerate treatment of employees by the company, by which it is enabled to enlist co-operation and enthusiastic support in the work in which they are engaged. Mr. Vreeland's remarks form an instructive contribution on the labor question, and are particularly timely. He said in part:

"In my management of the Metropolitan I have been backed by authority greater than is given to any man in a similar position in the United States, for I have the entire confidence of the company, and am allowed to manage its affairs as I see fit. This fact has helped me greatly in my cherished ambition of forming an organization such as we have among ourselves now. Twenty years ago, when I was doing the same sort of work you are at to-day, I promised myself that some day I would do this thing to better the conditions of those whose lines are cast in not altogether pleasant places.

"You know that any one of you can see the head of this company when you have any complaint. It will always be the same. And when you men say you want another head for the company, on that day I shall be ready to resign.

"This institution which you have organized and supported with your own money and by your individual efforts has attracted universal attention, and has taught an eloquent lesson. It originated with no other thought than the benefit of its individual members, and its growth and vitality have shown what can be done by a class of men who give exclusive attention to their own affairs.

"Since the existence of this association questions have arisen more than once involving the relations of capital and labor, and they have been settled amicably and to the perfect satisfaction of both parties to the issue, and without any of the wasteful expense that seems to be unavoidable with others.

"These frictions with us have left no wounds behind them. In fact, they have done more than anything else to foster and develop a mutual confidence between management and men that is as unique in its way as this organization itself. It has been proven to the men employed on this property that 'the open door' of the management was not a mere name, but an actual fact. That we have been able, without wasteful loss, to adjust our differences becomes very significant when one considers what the history of the last twenty years shows, that contests between capital and labor have cost the men the appalling sum of $257,863,487, and that employers in the same time, as the result of strikes, lost $122,731,121.

"It staggers imagination to consider what might have been wrought by the application of this princely sum, wasted so wantonly, if it had been applied to such ends as those to which we apply our little mite.

"In my opinion this great waste is the result of the failure of mutual knowledge between employers and their men. As this necessary knowledge can only come from acquaintanceship, and as associations like this promote and foster intercourse, it is to be regretted that other workers do not view the situation as we do. How can men, whether they are capitalists or laborers, expect to understand each other if they are not acquainted? Without acquaintanceship there must be as much ignorant suspicion on one side as on the other. Nothing inspires more fear and distrust than half understood and wholly unseen things.

"I am no prophet, nor have I at hand data to prove the assertion, but it seems to me that if all these difficulties—and there were 22,793 of them—had been left to the employers and employees, without outside interference, they would have been adjusted without this horrible waste, and would have tended to a narrowing instead of a widening of the breach between the men and their employers.

"However, I am not here to point the way to others, but merely to call your attention, and the attention of our visitors, to what we have done as an organization in this particular community, and as an educating influence to others elsewhere who are giving attention to such problems as ours.

"It is now ten years since I first made your acquaintance. There were not so many of us then, but we have increased in numbers, and our field of operation has widened very much in that time. But, great as has been our labor, I have never lost sight of the ambition I had when in the ranks, to do for my fellows, if God helped me on, what I felt was for their advancement and comfort.

"Engrossed as I have been in the yearly growing responsibilities of my office, I have kept steadily before me the idea that I would, if life was spared to me, leave to those in whose company I had labored some helpful institution, that others coming after might foster and improve, and when, three months ago, the pension system went into operation I felt a satisfaction than which no greater can come to any man. Our little company was then placed in a position beyond the hazard of any accident, and, as in construction and operation, we have set the standard for the rest of the world, so we have on the human side, without due consideration of which no great corporation can be said to be perfectly safe.

"I congratulate you on the fact that during all these years there has been a steady growth of esprit de corps, and that your loyalty and the even justice of the corporation that employs you have been the subject of universal comment.

"All told, there are more than 17,000 of us in this community, and as it is true that every one of us helps to support at least five persons, it will be seen that in the lite of this greatest metropolis on the Western hemisphere, we are no insignificant factor."

At the conclusion of this speech, which was received with enthusiasm by the men, an excellent programme was presented, and was thoroughly enjoyed. The entertainment was the most successful in the history of this organization.

Reorganization of the Northern Ohio Traction Company

Official announcement is made of the reorganization plan of the Northern Ohio Traction Company, reference to which has previously been made in these columns. The new company is to be incorporated with $7,500,000 capital stock, and the same amount in bonds. The present preferred stockholders will receive in exchange for their stock a 5 per cent thirty-year gold bond and 100 per cent of the new stock. The common stockholders will receive one-half in 4 per cent thirty-year gold bonds and 200 per cent of the same stock as is given to the preferred holders, there being but one kind of stock. The stock will be used as follows:

STOCK	
To preferred stockholders 100 per cent	$1,000,000
To common stockholders 200 per cent	5,000,000
Bonus on $500,000 bonds	500,000
Balance in treasury	1,000,000
Total stock	$7,500,000
BONDS	
To retire preferred stock 100 per cent	$1,000,000
To retire common stock 50 per cent	1,250,000
To be sold for improvements and extension	500,000
Held in escrow to retire bonds	3,000,000
Held in treasury	1,750,000
Total bonds	$7,500,000

A conservative estimate by a Cleveland broker places the value of 90 per cent on the new 5 per cent bonds, and 75 per cent on the 4 per cent bonds, at which prices they would yield nearly 5¾ per cent, and considering that the present company earned net for the year ending Aug. 31, 1902, $310,837; that the fixed charges would only be increased $70,000; and that increased earnings would follow the extensions and betterments, it is figured that the new common stock would be easily worth $25 or $30 per share. It is claimed that the new stock will earn 1 per cent from the start, and it would not be surprising to see it earn 3 per cent inside of five years.

These statements are interesting in view of the fact that in the early part of this year, shortly after the Everett-Moore embarrassment, the common stock of the Northern Ohio Traction Company dropped to 25, and the preferred to about 40. It is also interesting to note that at the time the bankers' committee sought to liquidate the common stock at 35 there were no takers. To-day Messrs. Everett, Moore and their friends own over 15,000 shares of the common stock, and something over 1000 shares of the preferred stock which is being sold to-day on a falling market at 70 and 97 respectively.

New York Central's Plans

The proposed electrical equipment of the New York Central trains entering New York and the changes necessary in the tunnel for this improvement will be the subject of a public hearing at the next meeting of the Murray Hill local board. The position of the railroad management is set forth in a letter from President Newman, in which he says:

"It has been the understanding with the Mayor that the city will only co-operate with the railroad company in making the necessary changes upon condition that the railroad company discontinue, as soon as practicable, the use of steam as a motive power through the tunnel in Park Avenue. The use of steam as a motive power cannot be actually discontinued until (1) legislative authority has been obtained, and (2) the necessary power house and equipment are constructed and acquired. Anticipating that at the next session of the Legislature the necessary authority to use electric power instead of steam may be given the company has acquired control of substantially all the private property required to make enlargement of the yards and for the widening of Park Avenue, and is ready to commence this work if the end sought by the petition can be obtained and the necessary municipal action taken. It is the present intention of the railroad company to discontinue the use of steam as a motive power for all of its trains through the Park Avenue tunnel and to operate such trains by electricity—probably as far as Croton on the Hudson division, and White Plains on the Harlem division. The date upon which operation by electricity can be commenced will be determined (the necessary authority being obtained) upon the time required for the construction and equipment of power houses. With the same desire the company is ready, if it has the co-operation of the city, as prayed for in the petition, to enter into contracts for the power houses required for operation by electricity and take other steps for expediting the work as soon as the necessary details can be perfected."

The Hearing on the Use of Fenders, Jacks and Power Brakes in Massachusetts

The Railroad Commissioners of Massachusetts gave a hearing Sept. 29, in accordance with their announcement, on the three resolves of the General Court, directing them to investigate and report as to the advisability of passing laws to compel all street railway companies operating in the State to equip their cars with jack screws and power brakes, and to determine whether there are more practicable types of fenders now in the market than those in general use. The electric railway managers were largely represented at the hearing, but it was continued in each case, so far as their side was concerned, until some date to be arranged later.

The jack proposition, which was introduced in the last Legislature by a New Bedford representative, was advocated by no one. The power brake resolution was favored by two citizens, and Chairman Jackson, of the Railroad Board, improved the opportunity to remind the auditors that in its report on the accident at Marlboro last summer the belief was declared that all double truck cars running at high speed on single tracks should be equipped with power brakes. Several parties exploiting fenders were present to explain the good points of the various devices, but no new voice was heard pleading for them on the part of the public. However, Chairman Jackson announced that this was not at all conclusive of a lack of popular demand, and stated that the Railroad Commissioners desire to examine all new devices. The desire is to examine devices in operation if possible, but models will receive attention. Records concerning the working of devices in the hands of the companies would be helpful, Mr. Jackson said.

A Discussion on Electric Railways by a Waterworks Association

At a meeting of the Central States Waterworks Association, held at Indianapolis, Sept. 25, an address on electrolysis was delivered by L. C. Anderson, consulting electrical engineer, of Franklin, Ohio. These remarks were followed by a discussion, in which various members of the association participated. As these proceedings give an idea of the way in which the representatives of the water companies regard the subject, a report of the proceedings is given below:

Mr. Anderson: Electrolysis is the name given to that mechanical process which consists in the dissolution of a chemical compound by the passage of an electric current through such compound. As applied to water pipes, this takes place during the passage of the electric current from the water pipe into the soil. The soil contains salts in solution. These salts vary in their character, but they nearly always contain sodium chloride from the street washings. A certain amount of refuse is necessarily on the street at all times, so that the sub-soil in which the pipes are buried necessarily becomes highly saturated with salts in solution. These salts are decomposed by the passage of the current from the pipe into and through the soil, and the acid constituent of that process of decomposition attacks the iron, or the lead or copper, as the case may be, in the pipe. The metal passes into solution, leaving in its place, in the case of cast-iron pipe, a carbon in the form of graphite, which is not soluble in the ordinary acids or salts. This process is continuing, and does continue in proportion to the amount of current which leaves the pipe, until the pipe is so injured that the pressure of the water in the pipe causes it to burst. This current referred to as being on the pipe comes from the operation of street railways. The rails of the street railway in the single-trolley system are in direct contact with the soil. As you all know, in operating the single-trolley system, the current passes from the car into the rails, and is supposed to pass along the rails back to the power house. Part of it does sometimes. But, inasmuch as the rails are in direct contact with the earth, part of the current which passes into the rails must necessarily leave them and pass into the earth and into any underground metallic structures that may be buried in the earth. This current does no injury to the pipe where it enters, but it does injure the pipe where it leaves the pipe and passes into any other conductor. As the current passes along the pipe it is found that a part of it passes around the joints of the cast-iron mains, on account of the high resistance of the joints. In measuring the resistance of the joints we find a great variation; some joints have a comparatively low resistance, some very high. I measured the resistance of one joint in a 6-in. pipe last week, and found it had a resistance of 40,000 times that of 1 ft of a 6-in. cast-iron water main. On account of this high resistance, part of the current passing along the pipe is shunted around the joint. Wherever this occurs the pipe is injured so that you have two kinds of damage; one of them where the current leaves the piping system to pass to the power house or to the return feeders from the power house, and the other where the current passes around the joints. Of course, the current passes over approximately all of the pipes in the piping system, not only the pipes under the rails, but frequently those which are far distant from the rails. With the exception of the dead ends of the pipes, it is safe to say that the current passes over all the pipes contained in the piping system. This damage to the joints of which I have spoken is not confined at all to the positive area, or to the part of the system where the current is leaving to return to the rails; it is found throughout the whole piping system, negative as well as positive area. It is generally greatest at or near the point where the pipes are changing from negative to positive.

In examining pipe in the various cities we find that what I have given as a theoretical expectation does actually take place. I have myself examined pipes in a number of cities, and in every place where the single-trolley system is used I found serious damage to the piping system. I am not a lawyer, and am not going to say anything as to the legal aspect of the question particularly, but it occurs to me from my experience I may be able to give you a little bit of advice regarding the proper methods of procedure in this matter. In the first place, I would advise you to not become in any manner a party to any agreement with any railway company which anticipates the use of the piping system as a part of its electric return system. By that I mean I would not become a party to any agreement which provides for the use

of a single-trolley system of any kind or nature. Wherever you have the power to dictate or influence the provisions of any franchise ordinance I would suggest and urge that provision be made which will protect the water plant from any damage from the operation of the street railway. I would further urge that this be not attempted in a manner to dictate the system to be employed or adopted by the railroad company, but that the requirements be made with a view alone to the results to be accomplished. It frequently happens that a railway company is applying for a franchise or renewal of its franchise, and it seems to me that that is the psychological movement for the water interests to protect themselves against this damage.

Mr. McK. Landon: You would not be a party to any agreement?

Mr. Anderson: I should be a party to no agreement providing for the bonding of the joints, or bonding of pipes, or insulation of the joints of the pipes, but only to an agreement providing that the railroad should be so operated that none of the electric current used in such operation of that road shall pass upon, to, over, or from, the piping system; that is the only agreement that I would advise you to become a party to.

Mr. Pater: Do you know of any other remedy than the employment of the double-trolley system?

Mr. Anderson: There is no other remedy except a system which provides for a return of the current to the power house by way of insulated conductors.

Mr. Pater: Third rail?

Mr. Anderson: Not necessarily third rail; it might be a second-wire overhead; it might be a second-wire underground, but it must be an insulated conductor. The only practical appliances used at the present time, the only ones that I know of, are the overhead double-trolley system and the underground conduit system, which is being used in New York and in Washington; in that system there are two conductors in the conduit, one acting as the positive and the other as the negative conductor. The current passes out from the power house through the positive conductor through the car which it operates, and back to the negative conductor, which is absolutely insulated from the rail, and over and upon that negative conductor it returns to the power house.

President Pater: Then you would suggest to this association, as you said, that the different municipalities suggest no remedy but make the street railway company furnish the remedy?

Mr. Anderson: My suggestion is just this: that this association be very careful to not suggest any remedy which may make them a party to any damage which might result from the use of that remedy when the remedy may not be complete. My suggestion is that, in order not to make any unreasonable requirement, that you only require results without specifying in what particular manner they are to be secured. Now, if you require, for instance, an underground double-trolley system the railroad people might very well argue that it is unreasonable for you to require that, and they would so contend before a court. They would argue that there are other methods by which the result desired could be secured, and that you had arbitrarily set up one particular method for bringing about one result without giving them any opportunity to adopt any other equally efficient method; consequently, that your requirement was unreasonable. On the other hand, if you require that that road shall be so maintained and operated that none of the electric current used in the operation of the road shall pass on, to, over, upon, or from your water pipes, then the railroad company has it in its hands to bring about that result in any possible manner, and it relieves you of the possible claim on their part of being unreasonable in your demand. You bring about the same result, but in a more reasonable manner.

President Pater: Would you not also suggest that all cities where there are street railway systems, especially the smaller towns where there are interurban lines using very heavy voltage, make an examination from time to time of their water mains and keep a record of the condition of same?

Mr. Anderson: I think that a very advisable precaution.

President Pater: I notice some courts have said you can only go back to the time when you found the damage occurring, and that you should have investigated the same and notified the street railway companies of its existence. If you have a competent engineer you can easily test the voltage on your water mains and keep an itemized record of same.

Mr. Anderson: I heartily concur in the suggestion made by Mr. Pater, and, in addition to having a record of the voltage readings between the pipes and rails, would suggest that accurate data of the condition of the pipes in different locations should be preserved at the times of these readings; also that arrangements be made to determine the amount of current passing over the piping system. While it is very interesting and very important to know the difference in potential between the pipes and rails, this determination does not go far enough to prove beyond a reasonable doubt that the damage is being done by the railroad company. It is necessary to trace the current back to them, and, in addition to that, it would be of great value to give the condition of the pipes at different times to show the depreciation extending over different periods.

Mr. McK. Landon: The court at Dayton said that facts seem to indicate at Dayton that the single-trolley system can be so operated as not seriously to damage underground metallic structures, but from your remarks I infer it is not possible to operate a single trolley so that there will not be serious damage. It may extend over a long period of years, but the damage will go on, and it is impossible in any system which returns the current by rail to prevent a considerable part of that current escaping to the underground-piping system. I would ask if bonding of the rails would prevent that?

Mr. Anderson: Even though the bonding is as perfect as possible to make it; further, even though the rails be made of solid copper themselves; the damage to water pipes would continue. It is absolutely impossible to operate a single-trolley system with the rails uninsulated from the earth, as they always are, without seriously damaging the piping system. While it was held in the Dayton case by the court that it was possible to operate a single-trolley system in such a manner as not appreciably to damage the piping system, I am willing to take issue with the court on that part of his finding.

Mr. Hulley, Marion, Ind.: Would not it be well, in making this investigation, to notify the street railway company that damage is being done, so that it cannot say hereafter that it was not notified of any damage?

Mr. Anderson: I had that in mind as one of my recommendations that the railway company should be notified that it was damaging the water pipes, and also to notify it to discontinue the damage. The advantage of doing this is in order to prepare yourself in case action is brought in court for damages existing at the time the notification was made. It would be very difficult to secure damages from the railway company, under a number of decisions that have been rendered, unless some objections had been entered to the manner in which the railway company is operating its system. The courts have in some cases held that the franchise ordinance should be interpreted as meaning the manner in which the ordinance was interpreted at the time of the construction of the road; that is, if the ordinance did not provide for a single or double trolley system specifically, that if the railway company, under that ordinance, built a single-trolley system and operated a single-trolley system, the municipal authorities meanwhile standing by all the time and seeing them build and operate that system, without objection made on their part, then the interpretation of that contract would be that up to the time the objection was entered, at least, that the contract in the franchise ordinance provided for a single-trolley system; this makes it very necessary that some notification be given the railway company at the time the damage is found to exist, and that should be at as early a moment as possible after discovery of it.

Mr. C. Monjeau: I should like to ask one question, which I think is due right here: Mr. Anderson, would you not advise without modification a resort to an injunction whenever any company or companies are proposing the introduction of a single-trolley system?

Mr. Anderson: Well, that is a legal question. Of course, I am not—as I said before—qualified as a legal expert, but from my limited knowledge of the law I should think that that would be a very advisable thing to do, indeed.

President Pater: I would state here, in this connection, that while the destruction of our water companies' mains is a tremendous loss in money to the water companies, or to the cities operating them, there is another danger arising to life from electrolysis with these large buildings going up all over the country. Some office buildings contain from 500 to 2000 persons, and there is great danger that this electrolysis will affect these steel structures in the course of time. Many of these structures run their iron framework into the ground a considerable distance, and the trolley cars are running around the corners of these large sky-scrapers. Now, that might entail not only great loss of property and money value, but loss of life. I believe that we can get those people interested in this matter. They are at present giving no thought to it, and will not until there is an accident, and then the country will wake up! If we will enlist some of these interests in this cause and call their attention to this great danger, as I think Judge Carter called their attention to it, it may accomplish something. Judge Carter said that you must always bear in mind the possible destruction of life that may occur if you destroy the tenacity of these steel frameworks. I believe we ought

to enlist the co-operation of these interests in this subject, and they will help us in fighting these people, who are simply determined not to give us a proper remedy.

Mr. Boynton: It occurs to me, in addition to the very excellent suggestion made in regard to the form of franchise or contract requiring results without prescribing manner of securing those results, that we should also include a clause that the railway company shall be responsible in damages for any injury resulting to the waterworks system from the operation of their road; embody that right in the franchise itself.

Mr. Anderson: One thought occurs to me with regard to Mr. Boynton's remarks, that any clause put in the ordinance or contract providing that the railway company shall be responsible for any damages which may arise from their manner of operating the road seems to my mind to imply the idea that they may possibly so operate that road as to do damage. The thing that you need is to have them build the road in such a manner that they shall not do damage, and that you shall not in any manner or form in your ordinance give any reason for any court to suppose that it was intended that they should do damage to the pipes, provided they paid for it. Any damages that you may recover from a railway company is, of course, to your pecuniary advantage, but the thing that is important to you is to preserve those pipes to the purposes for which they were installed in the ground. The railway company might agree to replace all the pipes that are destroyed by electrolysis, but what good will that do you if at the time of a large fire a main bursts? Suppose the disaster means that $1,000,000 worth of property is destroyed in the flames, what clause like the one suggested will cover the loss of that property in this indirect manner? Surely, none. It seems to me that the wisest thing to do in drawing up such an ordinance is not in any manner to suggest that any other system shall be adopted than such a system as will entirely protect you from this damage.

Traffic on the Chicago Elevated Roads

Traffic on three of the Chicago elevated roads so far this year in passengers carried is given in the following table:

METROPOLITAN ELEVATED

Month	1902	1901	Increase	Per Cent
January	98,029	89,699	8,339	9.3
February	100,466	97,659	2,807	2.8
March	105,512	98,339	7,173	7.3
April	109,246	97,018	12,228	12.6
May	105,799	92,579	13,227	14.2
June	101,743	86,179	15,564	18.0
July	97,299	79,308	18,621	23.4
August	100,099	81,256	18,843	23.1
September	109,751	88,226	21,525	24.6

NORTHWESTERN ELEVATED

Month	1902	1901	Increase	Per Cent
January	62,010	52,022	9,988	19.5
February	64,760	55,256	9,504	17.2
March	65,362	57,193	8.169	14.3
April	65,430	58,623	6,807	11.6
May	63,199	56,399	6,200	10.8
June	60,813	53,587	7,226	13.4
July	56,110	48,559	7.551	15.5
August	57,911	49,770	6,141	16.3
September	63,950	54,065	9.885	18.2

SOUTH SIDE ELEVATED

Month	1902	1901	Increase	Per Cent
January	79,154	71,137	8,017	11.2
February	79,386	74,525	4,861	6.5
March	80,313	76,269	4,044	5.3
April	81,009	77,772	3,237	4.2
May	76,063	74,205	1,858	2.5
June	76,449	69,645	6.804	9.7
July	70,767	63,763	7,004	10.9
August	68,334	61,143	7,191	11.7
September	76,572	67,627	8,945	13.2

Apparatus for the New Lines of the Union Traction Company of Indiana

Mention has already been made in these columns of the large mileage of new interurban lines being constructed by the Union Traction Company, of Indiana, in addition to the 100 miles of interurban line already operated. The electrical apparatus to furnish power for these new lines has recently been contracted for with the Westinghouse Electric & Manufacturing Company. The whole system will be operated from the present modern and economnical power house at Anderson. The transmission voltage at which the present sub-stations are supplied is 14,000. The power house will be increased in capacity by the addition of two 1000-kw generators and seven 500-kw step-up transformers. There will be six new sub-stations in addition to the eight already operated. Each sub-station is to have two 250-kw rotary converters and four 175-kw step-down transformers, reducing from 30,000 volts to 375 volts. The order for new apparatus, therefore, includes twelve rotary converters and twenty-four step-down transformers. The Westinghouse Company will also supply all the necessary switchboards in connection with this power distribution. In addition to the portable sub-station, which the Union Traction Company of Indiana already owns, another has been ordered, which will contain a 250-kw rotary converter and three 87-kw transformers. These portable sub-stations are placed in a box car and can be run into any sub-station on the system.

The Hudson Valley Railway Strike

The strike of conductors and motormen on the Hudson Valley Railway, which was declared on the morning of Saturday, Aug. 30, has been resumed, although last week it was announced that it had been closed, and that the men had acknowledged their defeat, and applied for reinstatement. The causes which led up to the trouble were explained in the STREET RAILWAY JOURNAL of Sept. 20. When the strike was ordered it was announced that the former employees had taken measures to prevent any deeds of violence and intimidation, but as soon as the company attempted to operate cars the usual methods were resorted to, and in several cases very serious accidents were averted only by the extraordinary precautions that were taken by the company. At several points along the road cars were stoned and attempts made to drive the motormen and conductors from their places, and it was found necessary to call out the State militia, as well as to secure the services of a large number of deputy sheriffs to protect the company's property. About two weeks ago the company succeeded in opening its lines and resuming service, although the regular schedule was not followed for some time, but last week most of the old employees had applied for reinstatement, and the leaders of the strike acknowledged their defeat. The company selected from its former employees enough men to fill the unoccupied positions on the road, the militia was withdrawn, and arrangements made to operate on the old schedule. On Saturday night and on Sunday, however, hostilities were renewed. At Glens Falls a mob badly wrecked several cars, took some of the motormen and conductors from them, stoned the cars, fired at the military, overawed the police, and for a time was in control of the town. The rioters started for a mass meeting the labor unions were to hold. They were making a parade preliminary to the meeting, and the rear end of the line broke off and followed a car. At a switch they got the trolley off the wire, broke the rope, jeered at the crew, threw stones, breaking the windows and forcibly dragged the crew off the car. Other cars came along until there were four on the switch. A motorman was hit on top of the head with a brick and badly cut in the face. The police succeeded in getting five of the crew on the four cars to headquarters, although followed to the station by the mob, which endeavored to force an entrance into headquarters through a rear window. They were not driven away until fired upon by the police. In the meantime the sheriff had called out Company K, National Guard, again. A detail guarded the four stalled cars and another went to police headquarters after the non-union men and escorted them to the company's offices. A mob of 2000 or more was hooting, jeering and crowding upon them, and it was necessary in several instances to club muskets to get through. The crews were put back on the cars, and, guarded by the soldiers, started for the station, 2 miles south. They were thus escorted to the outskirts of the village, where the soldiers boarded the cars. Almost immediately there were several shots fired at the cars, which the guard answered with a volley. A half mile farther the cars were stalled because poles and wires had been cut down. The cars returned to the armory, and later, repairs having been made, started for the station. On the grade near Rogers Street men signalled to the first car to stop, and when no attention was paid to the summons they endeavored to stone it. The cars slowed down and the soldiers arrested the men, not, however, until after the cars had crashed together, being damaged considerably. It was then found that the rails had been greased and an attempt made to pile the four cars in a heap.

At South Glens Falls, Saratoga County, the wires have been cut and a car stoned, the conductor being hit by a brick. The service there was discontinued. Everything is reported as quiet on the other divisions of the road in Washington, Warren and Saratoga counties.

On Sunday the militia was detailed to protect the power house and other property of the Hudson Valley Electric Company in Glens Falls. A squad also guarded a bridge at Sandy Hill, having been sent there owing to a report that one of the canal bridges there was to be blown up. Thirteen persons are being held for inciting riot Saturday night. Mud is being thrown at cars and passengers in Fort Edward.

Dick, Kerr & Co.'s Business

Dick, Kerr & Co., Ltd., of London, have made a very satisfactory showing in their annual report for the year ended June 30, which was submitted to the shareholders on Sept. 29 The profits earned during the twelve months' trading to June 30 amount to £103,757 16s. 7d. Out of this had to be paid debenture and loan interest and trustees' fees, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These absorb £6,683 10s. od., leaving a balance of £97,074 6s. 7d., to which must be added the profits brought forward from last year, viz.: £27,793 9s. od., making a total of £124,867 15s. 7d. available for appropriation as follows: (1) To pay a dividend of 5 per cent per annum on the preference share capital (the proportion of this dividend to Dec 31, 1901, has already been paid), £6,000. (2) To carry one-fifth of the remaining profits to reserve fund, as required by clause 24 of the trust deed securing the debentures, £18,214 17s. 4d.; further sum to this reserve, £21,785 2s. 8d. Total, £40,000. (3) To pay a dividend of 10 per cent and a bonus of 20 per cent on the ordinary share capital of £160,000, free of income tax, £48,000. (4) To carry forward the balance of £30,867 15s. 7d. Total, £124,867 15s. 7d. The dividend on the preference shares were payable on Oct. 1, as usual, and the dividends and bonus recommended on the ordinary shares will be paid when approved. The directors consider the result of the twelve months' trading satisfactory, and state that the prospects for the current year show every indication of good results. Since the last report important contracts have been carried out for the construction and equipment of several electric tramways in Great Britain and abroad; and these works have given satisfaction to the company's clients. The resolutions for acquiring the shares of the English Electric Manufacturing Company, Ltd., were duly passed, and the exchange of the shares will be carried out. Steps will be taken to acquire the few outstanding shares, and arrangements will be made with the debenture holders of both companies at an early date.

Ballast Car for Street and Interurban Railways

The old-fashioned ballast car is rapidly giving place, on both steam and electric railway construction work, to more modern types. One of these, which was designed especially for electric railway work, is illustrated herewith. These cars are not only

BALLAST CAR FOR CONSTRUCTION WORK

in extensive use for distributing ballast, but are also very economical for filling trestles or on other work requiring the load to be dumped between the rails. The wheels are chilled hard for long wear; bronze journal bearings are used and white oak timber is employed throughout. The doors are hung at the bottom of the bed by angle iron hinges of strong construction and are held in place by double test-proof cable chains. The load is discharged by tripping a lever, not shown in the illustration, which releases the doors. The latter are brought back to place by means of a lever and a ratchet winding the chains around a roller.

Removal of American Correspondence School to Chicago

The American School of Correspondence, which was organized several years ago at Boston, has removed its headquarters to Chicago, and will be conducted hereafter in conjunction with Armour Institute of that city. Dr. Gunsaulus, president of the Armour Institute, has been made chairman of the advisory board of the Correspondence School, and the work of instruction by correspondence will be carried on under the regular faculty of the Armour Institute. It is worthy of note that all work under the correspondence system will be recognized in applications for degrees from Armour Institute. The Correspondence School has been particularly successful in its mechanical and engineering departments, and it has already a large list of graduates occupying responsible positions. Its present roll of students includes representatives in many foreign countries, including New Zealand, China, India, Russia and other remote quarters. The Correspondence School has also recently issued a very handsome "Reference Library of Modern Engineering Practice." These volumes are prepared for the use of the more advanced students, and contain carefully prepared articles on engineering topics by authorities in their respective lines. Under the new arrangement with the Armour Institute it is expected that the Correspondence School will enjoy even greater success than it has already met, as its facilities will be very much improved.

Rapid Transit at the World's Fair

It will cost $750,000 to construct and equip the rapid transit system upon the World's Fair grounds at St. Louis. The length of the road and its branches will be 8 miles, and it will enable the visitors to see the vast exposition with as little fatigue as possible. The problem in planning the intramural road has been to place it where it would not mar the beauty of the exposition. Eminent engineers have been called into consultation and all phases of the project have been studied thoroughly. It is believed the plan presented by Charles V. Weston, of Chicago, comes nearest to a perfect solution of the difficulty. Owing to the varying altitudes of the exposition grounds the road will be at times an elevated line and in other parts built at grade or below the surface. The trip on the intramural railway will undoubtedly be one of the most delightful diversions for visitors to the exposition.

Sale of Southern Property

Interests identified with the Railways & Light Company of America, who are also the controlling owners in the North Augusta Electric & Improvement Company, of Augusta, Ga., and the Augusta-Aiken Electric Railway Company, have consummated the purchase of a majority of the stock of the Augusta Railway & Electric Company, of Augusta, which owns the entire street railway and electric lighting properties of Augusta. Its capital stock is $1,000,000, and it has $1,000,000 of bonds outstanding.

Meeting of the New York Railroad Club

The next meeting of the New York Railroad Club will be held on Thursday, Oct. 16, at the rooms of the Metropolitan Street Railway Association, No. 761 Seventh Avenue, corner Fiftieth Street, New York City. The subject of the evening, "Railway Freight Claims," will be presented in a paper by R. L. Calkins, freight claim agent of the New York Central & Hudson River Railroad. A full discussion is expected, particularly on the line of the relation efficient service by the mechanical and transportation departments bears to the number and importance of claims presented. The executive committee is experiencing considerable difficulty in securing satisfactory permanent quarters for the club, and in the emergency was glad to accept the invitation extended by the Metropolitan Street Railway Association to use its quarters for the coming meeting; at that meeting the special committee on new quarters, consisting of the president and the secretary, will render its report and a permanent location will then doubtless be decided upon. The secretary of the club has removed his office to 418 Center Street, South Orange, N. J.

Topics of the Week

In a speech in Hamilton County the other day Mayor Johnson, of Cleveland, said: "The Republicans at Akron had two big elephants in their parade. Our side have only Mr. Bigelow and myself to attract the people."

A wealthy resident of St. Louis has made a six months' contract with a street car advertising firm for the display on the cars of the St. Louis Transit Company of 200 cards on which are printed six scriptural quotations, taken from as many books of the Bible. The cards have appropriate headings, and since their appearance they have attracted unusual attention.

The Supreme Court of Washington has decided that a street railway company is responsible for mistakes made by its conductors in the matter of issuing transfers to branch lines, and that a person who may be ejected from a street car because he does not possess a proper transfer is entitled to recover damages against the company if the fault of the mistake lies with the conductor who issued the transfer.

The Lord Mayor of Liverpool, England, visited Cleveland a few days ago "to meet Mayor Tom L. Johnson and inspect his low-fare tramways," regarding which the Lord Mayor is said to have heard very much. Mayor Johnson was away on his circus campaign, and it took some tall explanations to convince the worthy Briton that the 3-cent fare lines exist only in the minds of the jovial Mayor and his followers.

According to last year's census, Paris had 96,698 horses which could be utilized in case of war, this having been the average figure for many years; but this year the number has suddenly fallen to 90,796. This considerable diminution is said to be due to mechanical traction. The Paris Omnibus Company had last year 16,579 horses in its service; now it employs nearly 2000 less. In all the companies which compete with the tramways and the Metropolitan Railway, the diminution of horses has been 2727. The remaining 3175 horses which, since last years's census, have passed out of service have, therefore, it is said, been replaced by automobiles.

The Wall Street Journal quotes a director of the New York, New Haven & Hartford Railroad as saying: "The operations of the New York, New Haven & Hartford Railroad for the year ended June 30 last were certainly very favorable and indeed gratifying to the directors. The annual report is certainly noteworthy when consideration is taken of the fact that the system is networked with electric car lines, more so than any railroad in the country. As I stated some time ago, I still maintain that the electric railway, as now operated, is a help rather than a detriment to the steam roads. The electric railway is bringing people to the centers of population, and encouraging travel by the general public. It is possible that the through electric lines may hurt the steam roads somewhat, but until these through electric lines have demonstrated their usefulness to the public, and their ability to earn dividends, it is impossible to say just to what extent their competition will affect the earnings of the steam roads." There are many persons who would like to have this director explain why the company equipped some of its branch lines with electricity, why the company always opposes the construction of an electric railway that enters its territory, and why that memorable fight was made against the New York & Port Chester Railroad.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED SEPT. 23, 1902

709,484. Magnetic Wheel; J. O. Heinze, Jr., Revere, Mass. App. filed Feb. 24, 1902. A number of electromagnets are formed in the structure of the wheel and energized for the purpose of increasing the traction of the wheel.

709,516. End Panel and Seat Post for Open Cars; J. Seeberger, Watervliet, N. Y. App. filed April 24, 1902. An improved construction for connecting the metal end panel with the base of the post.

709,517. End Panel for Open Car Seats and the Seat Post with which it Connects; J. Seeberger, Watervliet, N. Y. App. filed April 24, 1902. Modification of the preceding patent.

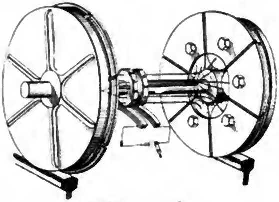
709,564. Pivoted Rocker Bearing Center Plate for Railway Cars; C. M. Thompson, Newark, Ohio. App. filed May 12, 1902. A truck center plate secured to the bolster and provided with an annular channel to receive a number of radially disposed rockers and with a central opening to receive the pivot portion of the body center plate.

709,590. Trolley Track Switch; P. F. Werner, Williamansett, Mass. App. filed April 7, 1902. Details.

709,675. Electrically Operated Railway Switch; J. Loney, Detroit, Mich. App. filed June 21, 1902. The switch point is raised and lowered by a cam surface on the rod which connects the cores of two solenoids.

709,743. Track Brake; T. S. Butler, Vandergrift, Pa. App. filed April 15, 1902. Two levers carrying roughened wheels are pivoted in a position so that when moved by the brake chain the wheels will be thrown against the rails.

709,755. Center Bearing for Railway Cars; F. Ditchfield, Avalon, Pa. App. filed July 1, 1902. A center bearing plate having a projecting member of any desired height and conformation and a base shrunk thereon.



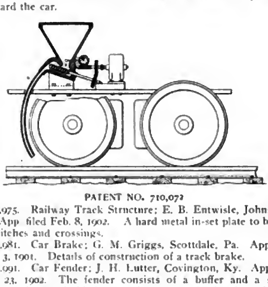
PATENT NO. 709,484

709,805. Railway Switch Operating Device; J. C. Booth, Monesson, Pa. App. filed May 14, 1902. A plow adapted to engage a switch-throwing lever in the roadbed is thrown downward by operating a push button which closes the circuit through a magnet whose armature moves the plow.

709,878. Manufacture of Rail-Bonds; F. H. Daniels and H. W. Wyman, Worcester, Mass. App. filed Feb. 7, 1902. The end of the bond is provided with a socket into which a hard metal plug is driven to spread the bond in the orifice of the rail.

709,884. Car Brake; J. H. De May and F. Hoyland, Jr., Jackson, Mich. App. filed Jan. 29, 1902. A combination of worm and spur gearing between the brake staff and the rigging.

709,923. Momentum Car Brake; T. E. McCollum, Toronto, Can. App. filed Jan. 2, 1902. Wedging discs are forced between a pair of discs loosely mounted on the axle, said pair of discs being located between two other fixed discs with which they engage to retard the car.



PATENT NO. 710,072

709,975. Railway Track Structure; E. B. Entwisle, Johnstown, Pa. App filed Feb. 8, 1902. A hard metal in-set plate to be used at switches and crossings.

709,981. Car Brake; G. M. Griggs, Scottdale, Pa. App. filed Sept. 3, 1901. Details of construction of a track brake.

709,991. Car Fender; J. H. Lutter, Covington, Ky. App. filed June 23, 1902. The fender consists of a buffer and a scoop; when the former is hit it trips the latter, allowing it to fall and pick up the obstacle.

710,072. Electric Railway System; W. B. Potter, Schenectady, N. Y. App. filed Feb. 28, 1901. A conveyor for feeding out the sand from the box is driven at will by an electric motor.

710,134. Sand Distributor for Railroads; W. H. Bell, Brooklyn, N. Y. App. filed May 7, 1902. The spout of the sand box is automatically moved by the truck when the car passes around a curve, to deliver the sand to the proper point at all times.

PERSONAL MENTION

MR. H. F. PARSHALL, who has been visiting in this country for several weeks, sailed last Tuesday for England.

MR. FREDERICK WILSON has resigned his position as manager of the Brantford Street Railway Company, of Brantford, Ont.

MR. A. B. DOLBY, who recently resigned his position with Mr. Francis Granger, is now in charge of the street railway department of the General Supply Company, of New York.

MR. WILLIAM F. MULKEY, one of the owners of the Toledo & Monroe Electric Railway, died at his home in Detroit a few days ago. He was identified with a number of prominent Detroit enterprises.

MR. ROBERT C. BROWN, formerly general manager of the Sao Paulo Tramway, Light & Power Company, Ltd., of Brazil, has been appointed electrical expert of the Toronto Railway Company.

MR. J. B. ROHRER, chief engineer of the Honolulu Rapid Transit & Land Company, Honolulu, H. I., has resigned his position to return to the United States. Prior to his connection with the Honolulu Rapid Transit & Land Company Mr. Rohrer was for three years connected with the Chicago Drainage Canal.

MR. A. B. SANDERS, who has for several years been connected with the engineering department of the American Telephone & Telegraph Company at New York, has resigned to take a position as sales engineer with the Electric Storage Battery Company, of Philadelphia.

LIEUTENANT-COLONEL HORATIO A. YORKE, chief inspecting officer of railroads for the Board of Trade, of London, who has been commissioned to prepare a report on the workings of American railroads, especially electric railways, is now in this country. Mr. Yorke proposes to spend about a month here, and will make a special study of the underground conduit system.

MR. THOMAS HAWKEN, who has been superintendent of the Rockland, Thomaston & Camden Street Railway, of Rockland, Me., for several years, has been appointed general manager of the company. Mr. Valentine Chisholm, who has been chief electrician of the company, has been appointed superintendent to succeed Mr. Hawken.

MR. LOUIS F. HYDE and MR. CHARLES S. BAXTER, who have had charge of the legal and claims department of the Boston Elevated Railway during the past five years, and who acted in like capacity for the West End Street Railway, of Boston, which was succeeded by the Boston Elevated, have resigned.

MR. ALEXANDER McKENZIE, formerly of the Toronto Railway Company, has accepted the position of vice-president and general manager for the Sao Paulo Tramway, Light & Power Company, Ltd., of Sao Paulo, Brazil, and is now on his way to Sao Paulo to take up the work. The Sao Paulo Tramway, Light & Power Company has just added a new turbine to its plant, making four machines in all, as well as thirty new cars, and it is extending its operations in every directions.

MR. E. W. GOSS has resigned as president of the Middletown Street Railway Company of Middletown, Conn., and Mr. Oliver Gildersleeve, of Portland, has been elected as his successor. Mr. Goss retired from the company in order to devote his entire attention to the Milford, Holliston & Framingham Street Railway Company, of which he is treasurer, purchasing agent and superintendent.

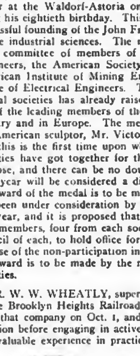
MR. CHARLES S. KIMBALL, designer of structural steel and track work for the Interurban Street Railway Company, of New York, was married at St. Nicholas' Episcopal Church, New York, on Wednesday, Oct. 8, to Miss Margaret E. Ireland. Mr. Farley G. Clark, electrical superintendent of the Ninety-Sixth Street power station of the company, was best man. After a short trip to Niagara and the Thousand Islands, Mr. and Mrs. Kimball will reside temporarily with the parents of the bride.

MR. A. W. DETWILER has resigned as treasurer of the Toledo & Indiana Railway Company and the Toledo & Indiana Construction Company, of Toledo, Ohio, although he retains his interests in both companies. Mr. G. G. Metzger has been elected to succeed Mr. Detwiler as treasurer of the Toledo & Indiana Railway Company, and Mr. George B. Boone has been elected to the position of treasurer of the Toledo & Indiana Construction Company.

MR. W. B. YEREANCE has resigned his position with the Brooklyn Heights Railroad Company. Mr. Yereance has been connected with the Brooklyn Rapid Transit Company for three years, having been closely associated with Mr. W. W. Wheatly, superintendent of surface lines. He is an engineer of large experience, and was for many years mechanical assistant to the general manager of the old Brooklyn L road. He left that position to accept a more responsible one with the West Shore Railroad, and was there at the same time as Mr. Wheatly. Mr. Yereance is well known to all local steam and street railway men as secretary of the New York Railroad Club, a position which he has filled with most satisfactory results.

MR. JOHN FRITZ, the distinguished ironmaster and inventor, of Bethlehem, will be entertained at a dinner given in his honor at the Waldorf-Astoria on Friday, Oct. 31, the occasion being his eightieth birthday. This banquet will also signalize the successful founding of the John Fritz Gold Medal, for achievement in the industrial sciences. The medal will be awarded annually by a committee of members of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers. The committee representing the several societies has already raised $6,000 in contributions from 500 of the leading members of the engineering profession in this country and in Europe. The medal itself has been entrusted to the American sculptor, Mr. Victor D. Brenner. It is understood that this is the first time upon which the four great engineering societies have got together for the accomplishment of any such purpose, and there can be no doubt that the award of the medal each year will be considered a distinction of the highest honor. No award of the medal is to be made unless the candidate's name has been under consideration by the board of award for at least one year, and it is proposed that this board shall consist of sixteen members, four from each society, selected by the governing council of each, to hold office for one, two, three and four years. In case of the non-participation in any year of one of the societies, the award is to be made by the representatives of the remaining societies.

MR. W. W. WHEATLY, superintendent of the surface division of the Brooklyn Heights Railroad Company, resigned his position with that company on Oct. 1, and will enjoy a couple of months' vacation before engaging in active work again. Mr. Wheatly has had valuable experience in practical railway work, supplementing his training as a steam railroad man by several years' service on the street railway system of Brooklyn. His railroad career began in 1875 as clerk and telegraph operator on the Paducah & Elizabethtown Railroad in Kentucky. He passed through the several positions of ticket and freight agent and despatcher's operator until he became a train despatcher. In that capacity he served the Louisville & Nashville and the Chicago & Northwestern railroads up to 1884. When the West Shore Railroad was completed and opened to Buffalo for business he became chief train despatcher and afterward assistant superintendent of the Buffalo division, and later car accountant of the entire road. In 1896, after C. L. Rossiter became president of the Brooklyn Rapid Transit Company, Mr. Wheatly accepted the position of superintendent of one of the largest divisions of the system, and one year later was made assistant general superintendent of the system. Upon the retirement in 1899 of Mr. Ira McCormack, superintendent of all the surface lines, Mr. Wheatly was promoted to his place. In 1895 Mr. Wheatly, on account of his wide acquaintance with railroad men and railway problems, was elected secretary of the New York Railroad Club, a technical organization of steam and street railway men having over 1100 members. He remained secretary of the club until 1900, when he was elected first vice-president, a position he still holds. Mr. Wheatly has said that inasmuch as he has not had a vacation in six years, he proposes to enjoy himself and take a good rest for the next few months.



W. W. WHEATLY

FINANCIAL INTELLIGENCE

THE MARKETS

Wall Street, Oct. 8, 1902.

The Money Market

Review of the money developments of the last fortnight can hardly be as important as consideration of their effects upon the present position in the domestic markets. An acute money stringency, threatening serious consequences to business and a financial panic, induced the Secretary of the Treasury to adopt relief measures more radical in character than any heretofore ventured upon by his predecessors in office. He ruled that security against United States deposits in the national banks should not be restricted any longer to government bonds, but should include State and municipal bonds as well. These latter bonds, however, could only be accepted as a partial substitute for the United States bonds now held against public deposits, and could not be used to take out any new deposits; moreover, they could only be accepted on condition that the government bonds released by the substitution should be used immediately as a basis for additional note circulation. That this privilege will be utilized by the banks to any considerable extent is doubted for three reasons; first, because State and municipal bonds are hard to get and their price is high; second, because there is no assurance of an attractive profit in extra note circulation for more than a brief interval, and third, because the statutory provision that bank notes can be retired no faster than $3,000,000 a month would pretty surely compel the banks, if they issued any large quantity of new notes, to keep them out for a considerable period during which there was little or no profit in the issue. The order of the Treasury dispensing with the 25 per cent reserve hitherto required against government deposits, is of much more practical importance. It places at the disposal of the banks a cash sum of between $20,000,000 and $30,000,000, against which four times that amount of credits can be issued in case of need. It is clear, however, from the action of the New York Clearing House Association that these additional authorized credits are to be held as an emergency reserve, only to be availed of in case the business needs of the country were to become really acute. For the present the New York banks are not counting, as they might, the $10,000,000 or so thus released locally, as part of their surplus reserve, but have announced to their customers that the $1,800,000 surplus reported last Saturday above the legal minimum, is all that there will be available. Inasmuch as sterling exchange is more than a cent in the pound above the gold import level, the Treasury receipts are still in excess of disbursements, and currency is still going out to the interior, there has been no recourse but to cause wholesale liquidation among Stock Exchange speculators to the end that deposit liabilities may be reduced and surplus reserves indirectly strengthened. A stiff money rate is the natural accompaniment of this situation. Call money, which broke from an extreme 35 per cent to an average 8 per cent at the time of the Treasury's offer, advanced again on Monday to 12 per cent. Time loans are only obtainable at 6 per cent, with a small commission added on.

The Stock Market

The necessity for compelling extensive Stock Exchange liquidation in order to strengthen the resources of the local banks has been and still is the preponderant influence in the security market On the part both of buyers and sellers there has been tacit agreement that until this liquidation has been carried far enough to afford substantial relief, the ordinary influences in the financial situation must be disregarded and market quotations lose account of real values. Consequently the decline in prices, rapid, and at times violent, as it has been during the last fortnight, has gone on without any attempts to check it. It stands to reason, of course, that the securities which, under pressure, have been thrown over hastily by speculators, have gone into stronger hands, but nobody can ever tell when this transfer will have gone far enough to satisfy the demands of the money conditions and place the market on a thoroughly solid footing. All that can be said at all definitely is that, barring the coal strike, nothing unfavorable has developed in the situation at large, from the time a month or six weeks ago when everything was confidence in Wall Street. The real test of the strike is about to be made no' that the Governor of Pennsylvania has issued the call for the whole of the State militia. It must soon be discovered whether or not the mine owners are right in their contention that plenty of coal can be mined if all the men who want to return to work are assured of protection. The market awaits the conclusion of this uncertainty with much anxiety, realizing that should this strongest hope of an early resumption of mining be disappointed, a serious coal famine, with all its grave possibilities, will be inevitable. Should the operators' claims be justified, however, the financial outlook will be clear again, awaiting only the ending of the temporary money market difficulties to find expression in the security dealings.

The local traction stocks during the fortnight have moved so nearly in the path of the general market that there is little need for any special comment. Manhattan showed relatively more strength than the others. It has been bid up from time to time by a pool which was formed in the expectation that with the installation of the electric service on the West Side lines, earnings of the property will at once begin to show large gains. This pool, however, has not tried to hold up the stock in face of the general market weakness. Liquidation has gone on uninterruptedly in Brooklyn Rapid Transit and Metropolitan, friends of the properties showing no inclination whatever to extend support.

Philadelphia

The local traction stocks have responded only partially to the depressed spirit of the general speculation. Doubtless, because comparatively little of the stock has been distributed in the hands of the public, the pool in Philadelphia Rapid Transit has been successful in sustaining and even advancing the price. The quotation touched the highest record, 18½, last Thursday, afterwards losing only 1½ points to 17. Union Traction, moving sympathetically, went as high as 48¼, and held all but a fraction of its gain. American Railways has also been conspicuously strong, establishing a new record price at 54, and later losing only a point. Talk of an increased dividend the coming winter accounts for most of the buying. Philadelphia Traction is steady, with the usual investment purchases in evidence, around 98. This is equal to par with the recently declared semi-annual dividend taken into account. The "deal," whatever it may have been, in Fairmount Park Transportation is off for the present, and the stock has yielded to 28½, against 34, the high price a month ago. Other sales include Consolidated of New Jersey at 69½, Easton Electric at 20, and Railways General at 4¼ up to 5. Bond sales include American Railway 5s at 109, Electric-People's Traction 4s around 98 and 98¼, People's Passenger 4s at 105, Union Traction of Indiana 5s at 100 to 101, Indianapolis Railway 4s at 87½, Newark Passenger 5s at 117, United Railways 4s at 87 and 88, and Atlantic City Railroad 5s at 112.

Chicago

Chicago traction stocks have moved, on the whole, pretty independently of general market conditions. People close to the inside say that Metropolitan traffic this month will approximate 109,000 passengers daily. For the fiscal year ending in February the daily average should be 118,000. This would make earnings of the company enough to pay all dividend on preferred shares and leave a balance of 1 per cent for the common. Doubtless it is this situation which has been chiefly reflected in the firmness of the Metropolitan stocks, the common selling freely between 41 and 41½, which is a somewhat higher range than it has held for some time past. Northwestern has also been fairly steady, between 36½ and 36, but Lake Street Elevated is off to 10, and South Side to 110. Surface line stocks have been extremely dull, a few sales only being noted in City Railway at 216½, and in Union Traction at 17½ and 17. September earnings on both these properties are expected to show inferior results as compared with former months.

Other Traction Securities

Boston dealings have not reflected very greatly the general tendency toward liquidation. Boston Elevated is off on light trading from 156 to 155, with sales of the subscription rights at 75 cents. Massachusetts Electric common after reaching 36¼ reacted later at 34½, the preferred going down to 96. West End common, on small offerings, yielded to 93. Baltimore has felt the force of the general depression more keenly. United Railways securities have all sold down to the lowest figures recorded in some time, the common as low as 13½, the income bonds at 66¾, and the general 4s at 94½. On the other hand, Nashville securities were better supported, the shares selling up to 6⅞, and the 5 per cent certificates from 75 to 78¼, receding later to 75¾. Other transactions include Newport News and Old Point Comfort 5s at 109¾, City and Suburban (Baltimore) 5s at 115, Anacostia and Potomac 5s at 100, and Atlanta Street Railway 5s at 106¼ down to 105½. The announcement of the consolidation of New Jersey traction properties came as expected. It did not have much effect on North Jersey stock, the

previous price of 34 being about what the issue is to be taken over at in the consolidation. Camden and Trenton, on the idea that it may form a connecting link, has been dealt in rather actively on the New York curb between 4½ and 4¾. Other New York sales comprise American Light and Traction at 41 up to 42½, the preferred at 92½, Brooklyn City at 248½, New Orleans common at 16 up to 16⅜, the preferred at 54½, Washington Railway and Electric preferred at 52, San Francisco common between 21½ and 22⅝, the preferred between 60 and 62⅝ and the 4 per cent bonds at 91.

As a result of the tight money market in the East, there was a natural reaction in the trolley stocks on the Cleveland exchange. However, the general tone is good and prices have been well maintained. This is regarded as an indication of the strength of these securities, as under present conditions a heavy line of liquidation and consequent declining prices would have occasioned little surprise. Sales of traction stocks numbered only 2955, as against 10,089 for the week before. Lake Shore common was the most active, 900 shares selling at about 19. During the previous week this sold as high as 22½. The preferred sold at 57 and 58 on sale of 210 shares, the high mark of the previous week being 61. Western Ohio receipts held at 32 during the week. During the previous upward movement they sold as high as 35. Sales were 450 shares. Northern Ohio common and preferred showed little decline in view of the announcement of the reorganization plan outlined in another column. Four hundred and eighty-three shares of the preferred sold at around 98, and 332 shares of common at between 68 and 70. Cincinnati, Dayton & Toledo was quiet, 300 shares going at 40 and 41. On the Cincinnati exchange it was in greater demand and stronger. Aurora, Elgin & Chicago sold at 41 for 20 shares. The range of the previous week was from 38 to 44. Elgin, Aurora & Southern sold for 60 on 100 shares. During the week before it sold as high as 65 and declined to 56¼. Miami & Erie Canal Transportation Company sold at 29 and dropped to 25 for a small lot. At closing 29 was asked with no bids. Monday the entire list was weaker with sales limited to 200 Western Ohio receipts at 30½ and 30; 110 Lake Shore Electric at 19 and 18⅞, and 5 Northern Ohio common at 67.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Sept. 23	Closing Bid Oct. 7
American Railways Company	54½	52½
Aurora, Elgin & Chicago	42	38
Boston Elevated	158	154
Brooklyn R. T.	65½	61½
Chicago City	215	211
Chicago Union Tr. (common)	18⅞	17
Chicago Union Tr. (preferred)	54	50
Cleveland Electric	90½	88
Columbus (common)	56	60
Columbus (preferred)	106½	108
Consolidated Traction of N. J.	70	69½
Consolidated Traction of N. J. 5s	110½	110⅜
Detroit United	96	84⅜
Electric People's Traction (Philadelphia) 4s	98⅝	98¼
Elgin, Aurora & Southern	62½	51
Indianapolis Street Railway 4s	—	87
Lake Shore Electric	—	16⅝
Lake Street Elevated	[illegible]	10
Manhattan Railway	134⅝	132¾
Massachusetts Elec. Cos. (common)	37¾	34⅛
Massachusetts Elec. Cos. (preferred)	96	95½
Metropolitan Elevated, Chicago (common)	41	40½
Metropolitan Elevated, Chicago	91	88½
Metropolitan Street	[illegible]	136½
New Orleans Railways (common)	17½	16
New Orleans Railways (preferred)	56½	54
North American	125	122
Northern Ohio Traction (common)	70	66
Northern Ohio Traction (preferred)	98	96¾
North Jersey	31¾	31¼
Northwestern Elevated, Chicago (common)	36	36
Philadelphia Rapid Transit	15½	17⅛
Philadelphia Traction	98¼	98
St Louis Transit Co (common)	29	29½
South Side Elevated (Chicago)	111	110
Syracuse Rapid Transit	28½	30
Syracuse Rapid Transit (preferred)	73	76
Third Avenue	129	—
Toledo Railway & Light	37	a35⅝
Twin City Minneapolis (common)	125	116½
United Railways, St. Louis (preferred)	—	—
United Railways, St. Louis, 4s	86¾	—
Union Traction (Philadelphia)	47½	47⅝
Western Ohio Railway	30	28

(a) Asked.

Iron and Steel

Importation of foreign iron and steel continues in increasing quantity all along the line. Not only in foundry iron but in Bessemer also, the imports are heavy, while orders are constantly being filled abroad for steel billets, rails and structural shapes. The "Iron Age" thinks these importations would have had to be made in any event, even had the coal strike not cut down domestic iron production. It is, however, a fact that the shortage of coke and coal is becoming more and more embarrassing, and that if it continues much longer will seriously check consumption of the baser products. Quotations are unchanged, on the basis of $21.50 to $21.75 for Bessemer pig, $31.50 for steel billets and $28.00 for rails.

Metals

Quotations for the leading metals are as follows: Copper 11⅝ cents, tin 24⅞ cents, lead 4⅛ cents, spelter 5½ cents.

COLORADO SPRINGS, COL.—The Colorado Springs & Interurban Railway Company has filed for record a mortgage for $1,500,000, given in favor of the Central Trust Company, of New York, to secure an issue of $1,000 5 per cent thirty-year first mortgage bonds.

LA SALLE, ILL.—The Illinois Valley Traction Company has filed for record a mortgage for $600,000, given in favor of the Portland Trust Company, of Maine. The mortgage secures an issue of first mortgage 5 per cent gold bonds.

ROCKFORD, ILL.—The consolidation of the Rockford & Belvidere Railway, the Rockford Railway, Light & Power Company and the Rockford & Freeport Electric Railway as the Rockford & Interurban Railway Company has been perfected. The Rockford & Interurban Railway Company is capitalized at $1,000,000.

CHICAGO, ILL.—A special meeting of the stockholders in the Metropolitan West Side Elevated Railway Company has been called for Nov. 5, at which time the question of enlarging the objects of the corporation, enabling it to build a terminal spur and depot between Jackson and Van Buren Streets, between Market Street and Fifth Avenue, will be voted upon.

WATERLOO, IA.—The outstanding bonds of the Waterloo & Cedar Falls Rapid Transit Company have been called for payment at 103, interest to cease Dec. 1. A new issue of $600,000 5 per cent gold bonds dated Oct. 1, has been made and is taken by the First National Bank, of Chicago. Of the amount, $460,000 were subscribed by holders of the old bonds, the remaining $140,000 being offered for public subscription at par.

SIOUX CITY, IA.—The property of the Sioux City Traction Company, including franchises, rolling stock, tracks and power plants and car houses, has been transferred to the new owners, Swift & Company and Armour & Company. Mention of the sale was made in these columns a few weeks ago. The street railway system will be used in connection with the packing houses, and there is also a move on foot to purchase the stock yards and unite all these interests under one management. The street railway system consists of 50 miles of lines which comprise all the lines which were originally owned by the Sioux City Traction Company, Sioux City & Leeds Electric Railway Company, Central Traction Company, Sioux City Rapid Transit Company and South Sioux City Traction Company. The present capital stock of $1,200,000 will probably be increased in the near future. The new owners of the property have not yet elected a new board of directors and a new set of officers.

ATLANTA, GA.—A quarterly dividend of 1¼ per cent has been declared on the preferred stock of the Georgia Railway & Electric Company, payable Oct. 15.

MACON, GA.—The Macon Consolidated Street Railway Company and the Macon Electric Light & Railway Company have accepted the ordinance which provides for the consolidation of the companies as the Macon Consolidated Street Railway Company.

BALTIMORE, MD.—The United Railways & Electric Company announces that it has created an issue of $600,000 car trust bonds payable in annual instalments during a period of ten years. These bonds bear interest at the rate of 5 per cent per annum, and were sold to the Mercantile Trust Company, of Baltimore, upon terms not made public.

WORCESTER, MASS.—The Railroad Commissioners have approved an issue of $500,000 twenty-year 4½ per cent bonds by the Worcester & Southbridge Street Railway Company for funding floating indebtedness incurred in constructing and equipping the road.

WORCESTER, MASS. The lease of the Webster & Dudley Street Railway Company to the Worcester & Connecticut Eastern Street Railway has been approved by the Railroad Commissioners, the terms having been amended to meet the decision of the Commissioners as to length of term, payment of taxes and maintenance and operation.

STOUGHTON, MASS. The Stoughton & Randolph Street Railway hearing in the equity session of the United States Circuit Court has again been postponed to Oct. 22.

PITTSFIELD, MASS.—The Railroad Commissioners gave a hearing on Oct. 2 on the petition of the Berkshire Street Railway Company for authority to issue $250,000 additional stock for the purpose of paying construction expenses and buying the pleasure park near Pittsfield which it now leases. The company has $550,000 stock and $550,000 bonds already issued, and it was shown that in addition to the amount covered by the outstanding stock and bonds there is $450,000 in the company's possession, much more than enough to cover the issue desired. There was no opposition to the petition.

WORCESTER, MASS.—The directors of the Worcester Consolidated Street Railway Company have declared a dividend of 3 per cent on the $3,550,000 of stock already issued. A dividend of 2 per cent was declared in July, making the total so far this year of 5 per cent.

BOSTON, MASS.—The Railroad Commissioners have approved the Old Colony Street Railway Company's petition for permission to issue 9487 shares of stock, aggregating at par value $948,700, as authorized by the stockholders. The new stock is to be issued to refund floating debt and provide for the extension and improvements of the company's property.

BOSTON, MASS.—The Railroad Commissioners have approved an issue by the Boston & Northern Street Railway Company of 17,973 shares of capital stock, aggregating at par value $1,797,300. Of the new stock to be issued $951,300 are to be applied only to the payment of floating indebtedness and the remainder is to be applied in paying for improvements now being made.

BOSTON, MASS.—The West End Street Railway Company has awarded R. L. Day and Estabrook & Company the $3,550,000 4 per cent thirty-year bonds recently authorized by the Railroad Commissioners.

BOSTON, MASS.—The terms of the lease of the Norfolk Suburban lines to the Boston Elevated Railway have been practically decided upon by the officials of the companies. If the directors are agreed as to the terms they must then be laid before the stockholders at special meetings, and then go to the Railroad Commissioners for their approval. In a general way the lease is drawn along the same lines as the lease of the West End Road to the Boston Elevated Railway. It is likely to be a matter of one or two months before the lease becomes operative.

DETROIT, MICH.—Russell Whitcome & Company, of New York and Baltimore, are offering for subscription at par and interest $200,000 of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company's first consolidated 5 per cent twenty-five year gold bonds, dated Feb. 1, 1901, and due Feb. 1, 1926, interest payable February and August at the office of the Detroit Trust Company, trustee.

ST. LOUIS, MO.—The United Railways Company paid its quarterly dividend on Oct. 1 of 1¼ per cent.

WEBB CITY, MO.—Stone & Webster, of Boston, are reported to have secured an option on the property of the Southwest Missouri Electric Railway Company, which is controlled by Harrisburg (Pa.) interests. It is said that 900 shares of stock are held at option at prices ranging between $84 and $90 per share. The system includes 41 miles of line, connecting Carthage, Joplin, Webb City, Center and Carterville, Mo., and Galena and Empire, Kan., and 60,000 persons are served by the company's lines.

ST. LOUIS, MO.—The stockholders of the St. Louis & Meramec River Railroad Company and the St. Louis & Suburban Railroad Company held an important meeting Sept. 24 at De Hodiamont as the final outcome of the recent reorganization of the St. Louis & Suburban Railway. The stockholders of the St. Louis & Meramec River have ratified the proposition to increase the capital stock from its present amount, $2,000,000, to $3,000,000, and to increase the bonded indebtedness by the issuance of $3,000,000 worth of bonds. Of these bonds $1,000,000 are to be reserved for the purpose of retiring bonds of the company to that amount outstanding. The plan to increase the capital of the St. Louis & Suburban Railway Company from $3,000,000 to $7,500,000 and to increase its bonded indebtedness $7,500,000 was affirmed by the stockholders of that company. Of this $7,500,000 issue of bonds $2,300,000 are to be reserved for retiring the present outstanding bonds. The stockholders authorized the directors of the companies to secure the payment of the new bonds by placing a mortgage or deed of trust upon the property and franchise of the company. The plans for extensive improvements throughout the St. Louis & Suburban system were also ratified.

ROCHESTER, N. Y.—The stockholders of the Rochester & Sodus Bay Railroad Company have authorized the lease of the property to the Rochester Railway Company.

BUFFALO, N. Y.—In the STREET RAILWAY JOURNAL of Sept. 27, 1902, under the caption "Buffalo, N. Y.," was printed the statement that the Central Crosstown Railroad Company had issued a mortgage for $3,000,000. This statement should have appeared under the caption "New York, N. Y."

SYRACUSE, N. Y.—An agreement of consolidation of the Auburn City Railroad Company with the Auburn Interurban Electric Railroad Company, forming the Auburn & Syracuse Electric Railroad Company, has been filed with the Secretary of State. The company has a capital of $1,300,000. The directors are: Hendrick S. Holden, William Nottingham, Lyman C. Smith, Albert K. Hiscock, Clifford D. Beebe, Frank C. Soule, Willis A. Holden and Horace H. Pierson, of Syracuse, and George B. Longstreet, of Auburn.

NEW YORK, N. Y.—Although E. F. C. Young, president of the North Jersey Street Railway Company, emphatically denies that a consolidation of the North Jersey Street Railway Company, Jersey City, Hoboken & Paterson Street Railway Company, Orange & Passaic Valley Traction Company and Elizabeth, Plainfield & Central Jersey Traction Company is proposed, the rumor will not down.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

August	1902	1901
Gross receipts	$1,226,954	$1,132,385
Operating expenses	632,087	684,021
Net earnings	$591,867	$448,363
Two months ending August		
Gross receipts	$2,463,355	$2,330,912
Operating expenses	1,271,192	1,367,631
Net earnings from operation	$1,189,163	$963,307

Includes leased railroad of New York & Brooklyn Bridge, 2.6 miles, and trackage rights over Coney Island & Brooklyn Railroad, 2.4 miles.

NEW YORK, N. Y.—Application has been made to the Stock Exchange to list $15,000,000 preferred and $10,000,000 common stock of the United Railways Company, of San Francisco.

NEW YORK, N. Y.—The statement of the Interurban Street Railway Company, covering the old Metropolitan system, from April 1, 1902, to June 30, 1902, and the Interurban Street Railway Company, from Dec. 9, 1901, to June 30, 1902, compares as follows:

	1902	1901
Gross receipts	$2,259,176	$2,206,489
Operating expenses	1,416,429	1,095,538
Earnings from operation	$842,747	$1,110,951
Receipts from other sources	692,026	449,235
Gross income	$1,534,773	$1,560,186
Fixed charges	1,758,309	1,763,296
Deficiency for year	$223,536	$203,110
Total deficit June 30	871,390	650,854

ZANESVILLE, OHIO.—It is reported that the property of the Zanesville Electric Railway has been sold to the Appleyard Syndicate, which is extending its lines from Newark to Zanesville. Officials of the Zanesville Company deny that the road has been sold.

TOLEDO, OHIO.—The negotiations with the Detroit United Railway relative to the sale of the Toledo & Monroe Railway have been declared off, and the Toledo & Monroe Company will proceed at once with the work of extending the line to Detroit.

CINCINNATI, OHIO.—The Cincinnati, Newport & Covington Light & Traction Company reports earnings as follows:

August	1902	1901
Gross receipts	$96,118	$74,525
Operating expenses	53,295	45,741
Earnings from operation	$42,823	$28,784
Fixed charges	22,238	15,807
Net earnings	$20,585	$12,977
To date		
Gross receipts	$707,432	$535,783
Operating expenses	396,430	327,614
Earnings from operation	$311,002	$208,169
Fixed charges	175,343	125,328
Net earnings	$135,659	$82,841

SPRINGFIELD, OHIO.—The directors of the Urbana, Bellefontaine & Northern Traction Company will meet Oct. 30 to vote on increasing the capital stock of the company to $500,000 and to complete traffic arrangements with the Dayton, Springfield & Urbana Railway. Both roads are controlled by the same interests.

CLEVELAND, OHIO.—Holders of certificates of deposit of preferred stock of the Aurora, Elgin & Chicago Railway have been notified that their certificates will be cashed on presentation, to the amount of ten-thirteenths of their holdings, and a receipt issued for the remaining three-thirteenths. The settlement represents the payment for the 10,000 shares of the stock recently purchased by Claude Ashbrook and associates, of Cincinnati. The price was $90.48 per share, which is considered remarkable for a road not fully in operation.

CLEVELAND, OHIO.—The Lake Shore Electric Railway Company has paid the balance on the purchase price of the Toledo, Fremont & Norwalk Railway, now a part of the Lake Shore Electric, the amount being $383,000. This removes one of the chief obstacles to taking the road out of the hands of the receiver. Remarkable gains in earnings are being made by the company.

SPRINGFIELD, OHIO.—The directors of the Dayton, Springfield & Urbana Railway will meet Oct. 15 to consider the advisability of increasing the capital stock of the company to $1,500,000.

PHILADELPHIA, PA.—There has been listed on the Philadelphia Stock Exchange $500,000 additional capital stock of the American Railways Company.

TACOMA, WASH.—Suit to restrain the Tacoma Railway & Power Company from absorbing the Seattle & Tacoma Interurban Railway Company, both New Jersey corporations, has been begun in the Court of Chancery at Newark, N. J. The suit is based on the contention that the Tacoma Railway & Power Company has no right to absorb the Seattle & Tacoma Interurban Railway Company by paying therefor a portion of its capital stock, inasmuch as the latter corporation is not a going concern, and that its franchises do not warrant a profitable business for many years to come.

WHEELING, W. VA.—It is announced that a four months' option at par has been given on the majority of the capital stock of the Wheeling Traction Company to T. H. Conderman, president of the company. The company is capitalized at $4,500,000, made up of $2,500,000 5 per cent bonds and $2,000,000 common stock. The property includes the majority of the city lines in Wheeling, the Steubenville, Mingoe & Ohio Valley Traction Company, the Bridgeport, Bellaire & Martin's Ferry Railway and several lines under construction.

NIAGARA FALLS, ONT.—The Niagara, St. Catharines & Toronto Electric Railway, through the Dominion Securities Corporation, is offering for sale at 101 and interest $150,000 5 per cent first-mortgage thirty-year bonds. The road was described in detail in the STREET RAILWAY JOURNAL for Sept. 7, 1901.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Aug. '02	84,340	42,191	42,149	12,737	29,412
	1 " " '01	67,698	34,084	33,600	11,653	22,016
	6 " June '02	318,987	185,362	133,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,166	136,162	130,004
	12 " " '00	513,722	* 317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., Aug. '02	141,820	80,736	61,084	23,865	37,218
	2 " " '02	282,029	169,749	112,281	47,732	64,549
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Aug. '02	23,547	12,324	11,223	......	......
	1 " " '01	21,490	10,866	10,624	......	......
	2 " " '02	46,816	23,522	23,294	......	......
	2 " " '01	43,970	21,638	22,332	......	......
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,969,496	7,836,597	3,532,899	2,896,359	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,181	3,915,496	1,862,645	927,206	935,462
	12 " " '00	5,518,827	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., Aug. '02	1,226,955	632,047	594,908	......	......
	1 " " '01	1,132,986	684,022	448,964	......	......
	2 " " '02	2,463,357	1,274,192	1,189,163	......	......
	2 " " '01	2,330,942	1,367,635	963,307	......	......
	12 " June '02	12,789,706	*8982214	3,817,490	......	......
	12 " " '01	12,101,198	*7970636	4,130,563	......	......
BUFFALO, N. Y.						
International Tr. Co.	1 m., June '02	271,245	147,614	123,632	97,043	26,589
	1 " " '01	409,206	192,265	216,941	94,098	122,842
	1 " " '00	218,738	106,174	112,565	65,348	47,217
	3 " " '02	786,280	436,915	349,366	289,063	60,303
	3 " " '01	952,702	485,809	466,894	272,864	194,030
	3 " " '00	631,371	333,927	297,444	221,844	75,601
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., Aug. '02	45,217	31,191	14,026	13,357	669
	1 " " '01	45,474	28,296	17,178	13,697	3,481
	6 " " '02	378,981	223,200	155,784	81,054	74,730
	6 " " '01	246,438	163,145	83,293	82,618	674
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Aug. '02	25,590	7,221	18,309	......	......
	1 " " '01	24,042	7,479	16,563	......	......
	8 " " '02	128,000	52,859	75,301	......	......
	8 " " '01	112,962	49,571	63,391	......	......
CLEVELAND, O.						
Cleveland & Eastern Ohio Traction Co.	1 m., July '02	20,223	10,554	9,669	5,416	4,253
	1 " " '01	17,026	8,311	8,703	5,393	3,400
	7 " " '02	101,889	60,349	41,381	36,474	4,907
Cleveland, Elyria & Western	1 m., Aug. '02	32,571	15,449	17,122	......	......
	1 " " '01	27,207	12,372	14,886	......	......
	8 " " '02	189,506	107,051	82,455	......	......
	8 " " '01	158,563	88,440	70,122	......	......
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,303	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Aug. '02	23,700	11,796	11,964	......	......
	1 " " '01	20,770	9,617	11,154	......	......
	8 " " '02	125,966	66,231	59,035	......	......
	8 " " '01	105,302	53,524	51,768	......	......
	12 " Dec. '01	161,971	* 87,102	77,869	72,500	5,369
	12 " " '00	141,112	* 80,302	71,530	72,500	† 980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.	1 m., Aug. '02	96,118	* 53,293	42,823	22,238	20,585
	1 " " '01	74,525	* 45,741	28,784	15,807	12,977
	8 " " '02	596,156	* 344,026	252,130	131,230	120,899
	8 " " '01	535,784	* 327,615	208,169	125,328	82,841
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,316	66,335	57,981	32,865	26,119
	1 " " '01	116,357	62,866	53,492	31,304	22,186
	4 " " '02	481,348	201,118	280,230	131,258	98,972
	4 " " '01	433,297	236,915	196,382	123,622	72,759
	12 " Dec. '01	1,507,298	818,321	688,165	383,180	305,785
	12 " " '00	1,362,308	782,458	579,859	374,291	205,548
DETROIT, MICH.						
Detroit United Ry	1 m., July '02	325,898	182,848	143,050	......	......
	1 " " '01	302,988	149,812	153,176	......	......
	6 " June '02	1,600,675	* 907,044	693,631	395,789	297,802
	6 " " '01	1,391,181	* 775,347	616,834	345,119	261,715
	12 " Dec. '01	2,919,171	*1596763	1,322,046	652,277	670,129
	12 " " '00	2,573,277	*1438088	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line	1 m., July '02	44,699	25,687	19,012	......	......
	1 " " '01	43,759	19,471	24,289	......	......
	7 " " '02	230,171	139,589	90,582	......	......
	7 " " '01	213,728	126,170	87,558	......	......
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Aug. '02	51,457	26,505	24,952	9,671	15,282
	1 " " '01	41,763	19,890	21,873	9,204	12,669
	8 " " '02	349,405	183,203	166,202	77,810	88,393
	8 " " '01	296,095	161,610	134,475	73,188	61,287
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Aug. '02	43,507	22,129	21,378	8,333	13,045
	1 " " '01	37,295	17,094	20,201	8,353	11,848
	8 " " '02	270,435	158,851	111,584	66,667	44,917
	8 " " '01	241,397	136,236	105,161	66,667	38,495
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., Aug. '02	24,340	12,033	12,307	......	......
	1 " " '01	16,849	9,025	7,824	......	......
	6 " June '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac Co.	1 m., Sept. '02	44,090	23,050	21,040	16,251	4,789
	4 " " '02	184,502	91,206	93,296	65,241	28,055
LONDON, ONT.						
London St. Ry. Co.	1 m., Aug. '02	16,108	9,699	6,408	2,270	4,138
	1 " " '01	16,260	9,347	6,913	1,895	5,019
	8 " " '02	97,503	62,164	35,340	18,174	17,165
	8 " " '01	91,676	58,064	33,611	15,971	17,641
MILWAUKEE, WIS.						
Milwaukee El. Ry & Lt. Co.	1 m., Aug. '02	243,845	112,340	130,905	68,677	62,128
	1 " " '01	211,808	96,194	115,614	61,068	51,086
	8 " " '02	1,755,350	835,772	919,578	533,219	383,760
	8 " " '01	1,574,615	784,752	789,864	497,404	292,460
	12 " Dec., '01	2,442,312	1,185,584	1,256,808	755,139	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	884,065	206,847
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Aug. '02	323,534	137,900	186,300	60,988	125,381
	1 " " '01	288,389	142,032	161,364	57,850	108,704
	8 " " '02	2,337,436	1,060,709	1,256,716	470,500	796,216
	8 " " '01	2,041,771	943,715	1,098,056	445,398	640,657
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., July '02	198,056	93,966	104,089	19,929	81,700
	1 " " '01	174,180	90,464	87,716	14,142	73,455
	10 " " '02	1,643,887	940,900	702,977	164,228	538,748
	10 " " '01	1,532,306	931,023	601,278	104,409	496,863
NEW YORK CITY.						
Manhattan Ry. Co.	12 m., June '02	11,291,711	5,518,585	5,773,126	2,699,670	3,073,456
	12 " " '01	10,258,271	5,258,229	5,000,042	2,677,706	2,322,336
Metropolitan St. Ry	4 m., Dec. '01	3,887,038	1,738,978	2,143,364	1,151,140	992,824
	4 " " '00	3,766,090	1,699,649	2,066,381	1,128,467	947,914
	12 " June '02	15,806,641	7,385,868	8,440,758	4,815,421	3,605,337
	12 " " '01	14,730,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., July '02	6,569	3,216	3,353	1,771	1,582
	1 " " '01	5,954	2,207	3,747	1,708	1,979
	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co	1 m., July '02	9,397	5,290	4,097	2,083	2,013
	12 " June '02	66,795	*36,388	30,408	23,125	7,277
PHILADELPHIA, PA.						
Union Traction Co	12 m., June '02	14,118,159	6,402,338	7,715,820	*6637781	1,078,038
	12 " " '01	13,431,081	5,895,186	7,535,494	*6734288	861,206
American Railways	1 m., Sept. '02	138,159	......	......	......	......
	1 " " '01	91,152	......	......	......	......
	3 " " '02	245,455	......	......	......	......
	3 " " '01	190,811	......	......	......	......
	12 " June '02	1,009,509	......	......	......	......
	12 " " '01	841,298	......	......	......	......
ROCHESTER, N. Y.						
Rochester Ry	1 m., June '02	89,296	46,860	42,436	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26,704	12,709
	6 " " '02	537,742	298,005	239,737	148,608	91,130
	6 " " '01	495,296	306,966	188,259	147,157	41,102
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Aug. '02	60,540	33,314	27,226	19,025	8,201
	1 " " '01	54,943	30,214	24,729	19,025	5,704
	2 " " '02	123,151	67,679	* 65,471	38,050	17,421
	2 " " '01	114,376	61,834	52,542	37,996	14,546
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Aug. '02	138,643	69,880	68,758	38,909	29,854
	1 " " '01	124,491	53,357	71,134	33,814	37,320
	8 " " '02	941,419	484,587	456,832	303,787	153,045
	8 " " '01	814,432	410,373	434,059	203,918	230,141
	12 " Dec. '01	1,321,084	* 656,407	674,677	415,168	259,510
	12 " " '00	1,182,517	* 616,945	565,572	409,051	156,521
Lake Shore Elec. Ry Co.	1 m., July '02	49,162	25,961	23,101	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,270	128,290	58,987	......	......
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	† 3,986
	3 " " '01	56,936	35,600	22,336	25,000	† 2,663
YOUNGSTOWN, O.						
Youngstown - Sharon Ry & Lt Co	1 m., July '02	39,363	* 23,638	15,725	......	......
	7 " " '02	237,415	134,029	103,386	......	......

NEWS OF THE WEEK

CONSTRUCTION NOTES

SANTA MONICA, CAL.—The Traction Electric Railway Company has been granted all necessary franchises to construct an electric railway through Santa Monica and Ocean Park.

STOCKTON, CAL.—H. H. Griffiths, manager of the Tesla interests, has been granted a franchise to operate an electric railway over different county thoroughfares by the Supervisors. The statutes prohibit the granting of a franchise over a county highway within ninety days prior or seventy days after a general election.

LOS ANGELES, CAL.—The Los Angeles Traction Company has applied for a franchise through Santa Monica. The company has also applied for a franchise to Pasadena by way of East Los Angeles.

SAN LEANDRO, CAL.—The Mayor has signed the ordinance granting to the Oakland Transit Company a franchise for the extension of its lines to connect with the proposed new Emeryville Ferry system between Oakland and San Francisco. When completed the new connecting links will unite compactly the Transit Company's system in Oakland, Alameda, Berkeley and suburban towns along the line of the Oakland, San Leandro and Hayward branch, and will put all these points in direct communication with San Francisco.

SANTA ANA, CAL.—The Pacific Electric Railway Company has begun work on its proposed line to connect Long Beach and Santa Ana. It is expected that work on the company's line between Santa Ana and Los Angeles will be begun soon.

SANTA MONICA, CAL.—The trustees of the town have recommended for passage the franchise ordinance granting W. S. Hook and his associates the right to build an electric railway here.

SANTA CRUZ, CAL.—The Supervisors have granted a franchise to W. J. Rogers for an electric railway to extend 5 miles from Watsonville to Camp Goodall, where it is to connect with a line of steamers to run to San Francisco.

SANTA BARBARA, CAL.—The application of the Consolidated Electric Street Railway Company for a franchise to construct and operate a street railway on Victoria Street, from Chapala Street to Rancheria Street, and on Bath Street, from Victoria Street to Sola Street, has been granted, and bids will be opened on Oct. 18.

HARTFORD, CONN.—The Bristol & Plainville Tramway Company has applied to the Railroad Commissioners for the approval of a proposed line from Bristol to Terryville. The extension will parallel the Highland Division of the New York, New Haven & Hartford Railroad Company.

NEW HAVEN, CONN.—It is stated that it is the intention of the promotors of the proposed electric railway between New Haven and Middletown, now being surveyed, to ask the coming General Assembly for a charter from New Haven to Willimantic, practically paralleling the Air Line division of the New York, New Haven & Hartford Railroad. It is further stated that this new road will connect at Willimantic with the proposed line to Southbridge, Mass., thus opening a through trolley route to Boston by the way of Southbridge and Worcester.

BOISE, IDAHO.—The entire system of the Boise Rapid Transit Company is to be improved. It is possible that the power facilities will be increased.

STERLING, ILL.—Material to be used in constructing the Sterling, Dixon & Eastern Street Railway is arriving on the ground, and the work of building the road will be begun at once.

CHICAGO, ILL.—The Council committee on harbors and bridges has been considering the matter of lowering the three tunnels under the Chicago River so as to offer less obstruction to navigation. Some advocate the abandonment and destruction of the tunnels; others their temporary abandonment pending future lowering and reconstruction, and others, lowering without interfering with their present use any more than necessary.

EVANSVILLE, IND.—The construction of the Evansville-Princeton Electric Railway has been begun at Evansville.

EVANSVILLE, IND.—The contract for building the power house of the Evansville & Princeton Traction Company has been let. It is to be located at Fort Branch, half way between this city and Princeton, and will cost $72,000. The road will probably be in operation April 1, 1903.

SOUTH BEND, IND.—Application has been made to the Council by the Elkhart, South Bend & Chicago Railway Company for a franchise to build an electric railway over a specified route within the city limits. The company proposes to build a bridge across the St. Joseph River to cost about $45,000, and has submitted to the city authorities a proposition to this effect. As an alternative proposition the company has agreed to contribute $45,000 toward the erection of a structure by the city. The company is seeking a fifty-year grant, and agrees to permit such other companies as are granted franchises by the city to enter over its tracks.

DAVIS, I. T.—The Chickasaw Electric Railway Company has been incorporated to build the proposed electric railway between Sulphur Springs and Davis. The company is capitalized at $50,000, and among those interested in it are: H. W. Stark and W. H. O'Brien, of Gainesville, Tex., and J. I. Coursey, of Claremore.

WATERLOO, IA.—The directors of the Waterloo & Cedar Falls Rapid Transit Company have made an appropriation of $250,000 to cover the cost of constructing the extension from Cedar Falls to a point on the Chicago Great Western Railway, near Tripoli. The company has already purchased the rails for the extension, and it is expected that they will be delivered in a few weeks. Some of the right of way has already been purchased.

MT. AYR, IA.—The Des Moines, Mt. Ayr & Southern Railway Company, capitalized at $600,000, has been organized to construct an electric railway from Mt. Ayr to Creston, a distance of 30 miles. It is the intention of the incorporators of the new company to make connections with the line now being constructed from Creston to Winterset by Lyman Waterman, of Omaha, Neb., and also to connect at Winterset with the line which the Des Moines Interurban Railway Company expects to build from Des Moines to Winterset. Two routes have been surveyed for the line between Mt. Ayr and Creston, one by the way of Tingley and the other by the way of Diagonal. The route via Tingley is favored, owing to the fact that there will be very few heavy grades. The farmers have become interested in the project and have agreed to donate land and also vote taxes in aid of the company. The officers of the company are: F. E. Sheldon, president; J. F. Wall, vice-president; H. C. Beard, secretary; Clyde Dunning, treasurer. These parties, with Lyman Waterman, constitute the board of directors.

LOUISVILLE, KY.—A company that has just been organized has arranged to lease from the Louisville & Nashville Railroad the Louisville, Harrod's Creek & Westport Railroad, the intention being to equip the road with electricity. The road is about 10 miles long, extending from Louisville to Prospect, and runs through a section of the country that is extremely fertile, and one in which many prominent residents of Louisville have summer homes. The company that has arranged to lease the road has perfected its organization and the following officers have been elected: Lafon Allen, president; Owen Tyler, first vice-president; Bethel Veach, second vice-president; W. N. Cox, secretary and treasurer; William F. Booker, Owen Tyler, Henry A. Bell, Bethel Veach, W. N. Cox, E. T. Halsey and Lafon Allen, directors.

NAPOLEON, LA.—John Marks, who represents the company that proposes to build an electric railway between Donaldsonville and Napoleonville, has applied for the right to build through Napoleonville.

ROCKLAND, MAINE.—The Rockland, Thomaston & Camden Street Railway is to be equipped with an automatic block signal system.

AUGUSTA, MAINE.—The Railroad Commissioners have received the petition for articles of association for the Auburn, Mechanic Falls & Norway Street Railway. The proposed road is to be 24 miles long, and will run from Auburn though Minot, Poland, Mechanic Falls and Oxford to Norway. Compressed air or electricity will be the motive power. The capitalization is $700,000.

OAKLAND, MAINE.—The Railroad Commissioners have granted a certificate of necessity to the Waterville & Oakland Street Railway, thus making it possible for the company to build its proposed road.

MAYNARD, MASS.—Marcus A. Coolidge, of Fitchburg, has been awarded the contract for building the Lowell, Maynard & Acton Street Railway Company's line between Maynard and South Acton. The franchise calls for the completion of 4 miles of road by Nov. 1.

FALL RIVER, MASS.—The Old Colony Street Railway Company has asked the Railroad Commissioners to approve the company's locations in Bedford, Fourth, Lyon and South Main Streets and Plymouth Avenue.

LAWRENCE, MASS.—The Lawrence & Methuen Street Railway Company has petitioned the Railroad Commissioners for approval of locations on Howe and Maple Streets and for private land locations near the same streets.

AMHERST, MASS.—The Amherst & Sunderland Street Railway Company has asked the Railroad Commissioners to approve locations in this town from the village toward the Pelham line; also for authority to extend its line into Pelham.

WEST BROOKFIELD, MASS.—The Hampshire & Worcester Street Railway Company has asked the approval of the Railroad Commissioners for private land locations near Ware and Milk Streets to avoid curves and grades; also for approval of locations on Ware, Milk, Front and Central Streets and the Ware Road.

MILTON, MASS.—The final hearing on the petition of the Milton Street Railway Company for the approval by the Railroad Commissioners of a location granted by the Selectmen of the town on July 23, 1902, was held on Sept. 26. Chairman Jackson, of the Railroad Commission, intimated that the Board would not go into question as to whether abutters had acquired a right of proscription in a part of the highway where a location had been granted, but would leave that to the courts preferably. Witnesses then testified as to the public convenience and necessity of the proposed locations and their general validity. The Commissioners will shortly make a trip to Milton to go over the ground, and will then decide the question.

BOSTON, MASS.—It is stated that the Massachusetts Electric Companies have ordered, and will soon have installed in their station at Newport, R. I., a steam turbine of 750 hp, made by the General Electric Company.

BOSTON, MASS.—The contract between the city and the Boston Elevated Railway for the use of the East Boston tunnel and the Washington Street subway has been signed. The term is for twenty-five years, and the rental is to be 4½ per cent of the cost of construction.

SHARON, MASS.—On Sept. 30 the Railroad Commissioners gave a hearing on the petition of the Norton & Taunton Street Railway Company for permission to extend its lines into Foxboro and Sharon. The company's counsel explained that it was now operating in Mansfield and Easton, adjoining towns, and that it was the purpose to secure, as far as possible, private land location into East Foxboro and from East Foxboro to Sharon. The new Canton, Norwood & Sharon Street Railway asked the Commissioners' position; if they learned that the company had already asked locations in Sharon from the Selectmen, and Chairman Jackson replied that as the approval of the Commissioners simply gave the petitioning company the right to ask locations the commissioners would assume that the choice between several companies simplified the task of the Selectmen.

SAGINAW, MICH.—Large quantities of material are being delivered at Bridgeport for the Union Traction Company, which is building a line from Saginaw to Flint.

LANSING, MICH.—The Council has passed the franchise for the Lansing, St. Johns & St. Louis Railway Company, restricting the route over which it may lay its tracks to Center, Saginaw and Cedar Streets.

KANSAS CITY, MO.—The County Commissioners of Wyandotte County have granted a franchise to the Kansas City & Bonner Springs Railway Company to operate an electric railway between Kansas City, Kan., and Bonner Springs, a distance of 17 miles. The company intends to have its western terminus at Topeka. The provisions of the franchise are that the company shall commence the building of the road within six months from the acceptance of the franchise, and shall complete it within eighteen months.

KANSAS CITY, MO.—The Kansas City & Olathe Electric Railway Company has completed about 10 miles of grading out of a total of 18 miles, and is now prepared to receive bids on ties and good 60-lb. relaying steel rails. The road will extend from Kansas City, Mo., to Olathe, Kan., and will later be extended to Topeka and Lawrence, Kan., about 50 miles farther west. The company may be addressed at the Century Building, Kansas City, Mo.

CAPE GIRARDEAU, MO.—The Cape Girardeau & Jackson Railway Company has been organized by local and St. Louis capitalists to take over the Citizens Street Railway Company, extending the lines of the company to Jackson. The company will have the contract for lighting the city. The whole length of the line will be about 18 miles. A bond has been filed by J. S. Lapsley with the Mayor in compliance with the terms of the ordinance, and work will be commenced soon.

KANSAS CITY, MO.—The Kansas City & Bonner Springs Railway Company, which was recently chartered under the laws of Kansas, has organized, electing the following officers: Ex-Senator Edwin Taylor, president; C. F. Hutchings, vice-president; F. W. Breidenthal, secretary and treasurer. The officers and Samuel Mayer and H. H. Anderson were made the board of directors. The company will operate in Wyandotte County under a franchise that has just been granted. The company has attained control of Bonner Springs Park with an area of 80 acres, and will equip this with golf, tennis, baseball grounds and for other games and prepare it for camping parties, erecting pavilions and cottages. The plan is to begin work at once.

ST. LOUIS, MO.—The prolonged contest for a fifty-year franchise for a street railway over the Olive Street road from the city limits to Creve Coeur Lake, in St. Louis County, has terminated in the award of the franchise to the St. Louis County Street Railway.

ST. LOUIS, MO.—The Brentwood, Clayton & St. Louis Railroad Company has been granted permission to transfer its right and franchises to the St. Louis & Kirkwood Railroad Company, which company in turn transferred the property to the St. Louis & Suburban Railway Company. The transfers were merely formal matters, as the Suburban has been operating the Brentwood line for several years.

ST. LOUIS, MO.—All cars of the St. Louis & Suburban Railway will be equipped with power brakes of a pattern recommended by the committee of the Board of Public Improvements. The members of the committee were notified Sept. 25 by the company of this decision, and were invited to witness a test of one of the brakes. The cars have already been fitted with the new brakes, and an order has been placed for 100 more. There are 130 cars on the system, all of which, Mr. Jenkins, the general superintendent, assures the committee, will be equipped with the brake by the time the new track work on the line is completed, about three months hence. The members of the committee are greatly gratified by this action.

ST. LOUIS, MO.—The cars of the St. Louis Transit Company are to be equipped with the Newell electric brake by the Westinghouse Electric Company. Experiments will be made at first with about a dozen cars representing the different styles of vehicles for which special brakes will have to be built. It will cost $90,000, or $100 each, to equip the cars with brakes, and at least a year will be required to complete the work.

PORTSMOUTH, N. H.—Another in the network of electric railways running out of this city was opened a few days ago when the Portsmouth, Greenland & Exeter Electric Street Railway was placed in operation. Now only Newcastle and Newington remain of the towns unconnected with this city, as a center for the railroads.

DOVER, N. H.—The Dover, Northwood & Concord Electric Railway Company, which plans to build an electric railway to connect Dover, Northwood and Concord, has perfected its organization, electing the following officers: Elisha R. Brown, president; Arthur G. Whittemore, vice-president; Wallace D. Lovell, treasurer; Thomas H. Dearborn, assistant treasurer; George D. Barrett, clerk.

WHIPPANY, N. J.—The Whippany & Passaic River Railroad Company, capital $75,000, has been incorporated to build a railroad 7 miles long from Whippany to Essex Falls. The incorporators of the company are: Edward M. Shepard, of Brooklyn; Herman Behr, Robert D. Foote, W. W. Cutler, of Morristown; Richard W. McEwan, Robert B. McEwan, Jesse L. McEwan, of Whippany, N. J.

TRENTON, N. J.—The Trenton, Pennington & Hopewell Street Railway Company has been incorporated to construct and operate the proposed Hopewell extension of the Trenton Street Railway Company's lines. The proposed road is to be 12 miles in length and it will extend through the townships of Hopewell and Ewing and the boroughs of Hopewell and Pennington. The company has an authorized capital stock of $250,000, divided into shares of a par value of $50.

TRENTON, N. J.—The Camden & Trenton Railway Company has been granted a perpetual franchise for the construction of street railway lines on South Warren Street and other streets necessary to reach its present terminus at Broad and Stanton Streets. The gage of the track will be 5.2 ins., and the company will pave between the rails and for a distance of 1 ft. each side, except where the streets are already paved. The company will be obliged to pay to the city 3 per cent of the gross receipts after ten years. The extension will be about 2 miles long, and it is understood that work will begin very soon. Ordinances covering these streets were passed by the Council last December, but the Trenton Street Railway Company carried the matter into the courts. The Camden Company finally confessed judgment in order to escape further delay, and this caused the introduction of the second set of ordinances. The Trenton Company also wished South Warren Street, and had an ordinance before the Council to that effect. The Camden Company was willing to allow any other company to use the street by joint arrangement, but the Trenton Company would not make the same arrangement, so the franchise was given to the Camden Company. It is understood that the Trenton Company will carry the case into the courts on the ground that the entrance of the Camden & Trenton Road is inimical to its interests. The Camden & Trenton Company has maps filed with the Secretary of State covering routes in all parts of the city.

SANTA FE, N. MEX.—Joseph E. Lacome has been granted a franchise for the construction of an electric railway here. The franchise grant is for a period of fifty years.

BUFFALO, N. Y.—The Buffalo & Depew Railway Company has applied to the Board of Trustees of the village of Leroy for a franchise to extend its lines through the village. A hearing will be given on the application on Oct. 16.

NEW YORK, N. Y.—It is said that the New York & Brooklyn Railroad Company, of which G. S. Drummond is president, is preparing to begin work on its proposed tunnel between New York and Brooklyn. Several large parcels of real estate have recently been transferred to the company, it is said, and the announcement has even been made that the tunnel will be completed by July 16, 1904. The estimated cost of building and equipping the line is placed at $6,000,000. Officers of the company are quoted as saying that $4,500,000 has already been subscribed.

MEDINA, N. Y.—The Union Traction Company, capitalized at $600,000, has been incorporated to operate a street railway 50 miles in length, from Batavia, Genesee County, to the shore of Lake Ontario, near Olcott, Niagara County. The directors of the company are: Isidor H. Gobelle, Fred L. Downs, Darius Fuller, Samuel Laudauer, of Medina; Joseph W. Holmes, of Batavia; Frank A. Pixley, of Alabama; Howard Hendrickson, of Albany.

NEW YORK, N. Y.—Plans have been filed at the Bureau of Buildings, Manhattan, for two three-story brick sub-stations for the underground rapid transit road, to be built, one at 29 to 33 City Hall Place, 58.2 ft. x 99.9 ft.; the other at 108 to 110 East Nineteenth Street, 50 ft. x 91.10 ft. They will be built of granite and limestone with terra cotta trimmings. The cost is placed at $115,000—$60,000 for the City Hall Place power house, and $55,000 for the Nineteenth Street power house. Plans have also been filed for an one-story brick inspection shed, to be built on the north side of 148th Street, 120 ft. east of Seventh Avenue, being 338 ft. front by 199.10 ft. deep. This building will be used for the inspection of cars, etc., and will cost $85,000.

HAMILTON, OHIO.—The County Commissioners of Butler County have granted a twenty-five year franchise to J. C. Hooven for the Cincinnati, Hamilton & Indiana Traction Company, which plans to build an electric railway from Hamilton to Oxford and College Corner; thence into Indiana. The road is to be completed July 1, 1904.

NEW PHILADELPHIA, OHIO.—Major C. E. Mitchner, who financed and built the Urichsville-New Philadelphia Railway, now a part of the Tuscarawas Traction Company's system, has asked the County Commissioners for a franchise along the highway from New Philadelphia to Newcomerstown. The proposed line will pass through Bredler, Tuscarawas, Seventeen, Port Washington and Glasgow.

CANTON, OHIO.—After a controversy lasting many months, the Stark Electric Railway Company has secured a franchise enabling its cars to reach the center of Canton without making a traffic arrangement with the Canton-Akron Railway Company. The line will secure entrance over Orchard, Second and Walnut Streets, with a downtown loop.

NORWALK, OHIO.—The Lake Shore Electric Railway is laying new turnouts and double tracking a portion of its line through Norwalk.

SPRINGFIELD, OHIO.—The Springfield, Piqua & Sidney Traction Company has applied for a franchise over Bechtel Avenue into Springfield. The company claims to have secured all necessary private right of way between Springfield and Piqua.

BELLEFONTAINE, OHIO.—The Urbana-Bellefontaine Railway is placing poles and stringing wires in Bellefontaine. The franchise calls for the operation of cars within the city by Dec. 1. It is probable that the company will erect a temporary power house and operate city cars to comply with this provision. The road is the northern extension of the Dayton, Springfield & Urbana Railway.

BRYAN, OHIO.—The People's Rapid Transit Electric Railway Company, which proposes to build from Toledo to Greenville, has obtained a franchise through Bryan.

LIMA, OHIO.—D. J. Cable, who has promoted several electric railways in this section, is working on preliminary plans for a line to extend from Toledo to Cincinnati by way of Paulding, Defiance and Van Wert. The line would connect at the latter place with the Fort Wayne, Van Wert & Lima Railway, of which Mr. Cable was one of the promoters.

DELAWARE, OHIO.—Pittsburgh capitalists have become interested in the Delaware & Magnetic Springs Railway. It is proposed to erect a large hotel at Magnetic Springs, and it is claimed that work on the line will start this fall.

TOLEDO, OHIO.—Mayor Jones has been elected a director of the Toledo, Hicksville & Fort Wayne Railway, succeeding J. B. McAlee. George Yesbera, of Montpelier, succeeds J. B. R. Ransom as a director of the company, and J. Q. Files, of Wauseon, has been elected a director. This road will connect with the Toledo & Indiana Railway at Hicksville.

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The Detroit Convention

According to all indications, the Detroit convention was the most largely attended of any in the history of the association, and the local committee is to be congratnlated npon the success which attended its efforts in the way of providing entertainment and facilities for the meetings of the association. The conditions which surround a convention of this association are more formidable than ever before, and in spite of the fact that Detroit is used to conventions of all kinds, from the G. A. R. to coal conferences, we imagine that the demand for accommodations on the hotels of that city were never greater than during the past week. As a consequence, those who applied for rooms late had considerable difficulty in getting what they wanted, but there was no real discomfort and the incident simply showed that the meetings of the association have now become so popular that only the largest cities must be considered in the future in the selection of a place for the annual meetings. The treatment of the guests at Detroit by the local company was most hospitable, and Mr. Hutchins and his associates were the recipients of many complimentary remarks, not only for the numerons courtesies which they extended to the visitors, but also for the fine transportation system which they have developed in the city of Detroit. The attractive appearance of the rolling stock was particularly remarked, and the sentiment was expressed that the cars all looked as if they had just been put on the road. The weather was propitious and many delegates improved the opportunity to ride over some of the long interurban lines which have made Detroit famous, and those who did so were well repaid for the time expended. The nomination of Mr. Hutchins for the new president of the association received popular approval and was a well deserved tribute to one of the ablest and most popular members of the association.

President Vreeland's address was one of the strongest documents which has ever been presented to the association and outlines a policy upon which all companies can unite with satisfaction. The position taken by Mr. Vreeland on the rights of corporations peaceably to conduct their business and to be regarded by the muncipalities in the same light as other corporations doing an important work was stated with great clearness and force. Mr. Vreeland touched upon this same subject about a year ago in a memorable address which he delivered at a dinner in Boston of the New England Street Railway Club, and the idea which he brought out so clearly at that time that railway companies were not "bandits," but were important business enterprises anxious to make only legitimate profits and ready to co-operate intelligently with the city authorities in all efforts to promote the transportation facilities and hence the prosperity of the city in which they operate, created at that time wide comment in the Boston papers. Mr. Vreeland followed up this demand for just treatment by referring to the importance which interurban electric railroading has acquired during the past few years and the possibilities before the American Street Railway Association as representing the broad industry of electric transportation in all its phases. There are several reasons why all electric railway engineers, whether they are connected with city roads or trunk lines, must and naturally will look to the American Street Railway Association for a long time to come as the natural exponent of all branches of electric railroading. Although the work on the trunk lines may be such as to require heavier motors, the engineers to take up this heavier class of equipment will for some time to come be necessarily those who have learned the business on street railway systems, the apparatus used will be largely the same and the manufacturers will be those who cater to "street railways" proper. As a result, the engineers will be men whose past affiliations have been largely with the association and no other body in the conntry will be able to afford, as Mr. Vreeland pointed out, anywhere near the same opportunity for instruction to those interested in electric transportation in its various phases.

Mr. Vreeland's long experience as an executive head and president of various deliberative bodies, such as the New

York Street Railroad Club, of which he has been president for a number of years, made him an ideal chairman and chief executive officer of the association. The business of the meetings was directed by him with despatch, the speakers were held closely to the topics under debate, and valuable points were brought out in the discussion in a way possible only through an experienced chairman. Mr. Vreeland's company set a good example by being represented at the convention by a large number of delegates, and both he and his associates received many compliments upon the success of the convention in New York last year.

Mr. Penington performed the services of secretary of the association in the efficient manner which has characterized his administration of this office for the last seven years, and his re-election to the office of secretary elicited great popular satisfaction. The plan of publishing the papers in advance, as inaugurated last year, added greatly to the facility with which these topics were taken up for discussion. Mr. Penington is to be complimented on the early date at which these papers were issued to the members as well as upon the excellence with which all the details of the convention were carried out.

The Registration of Transfers

The topic, which was treated by Mr. Meneely, of the Brooklyn Heights Railroad Company, has been a subject upon which there has been a diversity of opinion ever since transfers and registers were invented, and as much a bone of contention as the subject of opposite or broken joints in track construction. Both methods have been adopted on roads of the highest standing, and each has its advocates, who have no difficulty in pointing out very serious defects in the other method. As an actual matter of fact, both the method of registering the transfer as a cash fare and that of not registering it at all, have serious drawbacks, and it is interesting to note that the author of the paper recommends what is practically the issue of a receipt for every fare paid; in other words, the European system of fare collection, which has its advantages, but is cumbersome as well as wasteful of material and time. The fact of the matter is that there is no ideal method with anything connected with transfers. Transfers are themselves an anomaly, as they are practically the presentation of a free ride to any passenger who desires it, and the auditing or checking of the transfers is only one of the evils which accompanies their use. The most desirable plan is that followed in Philadelphia, where a charge of 3 cents is made for a transfer, and while this does not completely eradicate the problem, it reduces the number of transfers asked for, and makes the margin between the cash value of the transfer and the nickel considerably less than five cents, which is the value of the transfer when it is given away. As, however, it is a condition and not a theory which confronts us, and free transfers are the almost universal rule, we believe that in most cases fewer evils will follow where a single register is used in not registering the transfers than in registering them. While this opens the doors for free rides to the friends of conductors, the number who can participate in any fraud of this kind must be large; that is, there must be a considerable number of *particeps criminis* if a fraud of any considerable magnitude is committed, and this of itself will tend to expose the evil, for where there is a large number engaged in a crime some one will be apt to be detected. Again the raid is in the direction of free transportation rather than on fares received, and the theft must be premeditated, rather than decided upon at the close of a day's run after the conditions have shown that the chances of immunity against detection are good. Probably a better plan than either is the use of a double register, and it is interesting to note in the discussion that a number of the companies have introduced devices of this character with satisfactory results. It is needless to say that this system, as well as any other involving the issue of fare receipts, requires a frequent checking up of transfers and the practice mentioned by Mr. Beggs of having the transfers received for passage deposited at the end of the trip rather than at the end of the day's run seems advantageous. In conclusion, we derived the impression from the discussion on Mr. Meneely's paper, as well as from that by Mr. Sampson before the Accountants' Association, that suburban and interurban roads require a method of definitely recording each kind of fare received, that this can be advantageously done either by the use of multiplex registers or the zone system of fares, and that many city roads are tending in the same direction through the use of duplicate registers.

The Adjustment of Damage Claims

This subject is ever present, though never welcome, and its importance is increasing with advancing years in spite of the efforts made to minimize the causes for such litigation. The paper presented at the convention by Mr. Starring along those lines is a very interesting contribution, and contains some excellent suggestions as to the manner of handling cases of this kind. In general, the writer advocates a firm and conservative policy on the part of operating companies, but he advises discrimination in the matter of settlements where the interests of the company can best be served by reaching an amicable agreement. He believes, too, that while it is wise to establish a reputation for fighting unjust claims, it is not necessary to oppose every demand that is presented, but advisable rather to make a fair settlement where actual damage has been inflicted and reasonable compensation is sought. The author also recognizes the importance of making a favorable impression upon the jury when it is necessary to oppose even the most unreasonable demands, and his experience teaches him that to do this successfully it is necessary to accord fair treatment to the claimant and to his witnesses. Otherwise there is danger that jurors may believe that the company's case is weak, and that it is resorting to brow breating and other tactics which really amount to a persecution of the plaintiff. Naturally they resent being made a party to such proceedings, and there is always danger of the jurors' sympathies being enlisted in behalf of the weaker party in such cases. Many cases may be cited where judgments have been given against railway companies merely out of sentimental consideration. It may fairly be assumed, too, that many jurors—some of them unconsciously, no doubt—have a natural antipathy to corporations. This point was touched upon by Mr. Vreeland in his annual address, in which he said: "Even in the courts the standing of a corporation is prejudiced and before a jury sworn to render an impartial verdict upon the facts, its first and constant care is to remove from the minds of the jurymen a frankly admitted antagonism."

Of course, under these conditions, the successful handling of litigation of this character requires great tact and diplomacy as well as legal ability, and Mr. Starring urges that great care should be taken in selecting the men to be placed in charge of the department entrusted with the settlement of these claims. The importance of this work is constantly growing with the expansion of the railway field, and the adoption of higher speeds and heavier trains. The paper read by the expert of the New York State Railway Commissioners upon this subject before the last meeting of the Street Railway Association of New York, to which we have already referred, shows that there is a constant increase in the number of accidents due to the operation of electric railways, and it is only fair to assume, therefore, that there is a corresponding increase in the claims for damages. No doubt many of the claims that are presented against the companies have little real merit, and in many places it has been proven that organized attempts have been made to swindle operating companies by men who have made a profession, if such it might be called, of this business. There is another class against which the companies are obilged to guard, namely, the medical and legal sharks who have earned the title of ambulance chasers. These men are really more despicable than the class who risk life and limb by taking chances on receiving real and serious injuries in the so-called "accidents" which they bring upon themselves. The latter form a desperate class, but they are not so dangerous as the others, and Mr. Star-

ring's note of warning not to deal with either under any circumstances does not exaggerate in the least the danger of lending any semblance of encouragement to their operations.

Discipline

The discipline of employees by the merit system and street railway mutual benefit associations were the subjects of interesting papers by W. A. Satterlee, of Kansas City, and Oren Root, Jr., of New York City. It is unfortunate that the time of the association available for the discussion of these papers was not greater, as there is perhaps no department of street railway work in which more radical progress has been made during the last ten years than in the relations of the companies to the employees. The old ideas that no incentive for good work is necessary other than stipulated wages paid to all employees alike, and that the relations between the employees and the company terminate upon the payment of these wages, have almost passed away, although the equally erroneous view still held by some employees that their interests and those of the company are naturally antagonistic seems to survive in too many localities.

Taking up the question of discipline first, it should be understood that a company in dealing with an employee who breaks its rules occupies a different position than civic or State authorities in a like position, and whose object, at least theoretically, is to reform the offender as well as prevent a repetition of the act. The object sought by the railway company is solely to get good service, and to secure this its obvious policy is to advance the more efficient employees and get rid of those who show no aptitude to railroad work. Whatever system of discipline is followed, therefore, should be based on these two fundamental considerations; it should reward efficient service and it should gradually eliminate from the ranks those who have shown themselves incapable of maintaining the standard of the service required. As we have said before, we believe that some system of rating furnishes the most accurate method available for gaging the capabilities of different men, but coupled with this should be some incentive for securing and maintaining a good rating. Occasionally prizes for the most efficient service are offered to secure this result, but this plan is imperfect in that it can affect one man or a few men only, while the majority of employees are no better off under the prize system than those whose work has been no where near so satisfactory. For this reason we believe that the demotion system, described by Mr. Harrington, affords certainly an interesting attempt to graduate the rewards of the service to all employees according to their deserts, and his testimony as to the practical working of the system is worthy of careful consideration. It might be argued that an effort of this kind to draw fine distinctions between the value of the performance of the different men will create considerable dissatisfaction, and will be contrary to the American democratic spirit. The men should realize, however, that their relative standing is changed so often that a man who through ill luck has been dropped in the scale can regain a higher position. They should also understand that individually the company has the most cordial sentiments towards each one of them, and this feeling can best be developed through the mutual benefit association idea, which Mr. Root discussed in his paper.

Mutual Benefit Associations

The principle that these associations should be democratic in their character is the secret of the success which Mr. Root points out on his paper on the subject. When conducted on a proper basis they afford an opportunity not only for social enjoyment but also for strengthening the spirit of interest in the work in which they are all engaged. This is a benefit to employees and the employer, but if the democratic spirit is absent and there is a sentiment on the part of the men, either real or fancied, that they are being patronized, the good effects of the association are often lost. Mr. Root's paper will bear most careful reading from the fact that the Metropolitan Street Railway Association is not only one of the oldest and largest associations of the kind, but because it has gone further in many ways than any other body of the same kind. Mr. Connette, of Syracuse, was the only speaker who described a similar system on his own road, but there are many others in practical operation and their number is constantly growing. To many of the old school of workmen, the idea of an organization of employees which works in harmony with the employers is anomalous, for their sole idea of association is one whose principal object is to secure concessions from the employer through threats of organized revolt, and they cannot understand how their interests and those of the employer can be harmonized. All this goes to show the truth of Mr. Root's remark that the relations of capital and labor, as represented in street railway properties, have undergone a radical change during the last ten years. The true interests of both lie in mutual cooperation, and it is not unfair to say that as a whole the employers have learned this truth and have put it in application to a greater extent than the laboring man. The latter has been too often in the past governed by the old idea of antagonism toward his employer, and it is this feeling which the "benefit associations," with their opportunities for intercourse and acquaintance, will do more than anything else to destroy. As President Vreeland said last week in his annual address to the Metropolitan Street Railway Association: "How can men, whether they are capitalists or laborers, expect to understand each other if they are not acquainted? Without acquaintanceship there must be as much ignorant suspicion on one side as on the other. Nothing inspires more fear and distrust than half understood and wholly unseen things." If this truth had been wider realized in the past, a great deal of industrial waste would have been avoided.

Signals for Interurban Railways

In the paper on signals for urban and interurban railways, G. W. Palmer, Jr., gives utterance to a very important truth in railway operation, when he says that "even a perfect signal system cannot, after its adoption and installation, operate a road. Careful management and good discipline on the part of the men are still vitally necessary." Statistics from accidents in New York State seem to show that on electric interurban railways more disastrous collisions have been caused by lack of discipline and disobedience to rules than by defects in signal apparatus or mistakes of train despatchers. However, it is highly important that there should be, as a ground work for the safe operation of the road, the best and safest systems of despatching and block signals available. That the condition of the art of block signals on electric railways is not entirely satisfactory at the present time is not strange considering the short time there has been to perfect these appliances. There is one difficulty which has stood in the way of block signals on interurban roads, which it seems to us is due largely to a misconception of what it is possible to accomplish with this system. We refer to a demand, commonly made, that the block signal system shall permit several cars to move in the same direction in a block at the same time, operating as different sections of the same train, while at the same time demanding complete protection to all the cars. "One cannot have his cake and eat it too," according to the old saying, and if several cars are to be allowed in a block going in the same direction, it is useless to talk of protection from rear end collisions by means of block signals. The fundamental idea of the block signal is to keep a definite space interval between the cars to be protected, whether they are traveling in the same direction or opposite directions. Recent statistics seem to show that more life and property is lost by rear end collisions on electric roads than by head-on collisions. We are not prepared to argue that it is never necessary to operate several cars going in the same direction as different sections of the same train, following each other closely with no signal protection save that afforded by the vigilance of the train crews, but it is perfectly safe to say that no block signal system can ever be devised that will afford protection to trains under such circum-

stances. The only way to get aronnd this inherent limitation of all block signal systems is to lengthen the intervals between cars and shorten the block sections so that cars can follow within a few minutes of each other without having more than one occupy a block at the same time. When once the point is conceded that but one train is to be allowed in a block at the same time, the problem of a block signal system for electric railways is much simplified. This will mean much more frequent turn-outs for meeting points than are at present common, but such turn-outs should be considered simply as part of the cost of a truly efficient block signal system. It is certainly not logical to consider seriously putting block signals on a double-track high-speed road to keep definite space intervals between cars where the service is frequent, and at the same time permitting trains to be operated closely following each other on single track roads without any block signal protection. A fundamental principle of signaling recognized by the steam roads is that all signal apparatus must be so designed that when failures in apparatus occur they will always be on the side of safety. That is, the signals should always show danger except when held positively in a safety position by some artificial force. This principle has not been as fully recognized by many designers of electrical railway signal apparatus as it should be. Mr. Palmer advocates automatically operated signals rather than those operated manually by the trainmen. The automatic signals are, of course, most desirable from a theoretical standpoint, and if reliable are preferable to those manually operated. However, we are inclined to think, without saying anything against the merit of automatic systems, that there is much more merit in the manually operated electric light signals than is commonly thought, if only these signals are installed and operated on correct principles, as they frequently are not. The manually operated signal is so simple and involves so little apparatus that is likely to get out of order that it has great attractions for the practical electric railway man. We agree entirely with Mr. Palmer when he advocates placing the switch governing the signals at the entrance of a block far enough in advance of the signals so that motormen, conductors and passengers can look ahead and see the indication of the signal before the car reaches it. We fail to see, however, that lamp signal circuits are peculiarly susceptable to trouble from lightning. Circuits in which magnets are included are far more liable to such trouble, and the incandescent lamp is about as little likely to be injured by lightning as any kind of a signal device that can be placed in a circuit, even if it is not wholly exempt. Signal systems are frequently used in which the lighting of lamps indicates danger and their absence safety. Such a plan is fundamentally wrong and likely to be worse than no block signal system whatever, giving misleading signals. Although the use of a position signal, such as a semaphore, is desirable in many respects, its use involves greater complications than the use of lamps alone, and it is a question for profitable discussion whether the semaphore is worth this additional cost and trouble. The discussion on the subject of block signal systems was more extended than any other topic, although part of this discussion was contributed in writing, and hence was not read at the meeting. Mr. McCormack, who is now with the New York Central & Hudson River Railroad Company, but who has had long experience in both steam and electric railroad operation, presented a very complete communication on the subject, and we commend its perusal to our readers.

The Master Mechanics' Association

Steps were taken at the Detroit convention by a number of master mechanics and electrical engineers to form a separate association somewhat after the plan of the Accountants' Association, and a committee was appointed consisting of six prominent engineers to learn the sentiment of the engineers connected with the different companies throughout the country, and to complete the preliminary work of organization. The step, in our opinion, is an excellent one for many reasons. The broadening nature of the association, as outlined in the president's address this year, is certain to add greatly to the number of important problems which are facing the members and which require careful study and discussion. At the same time, the time available for business meetings at the annual conventions is limited and the main association cannot and should not attempt to take up problems of a purely technical character which can just as well be settled by the heads of the different mechanical departments. The latter, on the other hand, by having all the time of a convention meeting at their disposal can take up more subjects and, being a smaller body, the discussions will undoubtedly be more free than in a large assemblage. We assume that all matters relating to standards and similar subjects, which will be binding on the different companies, will be settled by the American Street Railway Association, and that the master mechanics will not attempt to operate independently from that body. They will rather be in the nature of an auxiliary to it, and will devote their attention to working out the details of mechanical construetion, maintenance and repairs. In this respect the organization will necessarily differ somewhat from the associations of master car builders and master mechanics of the steam railroads, but this will not necessarily affect the usefulness of the body. It will, in fact, rather add to it as their suggestions would naturally receive the greatest consideration at the hands of the national association. The meeting of the master mechanics at Detroit was not a large one, but was representative and the preliminary action taken was entirely satisfactory.

The Paper on Steam Turbines

Judging from the attendance at the different meetings, the paper by Mr. Sniffen on steam turbines attracted more attention than any other report presented at the convention. Whether the existing coal famine has made the average steam railway manager more acute to the possibilities of the economical generation of electric power or not, we are unable to say, but the paper was received with the greatest attention and the discussion indicated that the railway companies of the country are alive to the possibilities presented by the turbine of a reduction in their coal bills. The statement that one manufacturer alone has on hand unfilled orders for machines of this type having an aggregate capacity of 44,000 kw, or roughly speaking, 60,000 hp, gives us a forcible and somewhat startling impression of the important position as a prime mover in large power plants rapidly being assumed by this form of motor, which but a few years ago was regarded as little more than a mechanical curiosity. Nevertheless, as Mr. Sniffen remarked, the turbine is not new. It is an old idea that has lain dormant for years, awaiting an opportunity for its practical application. The records of the British Patent Office show that at the close of the year 1899, a total of over 350 patents had been issued relating to steam turbines, the first dating back as far as 1784. It is the immense developments in alternating current work which seems to have furnished the steam turbine with its long-needed opportunity.

Being essentially a high-speed machine, the electrical generator seems to be the best medium for absorbing and distributing the power of the turbine without the intervention of speed reducing devices which uselessly absorb a considerable part of the available power. In direct-current generators, grave difficulties are encountered in commutation, and the construction of an armature that would withstand the enormous strains due to centrifugal force at the high speeds that were necessary, presented mechanical problems that were far from being easily solved. The alternating current generator is almost ideal in its adaptability to the conditions of speed imposed by the motor; the troublesome feature of commutation is entirely eliminated and the problem of the mechanical construction of the rotating element—especially in the stationary field machine—is greatly simplified. Now that the steam turbine has found a suitable opportunity to utilize the inherent merits that have been recognized and understood for over

half a century, it is only reasonable to expect that its practical application will be extended with almost phenomenal rapidity.

Types of Turbines

The three types of turbines which have been put into commercial service in this country are the Parsons, as manufactured by the Westinghouse Company, and described by Mr. Sniffen, the DeLaval and the Curtis, as manufactured by the General Electric Company. The Parsons design is analogous to that form of hydraulic turbine in which the fluid is directed by guide blades against the vanes of the wheel, giving the impulse partly by the impact of the water against the moving vanes, and partly by the reaction due to the relative velocity imparted to the water as it is discharged from the moving wheel. The available "head," i. e., the fall in steam pressure, is divided into a number of stages, and a set of guiding and moving vanes is placed at each stage of the fall so as to reduce the velocity of the fluid and consequently the speed corresponding to the best efficiency. In the Parsons turbine, as built for the Rapid Transit subway station in New York, the plans indicate some very slight modifications in the pattern as described by Mr. Sniffen, notably in the separation of the high pressure and low pressure cylinders and the introduction between them of a reheater.

The DeLaval turbine corresponds to the well-known Pelton water-wheel, in which a high velocity is imparted to the fluid by passing it through a properly shaped nozzle, and the impulse is due solely to impact against the vanes or buckets on the wheel. In the De Laval turbine the conversion of pressure into velocity has generally been made in one step which has necessitated rotative speeds of from 10,000 to 20,000 or more revolutions per minute. To reduce these enormous speeds sufficiently to permit of driving any existing mechanisms, a very ingenious system of helical gears has been devised, which has worked out excellently well in moderate powers, say up to 200 or 300 hp. Three hundred hp has become, however, in modern power plant practice to be regarded as a very small unit, and the engineering profession will await with much interest a demonstration as to the sufficiency with which this arrangement will operate in units ten times as powerful, which, judged by modern standards, would be only of ordinary size.

Details of the General Electric turbine have not been made public, but several contracts for turbines of this type of 500 kw and 1500 kw have been taken and at least one 5000-hp machine has been built. It is generally understood that in a number of important points this turbine differs from the other two mentioned. It has, for instance, a vertical shaft, the effect of which is greatly to reduce the floor space occupied and to take all strain off the bearings, and, as the shaft is short, to produce also a very compact machine and make the question of alignment easy. The construction is said to be extremely simple, and to involve only very few rows of buckets. The governing is accomplished by a method which it is claimed gives a very flat efficiency curve and one which bears a striking resemblance to that of a standard large generator. The machine also runs at a greatly reduced speed.

The Theory of the Turbine

The theory of the steam turbine in no wise conflicts with our present theory of thermodynamics as applied to other heat engines. The same expression for the ultimate ideal efficiency holds good, i. e., $\frac{T_1 - T_2}{T_1}$ in which T_1 and T_2 represent the absolute initial and final temperatures of the working fluid, expansion being carried out to the exhaust temperature. In the ideal engine increasing the initial temperature or decreasing the final temperature increases the possible efficiency. In the ordinary reciprocating engine the cylinder walls and the pistons are exposed alternately to the initial and exhaust temperatures, causing a partial condensation of each charge of incoming steam. This is the most serious loss in the steam engine, and grows worse as we increase the temperature limits, so that our efforts to improve the theoretical conditions are met with a constantly increasing practical difficulty, which limits the point to which expansion may be carried with useful effect, and in a measure also the height of the initial pressure that may be advantageously employed. In the steam turbine the parts in contact with the steam are not subjected to any cyclical variations in temperature, but the temperature and pressure at any given point in the machine remain constant, at least as long as the load does not change. In the turbine, therefore, this most important loss, which is inseparable from the reciprocating engine, is entirely eliminated, and there is apparently no reason why there should be any practical limit to the initial pressure, or to the degree of expansion that may be used to good effect. The use of superheated steam in the turbine as well as in the reciprocating engine improves the efficiency in a very marked degree, but probably for an entirely different reason. In the reciprocating engine the superheating is primarily useful in counteracting cylinder condensation, while in the turbine it can have no such office. The presence of water in the turbine seems to create a purely mechanical resistance corresponding to friction. With saturated steam a certain amount of moisture is inevitable even in an ideally perfect engine, as a part of the steam condenses during adiabatic expansion without any loss of heat. By superheating the initial steam we can prevent this normal condensation, and while, perhaps, not greatly improving the theoretical conditions, we can succeed in removing or preventing a mechanical obstruction. Although not yet fully determined by actual experiment, it would seem that the practical limit to which superheating should be carried would be the degree that would just suffice to keep the steam dry during expansion, and allow it to escape into the condenser at saturation temperature. This would also seem to be indicated by the fact that the increase in economy, that is, the reduction in steam consumption per unit of output, is greater with the earlier stages of superheat than with steam at higher temperature. Thus, foreign tests seem to show that while the gain of about 8 per cent results from a superheat of 50 degs. F., the gain from a superheat of 100 degs. F. would be only about 12 per cent, and that from 150 degs. F. about 15 per cent.

In comparing the economy of the turbine with that of the reciprocating engine it must be remembered that there is no such thing as indicated horse-power in a turbine. The most usual and convenient measure of the power is in electrical units. The economy of reciprocating engines is ordinarily stated in pounds of steam per indicated horse-power per hour, and there is very little available information as to the economy of such engines referred to electrical measurements. The Hartford turbine, cited by Mr. Sniffen, is the largest for which tests have been published, and, as stated in the paper, indicate a consumption of 19.1 lbs. of steam per hour with steam at 155 lbs. pressure and 45 degs. superheat and with 27 ins. of vacuum. The importance of good vacuum is shown by the fact that it has been found that a gain of about 4 per cent in economy is secured for every inch of vacuum above 25 ins. to 26 ins.

Economy of Large Machines

With the large machines which are now being built, such, for instance, as the 5500-kw turbines, which the Westinghouse Machine Company is now building for the Metropolitan & District Railways, of London, and which are to operate with 165 lbs. steam pressure and 27 ins. vacuum, reliable figures on steam consumption will be available. It is believed, however, that the reduction in steam consumption over that shown by the smaller sizes will be considerable, even in view of the fact that these figures compare most favorably with the results from reciprocating engines. For instance, Brown, Boveri & Co., of Baden, Switzerland, are installing a 5000-kw turbine at Frankfort, with which a consumption of 10.78 lbs. per indicated horse-power are guaranteed with steam at 202.9 lbs. and a superheat of 175 degs. F. From the guarantees which have been given on some of the large machines

in this country and from the results derived from the smaller machines, it seems not improbable to expect the production in these large machines at full load, with 28 ins. vacuum and with 100 degs. superheat of an electrical horse-power with 13.2 lbs. of steam. With 180 degs. superheat the consumption should be reduced to 12.9 lbs. per electrical horse-power. As compared with a generating set, consisting of a reciprocating engine, direct-connected to a generator, the combined efficiency being 83 per cent, which is about what is met with in ordinary practice. This would correspond to 10.95 lbs. and 10.77 lbs. of steam respectively per indicated horse-power per hour. With dry steam the figure for turbine performance would probably be in the neighborhood of 14.8 lbs. of steam per electrical horse-power.

America in the Lead

It may be asked why the turbine is so slow of adoption in this country as compared with Europe. We are prone to boast of our own progressiveness, and to talk about the conservatism of European nations. As a matter of fact, the American nation is perhaps the most conservative of all as regards taking the initiative with new and untried devices. Our enterprise consists more in the magnitude of our operations when we have determined that a certain line of practice is sound in principle and satisfactory in its application. In high-speed engines our practice is exceedingly conservative as compared with English practice. Our large slow-speed engines are strikingly uniform in design as compared with the multiplicity of valve gears and special features exhibited by Continental builders. Superheated steam has as yet had hardly more than a passing consideration with us, while it is extensively used abroad. Instances might be multiplied almost without end to show that in some respects we are exceedingly conservative. When the Westinghouse company, which was the first in this country to undertake the manufacture of large machines, took up the steam turbine seven years ago, it was hopelessly impossible to interest steam users in such a machine. But by installing a plant of 1600-kw capacity in the power house of the Westinghouse Air Brake Company a commercial demonstration was made of the advantages of the machine, which was convincing to the most skeptical. It took four or five years to fully establish confidence, and it is only now that the results of this pioneer work are beginning to show. The peculiar quality of our American enterprise will exhibit itself not in doing the newest thing but in doing a good thing on the biggest possible scale. We have already the largest steam turbine yet built, and American brains and capital are already engaged in building, and an American management has ordered and will install the largest steam turbine that has so far ever been contemplated.

The Accountants' Association

The space at our disposal in this issue will prevent us from publishing the papers presented at the meeting of the Street Railway Accountants' Association of America, as well as our comments on the papers, and action taken by the association on the topics discussed. Some of the decisions made at the meeting of the accountants, especially in the matter of classification, were of quite a radical character, and brought out a very animated debate. Whether the classification finally adopted was in all cases the most desirable is a question we expect to take up in an early issue. We shall, in our next issue, publish all of the papers and reports presented at the Accountants' Association on both Wednesday and Friday.

It will also be impossible in this issue to discuss the general features of the exhibits made at Detroit. In spite of the somewhat limited facilities available at the Light Guard Armory, the exhibit as a whole was a very fine one, and the past record of the association in securing annually the finest exhibit of electrical apparatus made before and for the benefit of any technical body, was amply fulfilled this year. The exhibits individually are described at length elsewhere in this issue, and views are given of some of the more important of them.

J. C. Hutchins

Mr. J. C. Hutchins, the new president of the American Street Railway Association, has been identified with the Detroit street railway system since 1894. It has been under his management that the various interurban railways terminating in that city have been brought under one control. Eight years ago, or at the time at which Mr. Hutchins went to Detroit, the city system was distinct from all of the interurban lines which now form a very important part of the entire system owned by the Detroit United Railway Company. Mr. Hutchins realized the importance of uniting all of these different systems, and owing largely to his initiative, the capitalists interested in the city system acquired gradually first one and then another of the outlying interurban lines until the present magnificent system owned by the Detroit United Railway has been built up.

J. C. HUTCHINS

Mr. Hutchins was born in Carroll Parish, La., Oct. 13, 1853. He engaged in active business first as a constructing and civil engineer and took an active part in the early railroad construction in Texas, Missouri and throughout the Southwest. Later, for a short time, he engaged in newspaper work in Waco, Tex. Mr. Hutchins moved to Detroit in 1894, at which time he was elected secretary and treasurer of the Detroit Citizens' Street Railway Company, and when the Detroit Railway Company was acquired was elected to the same positions in that company. Later, upon the organization of the Detroit United Railway, Mr. Hutchins was elected vice-president and general manager of the company, and on Jan. 21, 1902, he was elected president of the company.

Mr. Hutchins' administration of the Detroit system has been marked by the introduction of a number of radical improvements in all directions of the service. One of the policies followed by Mr. Hutchins has been that of improving the conditions of the employees, and in this direction the company adopted the system of merit and demerit marks for employees, already described in these pages, as well as a number of other steps toward the betterment of the condition of the men on the road. The unification of the city system with the interurban lines required many changes in the organization of the system which Mr. Hutchins has built up to be a very strong organization. He is recognized as a broad and far-sighted railroad manager, and his election to the office of president of the American Street Railway Association is a well deserved tribute to his ability as a street railway manager.

The progress that has been made in developing the interurban freight and express business in Ohio has attracted the attention of many railroad men in the East, who as a rule do not take much interest in matters outside their own particular territory. One of these authorities says: "The Lake Shore Railroad's freight traffic through Ohio is being cut into by the aggressive competition of the Cleveland & Eastern Electric road, which operates about 100 miles of trolley line. This electric road has always secured a large proportion of the local freight traffic in its territory. Its rates are lower than those of the steam railroad and in most instances deliveries of consignments are quicker. Milk and farm produce form the great part of the business given to the electric line."

PAPERS READ AT FRIDAY'S SESSION, A. S. R. A.

The Steam Turbine—Its Commercial Aspect

BY EDWARD H. SNIFFIN,
Westinghouse, Church, Kerr & Co., New York.

The steam turbine is not as young as it looks. Although its application to commercial power generation in its present several forms is the achievement of recent years, its principle is neither new nor novel, and it may be wondered that a century of effort should have been applied to the reciprocating engine—which became, indeed, more complicated as it grew, before the primal theories of the heat motor assumed corporate, practical form. It is true that later knowledge of materials, and how to work them, has made the way clearer, and the wider use of the steam turbine has in a measure depended upon the development of electrical practice, with which latter it is now so intimately identified.

Much interest has for some time been centered in this type of prime mover and the possibilities of its application. The history of its development is quite generally known, and up to this time attention has been more particularly directed to its engineering and mechanical characteristics. It now seems appropriate to inquire into the controlling features of its commercial utility, and determine, if we may, whether the steam turbine, subjected to a somewhat careful analysis, is a machine still to be developed, though of ultimate promise, or whether it has been well tried and its advantages proved. What has it accomplished? What justifies its use? What otherwise unattainable results will it produce? What are its limitations? It is this aspect of the case on which the light is needed.

It is of little moment what the direct or contingent advantages of the turbine may be, if its reliability remain in doubt. Offered, as it is, in large units, and being apparently more related to the classes of service which impose the most exacting requirements, the demand is imperative that in this one vital respect there be little left to chance.

Before recurring to actual experience it may be instructive to consider for a moment the general character of the turbine as a type of motor, contrasted with the piston engine. Fig. 1 shows the longitudinal section of the Westinghouse turbine. The steam entering the governor valve arrives at the chamber *A*, then turns to the right, passing first a set of stationary blades, then impinging on the moving blades, driving them around, and so on, until it arrives at exhaust chamber *B*. And here is an interesting lesson in physics, a demonstration of the conversion of heat into energy; for while the temperature of the inlet end is that of the entering live steam, the exhaust end, but 3 ft. or 4 ft. distant, is not so hot (about 126 degs. F.), but that one may bear the hand. The cut will show that the only real moving part is the spindle, revolving in its bearings, the governor mechanism and oiling arrangement being comparatively insignificant. The blades do not wear, as the steam velocity, some 500 ft. or 600 ft. per second, is not sufficient to affect them. The blades are made of a special material, and are calked in such manner that the force required to pull them out would exceed the elastic limit of the material in the blades. They are subjected in regular practice to a strain of about one-fortieth of this amount. The actual pressure exerted on each blade is about 1 oz. A complete description of the mechanism is not needed here.* It is sufficient to note its general character and to contrast its obvious simplicity and freedom from complication, with the recognized complexity of the piston engine. The inference is clear that in constructive opportunity, at least, the turbine should be the more reliable.

The steam turbine, before it had obtained any considerable recognition here, was not entirely without success abroad. Parsons and others had done much to prove its reliability. For instance, in 1897 the Newcastle & District Electric Lighting Company, operating eleven turbines of 75 kw to 150 kw each, showed the cost of repairs and renewals on the entire plant, including turbines, generators, boilers, condensers, pumps, fittings, cables, etc., to be .25 of a cent per kilowatt per annum.

In this country the steam turbine is now operating in several plants. The first prominent installation was at the Westinghouse Air Brake Company's works, at Wilmerding, Pa., where the first unit was started in August, 1899, two more shortly after, and the fourth unit in April, 1901. Thus the plant has been in service, for the most part, more than three years, and the fourth unit about eighteen months. The plant operates regularly eleven hours a day, the service being electric power and lighting. With the iron foundry running at night, one turbine is run twenty-two to twenty-three hours per day. In general, the units have run quite to their rated capacity—perhaps within 20 per cent of it—as a minimum. An interesting comparison has been made elsewhere of the efficiency of this turbine plant with the installation it supplanted, the latter comprising simple and compound engines, scattered about the works. After the three turbine units had been placed in operation they were shut down, and the steam engines previously in use (not yet disconnected from service) were again started up and a test made. A test was then made of the turbine plant. These were based upon a week's run, careful measurements being taken of fuel and water. The saving of coal in favor of the turbine plant averaged 35.7 per cent during the day, and 36.4 per cent during the night. The saving in feed-water averaged 29.8 per cent during the day and 41.4 per cent during the night. In round numbers this meant a saving of about 40,000 lbs. of coal per twenty-four hours. This improvement, of course, was attributable not entirely to the turbine itself, but also to the more efficient method of electric power transmission in comparison with the previous scattered arrangement of steam engines, with long runs of steam piping, use of belts, etc. It is, however, instructive as indicating the results accomplished in a specific and prominent case, as between an old and still commonly used system of power transmission and a modern method.

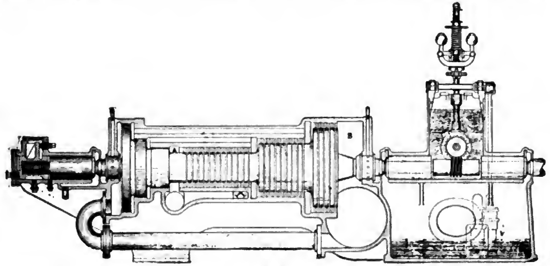


FIG. 1.—LONGITUDINAL SECTION OF WESTINGHOUSE TURBINE

This plant at Wilmerding was the first of its kind. It naturally was not without its minor difficulties. The turbines themselves, from the time of starting, have been practically free from trouble of any kind. Some armature difficulties were at first experienced, but not of enough moment to interfere with operation, and were readily corrected. Summing up the experience had with this first installation, undertaken somewhat experimentally at the time, the net result is that the plant has operated about three years in heavy

* See paper read by Francis Hodgkinson before Engineers' Society of Western Pennsylvania, November, 1900.

daily service; that the work has not suffered interruption, and that the plant is to-day running with sustained satisfaction and with no visible signs of wear in any of its parts. Fig. 2 shows this installation, comprising four 400-kw units located within a space 45 ft. x 61 ft., the height of the engine room being 20 ft. 6 ins.

The Yale & Towne Manufacturing Company, at Stamford, Conn., has a 400-kw steam turbine furnishing 240-volt, two-phase current at 7200 alternations. This outfit was started in operation Feb. 1, 1902. Since that time it has been in regular daily service, carrying about its rated load, operating ten hours per day, furnishing current for electric motors and some lighting. Up to this time, therefore, it has been in service about eight months, and its mechanical operation has been most satisfactory. No quantitative tests have yet been made of steam performance, but there is general evidence of its economical operation. Fig. 3 shows the appearance of this outfit.

The Hartford Electric Light Company, at Hartford, Conn., have a 1500-kw, two-phase, 2400-volt, 60 cycle, turbo-generator outfit, perature under superheated steam, and means were taken to make the temperature at all points more uniform. Having in due time overcome these local defects, which partook in no sense of functional fault, the turbine was then in serviceable condition, and its operation has since been most satisfactory. The Hartford Company, notably alert to adopt the newer thing if there seemed advantage in it, found when their water supply ran short that it paid to run the turbine and allow their Corliss engines to remain idle. This turbine is seen in Fig. 4.

Is the steam turbine efficient? And what, if it may be so termed, is the character of its efficiency? Is it, like the various types of piston engines, peculiarly fitted to certain conditions which permit of little change if economical performance be retained, or is there evidence that the turbine has a greater inherent efficiency that is less affected by attending circumstances?

The interest of engineers in the turbine has, perhaps, been drawn chiefly to the evident possibilities of its steam economy, and to the data already acquired, with the discussion it has provoked,

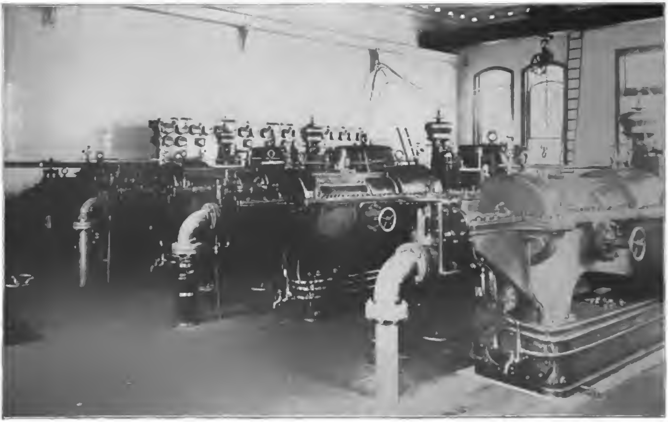


FIG. 2.—TURBINE PLANT AT WESTINGHOUSE AIR BRAKE WORKS, WILMERDING, PA.

which was started in April, 1901. This, at present, is the largest turbine yet installed in this country. Put in, as it was, to relay their water power, it has not been in constant service, but has usually been required only one or two days a week. At such times, however, it has carried the full station load of some 1800 kw or 1900 kw. Reference will hereafter be made to its striking economy.

A great deal of interest has centered in this early installation of a good sized outfit in a prominent location, and its excellent performance is now generally well known. Some difficulties were at first experienced; nor were they entirely unexpected, for there had been no facilities, as there are now, for testing the outfit before shipment, and it was merely run at the shop without load. Before the machine was successfully in operation one trouble that developed was with lubrication. The packing glands around the turbine shaft leaked somewhat, and the construction of the oil passages with reference to these glands enabled the oil to come into contact with the steam, impairing its lubricating quality. This was easily overcome by modifying the vents and employing glands of different construction.

Some time was also required after erection to make necessary adjustments to relieve the turbine of longitudinal end thrust. This would have been corrected at the shop had the opportunity then been present for making complete test. It was found, too, that the shaft, which had been designed to afford the utmost ease of dismantling, was subjected to a considerable unevenness of tem- much more of value will be added. We may in a general way, however, without referring to its thermodynamics obtain from the evidence of actual results some knowledge of its efficiency and determine if the standards of present practice may not be improved.

It is well that the makers of the turbo-generator have been compelled to adopt the practice of basing the steam consumption on the unit of output, so that their guarantees are given on the electrical horse-power or kilowatts delivered on the switchboard, and not on the indicated horse-power developed. This at once eliminates the factors of engine friction and generator loss, and thus more definitely establishes a measure of performance.

One is impressed with two distinguishing features of the turbine's steam efficiency, namely, that it seems to vary but little over wide ranges of load, and, further, that the size of the unit has comparatively little bearing. It follows, then, that if good results are possible at all, they are neither restricted to the larger plants nor to the requirement of steady load.

Fig. 5 illustrates this. Herein are given the results of tests on a 400-kw turbine made at the builders' works before shipment, the machine having since been in daily operation eight months. These tests were conducted under brake load, so that the figures are based on the brake horse-power developed. The rated load would be about 600 B. H. P. The steam consumption is seen to be very flat, graduating from 14.47 lbs. at full load to 16 lbs. at half rating, and to less than 19 lbs. at one-quarter capacity. The

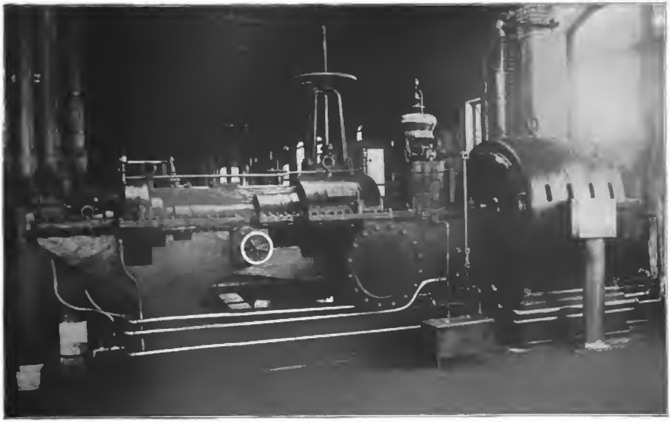


FIG. 3.—NEW 400-KW STEAM TURBINE AT YALE & TOWNE MANUFACTURING WORKS, STAMFORD, CONN.

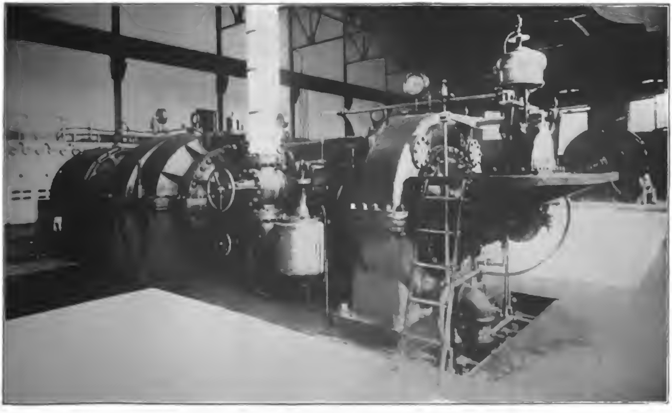


FIG. 4—1500-KW WESTINGHOUSE TURBINE AT HARTFORD ELECTRIC LIGHT COMPANY'S CENTRAL STATION

relation of the consumption of steam in pounds per hour to the brake horse-power developed is also shown, this line being almost straight. In the tabulation may be observed the interesting comparative effect of vacuum and superheat.

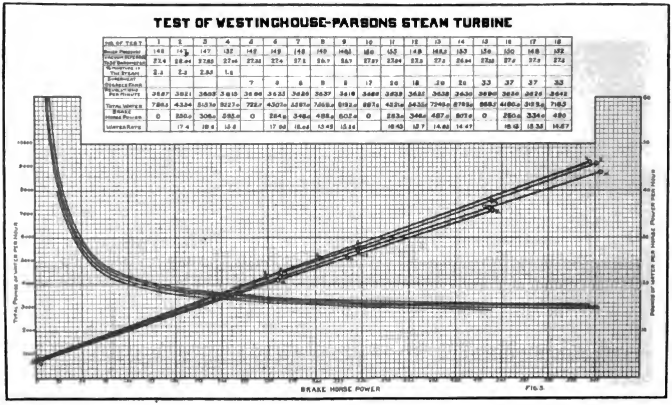
If it is thus shown that with a unit as small as 400 kw we may obtain a result of 14.47 lbs. of steam per brake horse-power per hour, corresponding to less than 13¾ lbs. per ihp, it is evident that moderate sized plants may with the turbine be sufficiently subdivided to give the maximum flexibility of service, with insurance of relay, and yet possess an efficiency heretofore identified only with very large units. Further than this, a fluctuating load is not incompatible with high economical performance.

As the units become larger the turbine is then brought into comparison with the best steam-engine practice, where it still preserves its uniform efficiency, and where its practical advantages are no less evident. In a recent instance, a result of 11.7 lbs. of steam per electrical horse-power per hour was guaranteed on a turbine of 750-kw capacity, corresponding to about 10.17 lbs. per ihp, which, though the size is moderate, is perhaps within the ability of but few engines of any size or type that have ever been built.

At the Elberfeld Municipal Electricity Supply Works, in Germany, two 1500-hp Parsons turbines, which are run in parallel with two Sulzer horizontal engines, were tested by Prof. Schrotar, Dr. Weber and Mr. Lindley. With steam pressure averaging 95 lbs., running condensing, and with 18.3 degs. of superheat, the result obtained at maximum load was 19 lbs. per kw-hour, or about 11.4 lbs. per ihp-hour.

Many other results have been recorded, but those given will probably be sufficient to show that under service conditions the turbine has demonstrated its high efficiency.

But is its efficiency maintained? A question often asked, and a very important one, too. Looking at the turbine casually, it seems as though there would be little opportunity for any change in its mechanical functions. There is no complicated valve gear to get out of adjustment; no pistons to leak; no rubbing surfaces to set up excessive friction; little chance of misalignment, and altogether there seems to be no good reason why its original condition should ever be very much disturbed. The blades appear to be the vulnerable point, for they do the work, and there are a good many of them. Their number, though, is in their favor, and,



No. of Test	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Gauge Pressure	148	147½	147	132	149	149	148	149	148.5	150	155	148	148.5	153	150	150	148	152
Vacuum Referred to 30" Barometer	27.4	28.04	27.85	27.06	27.35	27.4	27.2	26.7	26.7	27.87	27.04	27.5	27.3	26.64	27.20	27.0	27.3	27.4
% Moisture in the Steam	2.3	2.3	2.85	1.6														
Superheat Degrees Fahr.					7	8	8	8	8	17	20	18	20	20	33	37	37	33
Revolutions per Minute	3587	3621	3603	3613	3606	3635	3626	3637	3616	3466	3629	3625	3638	3630	[illegible]	3630	3626	3642
Total Water	786.5	4324	5157.0	9227.0	722.0	4302.0	5387.0	7068.0	8192.0	667.0	4321.0	5435.0	7240.0	8789.0	888.5	4180.0	5129.0	7165
Brake Horse Power	0	250.0	306.0	585.0	0	284.0	348.0	488.0	602.0	0	263.0	346.0	487.0	607.0	0	250.0	334.0	490
Water Rate		17.4	16.6	15.8		17.06	16.06	15.45	15.26		16.43	15.7	14.86	14.47		16.48	15.35	14.67

FIG. 5.—RESULTS OF TESTS ON 400-KW TURBINE

It may be pertinent to cite a few results obtained in regular service. The turbine at Hartford, under test conducted by Prof. Robb, at an average load of 1800 kw, with 155 lbs. steam pressure, 27 ins. vacuum and 45 degs. superheat, gave a result of 19.1 lbs of steam per kw-hour, or an equivalent of about 11.46 lbs. per ihp-hour. An interesting comparison has been made at this plant of the relative efficiency under regular operating conditions of the turbine and their Corliss engines. They have one 18-in. and 34-in. x48-in. and one 24-in. and 44-in. x 60-in. cross-compound horizontal Corliss engine. These engines drive direct by belt one 400-kw and one 600-kw generator. The turbine is, of course, direct-connected to its generator. They have made comparisons of operation based in each case on rather extended runs. It has been found that the turbine requires in delivering 1900 kw on the board about the same amount of coal that is used with the Corliss engines to deliver 925 kw, the steam pressure and vacuum being identical in both cases, and this with the engines running at about their point of best efficiency and known to be in excellent condition. Comparisons of this kind, while not scientifically exact, are, perhaps, of greater interest as a measure of commercial performance.

The data at hand of test on one of the 400-kw turbines at Wilmerding shows a result of 16.4 lbs. per ehp-hour at full load, with 125 lbs. steam pressure and 26-in. to 27-in. vacuum. At half load it is 18.2 lbs.

being loaded as they are to only about 2½ per cent of the pressure they are built for, they possess an abnormally large factor of safety. The experience has been that the turbine is less liable to depart from its original standard of performance than any other type of prime mover, and there seems little reason to suppose that it is capable of much deterioration.

A recent interesting investigation along this line was made at the plant of the Cambridge Electric Supply Company, Ltd., in England, where they have a 500-kw Parsons turbine. The outfit was erected in January, 1900, and during the past year has been doing constant work. After it had operated about eight months a second one was installed. The first outfit had been tested at the maker's works before shipment, and showed a result of 24.1 lbs. of steam per kw-hour at 520.4 kw. And it was for the purpose of noting its performance after a year's operation that Prof. Ewing conducted a second test.* In this latter test the turbine at 518 kw, under nearly equal conditions of steam pressure and vacuum, gave a result of 25.0 lbs., and at 586 kw. 24.4 lbs. In the second instance, the turbine, beside trouble experienced with wet steam, was driving its own air and circulating pump (a surface condenser being used), and the steam required to drive these auxiliaries was charged to it. In the test at the builders' works the turbine did not drive its pumps. The results, to use Prof. Ewing's

* London Engineering, June 14, 1901.

words, give most satisfactory evidence that the turbine retains its character as a highly efficient generator.

It remains to be said in this general connection that there will be found in steam-turbine practice a more satisfactory treatment of the economy question than has heretofore prevailed. There will exist not only a truer basis of measurement than the indicated horse-power, but there will be opportunity for more thorough demonstration. It is now generally recognized that efficiency guarantees on large engines have little significance. The builder is physically unable to completely assemble and test such engines before shipment, and the user is seldom able or disposed to incur the distraction and expense which a field test involves. It is in the exceptional case, therefore, that actual tests are made, and there is still much to be known concerning the economy performance of large engines. It might be said, too, that while builders and engineers generally recognize the elements of design

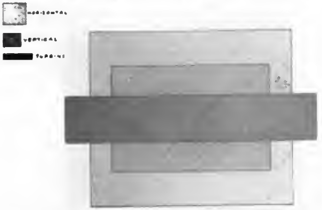


FIG. 6.—COMPARISON OF FLOOR SPACE OCCUPIED BY HORIZONTAL, VERTICAL AND TURBINE ENGINES

that conduce to efficiency, there is no unanimity of opinion as to what those elements will actually produce.

It is, therefore, gratifying to know that one builder, the Westinghouse Company, is now erecting a new testing room in which a complete plant of boilers, condensing and superheating apparatus will afford facilities for testing turbines up to 3000 hp at

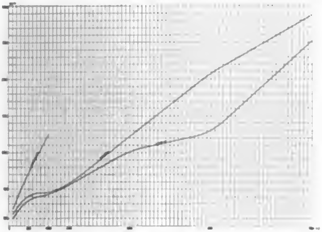


FIG. 7.—FLOOR SPACE, SQUARE FEET PER HORSE-POWER

all loads up to full capacity, and larger units up to this point, with practically any steam pressure and wide ranges of vacuum and superheat. Thus, the conditions to be met in practice may be approximated in the shop, and the information acquired will be of the highest value.

Turning now to one notable feature of the turbine, its compactness, Fig. 6, is a graphic illustration of the floor space it occupies, compared with the vertical and horizontal cross-compound Corliss engines, the basis of comparison being a 1000-kw unit, including the direct-connected generator, the engine cylinders being 28 ins. and 56-in. x 48-in. stroke, which, at 95 revolutions, with 25 lbs. mean effective pressure referred to low-pressure cylinder, gives about 1400 ihp. It will be seen that the floor area of the turbine is about two-thirds that of the vertical engine and about two-fifths of the horizontal. Such comparison, of course, is limited in its application. With each set of conditions requiring special treatment no standardization of space requirements can be established. Still, with the limitation of isolated experiences, it is possible, without attempting to establish any universal laws, to make some reasonably close comparisons of the space required for the turbine as against the conventional types of engines. It has been thought desirable, then, to take a number of different sized plants, each composed of several appropriate sized units, the selections being as follows:

1,000 hp	in	2	400-kw units.
8,000 hp	in	3	750-kw units
5,000 hp	in	4	1,000-kw units.
†10,000 hp	in	3	2,500-kw units.
15,000 hp	in	4	2,500-kw units.
30,000 hp	in	4	5,000-kw units.
50,000 hp	in	7	5,000-kw units.
75,000 hp	in	10	5,000-kw units.

These combinations were laid out for the turbines and for the vertical and horizontal cross-compound Corliss engines, all with their direct-connected generators. A clearance space of 7 ft. in all directions was allowed, and is probably a fair average. The computations were confined to the units themselves, with the clearance stated, the disposition of the balance of the plant being assumed to be unaffected by the type of motive power.

Fig. 7 shows the comparison of floor space. The curves show the turbine to require about 80 per cent of the space needed for the vertical, and not over 40 per cent of that wanted for the horizontal.

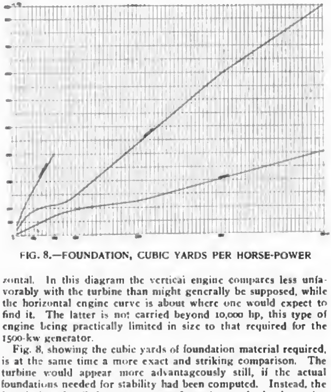


FIG. 8.—FOUNDATION, CUBIC YARDS PER HORSE-POWER

In this diagram the vertical engine compares less unfavorably with the turbine than might generally be supposed, while the horizontal engine curve is about where one would expect to find it. The latter is not carried beyond 10,000 hp, this type of engine being practically limited in size to that required for the 1500-kw generator.

Fig. 8, showing the cubic yards of foundation material required, is at the same time a more exact and striking comparison. The turbine would appear more advantageously still, if the actual foundations needed for stability had been computed. Instead, the foundations in all three cases were figured at 15 ft. depth to give space underneath the engine room floor for condensers, etc., though for large engines this depth is usually inadequate. The only foundation needed for the turbine is that necessary to hold its weight, as if it were a tank, or some other stationary affair. It does not even require foundation bolts, there being no vertical or horizontal thrusts to be resisted. Comparing again the 1000-kw units, it is found that in actual foundation volume required the ratio of the turbine to the vertical and horizontal engine is that of 1 to 9 and 15, respectively.

In Fig. 9 will be observed the comparison of engine-room building space, in which the turbine appears to hardly less advantage, though in this diagram the horizontal engine, gaining in head-room what it lost in floor space, compares more favorably with the vertical. In plotting these curves sufficient head-room was allowed to accommodate a crane, leaving adequate clearance for handling any part.

Having noted, then, the marked advantage which the turbine appears to offer by virtue of its compactness, it would seem that the comparison might be carried a little farther, and with assumed valuations of masonry work and building construction, as well as

† In this size the horizontal engine is figured on five 1500-kw units.

of land, the money saving to be effected in these important features of initial cost be defined.

Still adhering to the same plant size and combinations of units, in Fig. 10 is found the comparative cost of foundations, the basis assumed being $7 per cubic yard for concrete, laid. It will be seen that while the turbine seems to average a foundation cost of about 50 cents per horse-power, the vertical engine in the more frequent sizes is approximately $1.50, while the horizontal is not far from $2.50. Not forgetting that all three foundations are figured of equal depth—15 ft.—to provide space below, as before

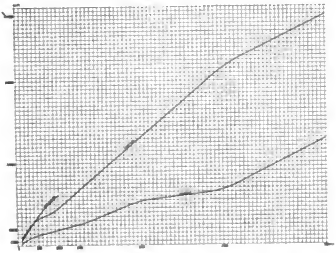


FIG. 9.—ENGINE ROOM, CUBIC FEET PER HORSE-POWER

stated. In the instances where special foundation work is required, such as piling or otherwise preparing suitable bottom, or shoring up building walls to enable sufficient depth of excavation, the expense avoided by the use of turbines is obvious.

In Fig. 11, showing comparative engine-room building cost, the basis assumed is 15 cents per cubic foot of space inside of walls. Building construction necessarily varies widely with the size, design and materials employed, but the figure taken is perhaps not far from a fair average for building built of brick, with steel trusses and fireproof covering. The curves show that the building

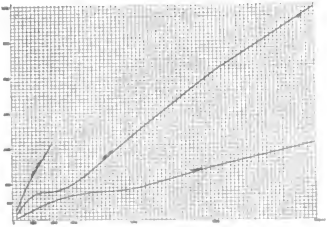


FIG. 10.—FOUNDATION, COST PER HORSE-POWER

cost for the turbine is about one-half of what is required for the horizontal or vertical engine, the latter two apparently not being far apart. In this comparison of building cost experience would differ widely. Architectural considerations and local conditions would produce varying results. Exigencies would, however, favor the turbine, because of its smaller size and rectangular proportion, and it not infrequently happens that increased power may be supplied by locating the turbine in existing space, whereas an engine would necessitate building extension, and, perhaps, the purchase of additional land. An instance of this kind arose at Akron, Ohio, where in the existing space no arrangement could be devised to accommodate additional engine power. It was found possible, however, by rearranging auxiliary apparatus, to provide space for one 750-kw and one 400-kw turbo-generator outfit, which will shortly be in operation.

Fig. 12 gives the comparative cost of land to accommodate the engine-room space, the land valuation being placed at $3 per square foot. Whatever may be the value of land, the relative comparison would remain unaffected. Land value, however, is never of minor importance, for desirable power-house sites, with transportation and water facilities, usually cost a good deal. And, alloting about ½ sq. ft. of floor space to the horse-power of generating unit, it takes but little figuring, where plants are located on expensive ground, to show that the turbine in this respect alone may save a considerable part of its first cost.

The last diagram of the sequence, Fig. 13, summarizes the preceding curves and shows, with foundations, building and land at

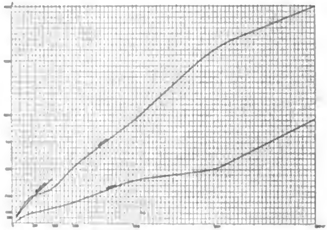


FIG. 11.—ENGINE ROOM, BUILDING COST PER HORSE-POWER

the valuations given, how these factors of cost compare. The data will have served its purpose if it show that in a properly designed plant employing the steam turbine far more money may be saved in these particulars than is ever represented by the difference in cost between machinery of high grade and that of inferior quality.

A case or two may be to the point. A plant was recently laid out to contain three 1000-kw units, with vertical cross-compound Corliss engines. Subsequently three more 1000-kw units were contracted for, steam turbines being ordered. It was found that

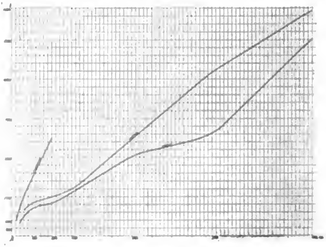


FIG. 12.—ENGINE ROOM, LAND COST PER HORSE-POWER

the turbine saved 900 sq. ft. of engine-room floor space and about 38,000 cu. ft. Had the whole plant been originally designed for turbines the saving of space would have been double these amounts, and the cost of land, building and foundations been reduced about $50,000.

An electric railroad plant in Ohio was some time ago installed, in which there are 500-kw generators direct-connected to cross-compound Corliss engines. Space was provided for two more units of the same size. For the increased power two 1000-kw turbine outfits were purchased, which will go in the space left, and leave room for another turbine of 2000 kw. Thus, the engine-room space planned for 2000 kw is found sufficient for 5000 kw. It is estimated that the boiler-plant extension will be reduced about one-third because of improved efficiency. It is figured, too, that a saving of $2,900 was effected on each 1000-kw foundation.

One other case, of perhaps greater interest, recently came to notice, that of a plant of 8100-kw capacity, laid out on modern lines, employing vertical cross-compound condensing engines. There is no space for additional engine power, and any increase would require building extension and encroachment upon valuable land. It was shown that without going beyond the present building walls, and without disturbing the existing machinery, the plant might be doubled in capacity by installing turbines in the space available below the present engine-room level and adding another deck of boilers. And it has been figured that this arrangement would effect a reduction of over $3 per kilawatt per annum in the present interest charge.

With some measure thus obtained of the comparative indirect expenses of installation we may turn to consider the cost of the turbo-generator outfit itself. Is it high in price, or is its cost, if not an attractive feature, still within our common idea of value? The answer is that its price is reasonable; that, indeed, where the comparison is fair, the turbine will require the lesser first investment. It is, unhappily, quite as difficult to compare the costs of the turbine and piston engine as to compare the costs of engines themselves. A thing is, of course, high or low in price by comparison. but where the steam engine is concerned, to measure values were a hopeless task so long as there are held divergent views of design

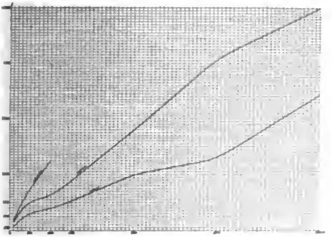


FIG. 13.—TOTAL ENGINE ROOM COST PER HORSE-POWER

and construction and of engineering adaptation, with the builders themselves wide apart in their practice.

There are engines of good workmanship and of poor, of heavy proportions and light, and generous and scant proportioning of cylinder size and ratio, and of piston speed, to the work to be done. Perhaps, too, the voice of experience may protest that the buyer's insistence on his bargain is not always in keeping with the quality he would have, or should have, and it is not surprising that commercial necessity should sometimes affect engineering ideals. While the reliable builder will adhere to his high standards, there still will be found those whose more flexible practice will suffer impairment of quality to fit the price

Proceeding with the comparison, however, it may be assumed that the larger field for the turbine begins about where the high-speed engine leaves off. Its steam economy at once identifies it with the most efficient engine practice, and it therefore applies more appropriately to the classes of service where medium and large-size units are used The comparison, then, lies generally between the turbine and the slow-speed engine. It remains merely to take an engine and generator of good construction, bring the engine efficiency as nearly as possible into parity with that of the turbine, also having it possess the same overload capacity, to find that the turbine is reasonable in price. And when we add the possible saving in foundations, buildings, etc., the first cost of installation is usually much in its favor.

There remain still one or two important features of electric power plant operation wherein the use of the reciprocating engine is attended with difficulty, and with respect to which the steam turbine offers unquestioned improvement.

One of these, the running of direct-connected alternating current generators in parallel, has come to be a frequent requirement but frequent as it is, and essential as it is, its accomplishment has been anything but an exact science. There has, in fact, been so little synchronism of method as to justify some wonder at the results that have really been obtained. There is no need here to particularize the complications of the problem. It obviously is not the work of the tyro to introduce into two or more units the identical conditions that will convert reciprocating motion into synchronous rotating motion, co-relating, as he must, the features of governing functions, inertia of reciprocating parts, fly-wheel weight and radius and the like. And it becomes evident that where successful parallel running is achieved it is the triumph of skill not only in design, but in the handling of the machinery itself.

These difficulties cease with the turbine. In it there is no fluctuation of angular velocity. There is but one direction of motion, with no element to detract from even turning moment, and due to its speed there is stored up more fly-wheel effect than is present in the piston engine.

It is, therefore, found that not only do steam turbines easily run together in parallel, as hydraulic turbines have always done, but it may be expected that they will operate with piston engines and the performance of the latter in this respect be much improved. In electric railroad work especially is this feature of the steam turbine of much interest, for it is well known how irregular loads accentuate the difficulties of regulation. Furthermore, the uestion of operating high-frequency apparatus in combination electric railroad and lighting service may be more satisfactorily approached.

The feature next in importance, perhaps, is that of superheated steam. It is now quite generally recognized that superheating is of advantage, though there is still much about it to be learned. Future investigation, however, in which the turbine will take important part, will reveal more precisely its economical status, and it may be hoped that before long the net advantages derivable from different high-steam temperatures will be known. Meanwhile, superheaters are being installed, and collaterally the problem of handling superheated steam has assumed importance. Engine builders themselves are feeling their way, for while some appear unrestrictedly to offer the Corliss valve for superheat work, others seem prone to confine it to the more conservative temperatures, and others still reject it altogether, and hold to the poppet valve, where superheat is employed.

The turbine may be used unreservedly with superheat of any feasible temperature. It has no internal rubbing surfaces, and there are no glands to become injured. Also, as no cylinder oil is required, there is no opportunity for lubricating trouble. Furthermore, there seems to be with the turbine rather more proportionate benefit from superheat than with the piston engine, because of diminished skin friction.

Having said that the turbine requires no cylinder lubrication, the inference follows that the steam is therefore uncontaminated with oil, and that the exhaust, when condensed, is pure distilled water. This is true, and while it is of little consequence where water supply is abundant and good and cheap, it becomes, where conditions are otherwise, of exceeding importance. In many sections of the country, where the water contains either mud or scale-making impurities, the cost of repairs to boilers, with the expense in labor and interruptions of service entailed by constant cleaning, is a besetting evil, and to alleviate this trouble large surplus boiler plants are often installed. As a usual thing, too, difficulty is experienced in attempting to extract oil from exhaust steam.

To recur once more to this feature of lubrication in the turbine, it may be remarked that it is an item of very little expense. The bearings are the only points requiring oil, the lubricant being circulated around under pressure. The reservoir being once charged, very little is needed to maintain the supply.

Finally, in this commercial consideration of the turbine, one other question should perhaps not be omitted, one, in fact, which sometimes seems to outweigh almost every other, namely: How long does it take to get it? While the demand has, in truth, for some time exceeded the capacity for production (there being now under construction at East Pittsburgh some 44,000 kw on order), so that the turbine has required about as much time to build as everything else, the extended facilities now nearing completion will better this considerably. Certainly, under normal conditions, these outfits, made of comparatively small parts, with no enormous pieces to be handled, ought to be quickly built, and what is quite evident, they can, when delivered in assembled condition, be so readily installed that the months sometimes required to erect large engines will be reduced to weeks.

If it is, then, seen that the steam turbine in all the essential aspects of its commercial utility appears to stand on solid ground, there cannot be yet attributed to it the virtue of universal application. It has its field chiefly in electric lighting and power work, though in small sizes it has been extensively used for driving blowers, pumps and other devices. Its speed, of course, prohibits belt drive.

But the direct-connected electrical generating unit has been the sine qua non of modern power development, and the reciprocating steam engine, under the stimulus of opportunity, has been brought

nearly to its mechanical and thermal limit. With all the ingenuity and skill and patient effort that have marked its growth; with its notable achievement, symbolizing as it does the march of industrial progress, it still remains, even in its most advanced form, a wasteful and complicated means for converting heat into energy. If we are to exact further tribute from the agency of steam; if we would hope to reduce complexity, and by a more simple, reliable and durable method of operation reduce the interest and maintenance charge; if, in a word, we would improve the standard of existing practice and surmount many of its limitations, we must then change the character of our medium, employ different principles and give to the generation of power a new and greater significance. The steam turbine seems destined to mark the way.

Signals for Urban and Interurban Railways

BY G. W. PALMER, JR.

The many recent disastrous collisions on street railways must have convinced operators and managers that the use of an efficient and reliable signal system would add to the safety and facility of the handling of their traffic. As faster schedules and heavier cars come into use, there is imperative need of a system of operation which will guarantee freedom from accidents caused by cars meeting head on, or by one car overtaking another.

There is only one way to prevent these accidents, namely, to adopt such rules and methods of operation as will insure that but a single car will occupy any block or section of track at any one time; any signal system which will aid in accomplishing this result is worthy of consideration.

We believe that the steam roads in their early days were confronted with precisely the same problem in relation to signals as the electric roads are now contending with. The steam signals are now probably as nearly perfect as human skill and ingenuity can make them. They did not, however, spring into existence in their present perfected condition, which has been reached only after years of work and effort to eliminate the defects shown up in practical work.

Electric roads should not, therefore, say "show us a perfect system and we will adopt it." It is decidedly to our interest to encourage the efforts of those who are endeavoring to work out something which will be accurate and reliable and to contribute whatever we can to this end.

It is obvious, however, that even a perfect signal system cannot, after its adoption and installation, operate a road. Careful management, and good discipline on the part of the men are still vitally necessary. We believe that no man should be given a second opportunity to disregard a signal set against him or to break any rule which it has been found necessary to make to insure safe operation. The employment of such a man involves a risk which should not be disregarded.

When electricity was adopted as a motive power on street railways, and especially when lines were built between cities, in some cases paralleling steam roads, and invading a field hitherto occupied solely by the latter, many saw that methods which prevailed during horse car operation would not do under conditions of higher speed, heavier cars and greater volume of traffic.

The need of something which would show that a car was approaching from the opposite direction, or was a short distance ahead going in the same direction, was quickly perceived and the problem attacked by a number, on various lines, but all having a common end in view. Several systems of block signals were put upon the market, and have since their early adoption and use undergone a process of development to get rid of the faults which became apparent by their continued use.

We believe that all single track suburban and interurban roads should adopt the best obtainable block system, together with a telephone system which will enable a despatcher to reach any car crew at regularly established stations.

A signal to be reliable and efficient should be quick and positive in action; it should be impossible to set the cautionary or permissive signal at the near end of the block before setting the danger indication at the far end; incandescent lamps should not form a part of the main signal circuit, nor should the lighting and extinguishing of lamps be the only visual indication of the signal. This should be supplemented by the movement of an arm or semaphore blade which will move each time the signal is operated whether the lamps burn or not. The device will then be operative if the lamps burn out, as sometimes will happen. Manual control affords unauthorized persons a chance to interfere with the signal, and should not be depended upon; the setting and clearing circuits should be closed automatically, and when the signal has been set at danger it should lock so that it cannot be cleared until all cars have passed out of the block. It should be possible to set the signal only one way by two cars entering a block from both ends at the same time.

Special attention should be given to freedom from damage by lightning. As the pressure is liable to fall considerably at the ends of long lines, and also on parts of the system when heavy local loads are carried, the signal should be able to operate through a wide range of voltage, and should not be liable to damage through crossing of the signal circuit with the lines.

There are several systems now in use on electric roads, one using simply a circuit of lamps operated by a two-way hand switch at either end of the block, part of the lamps being lit as a permissive signal at the near end, while the balance indicates danger to an approaching car at the far end; this system is peculiarly susceptible to trouble from lightning, and also fails when any lamp burns out. As commonly used the switch and lamps are in the same box, and generally the car is run into a position where the conductor can easily reach the switch. In most cases the motorman then cannot see the lamps and depends on the bell signal from the conductor.

The proper method would be for the car to be stopped at a point far enough to the rear of the box for the motorman and passengers to observe the character of the signal, the conductor going ahead and throwing the switch; where the blocks are many, this will cause an annoying delay, which could be avoided by having the switch separate from the signal box, at a point about a hundred feet to the rear of it, and at such a height that the switch cannot be reached from the ground. When permission to proceed has been obtained, the motorman should not enter the block until the conductor has struck two bells, thus making the men jointly responsible.

An improved method of operating the signal is by means of a circuit closer hung overhead and at a point sufficiently in the rear of the box, the circuit being closed by the passage of the trolley wheel; there are devices of this kind now obtainable which are reliable and effective in action.

A better system is one which uses a setting and clearing circuit separate from the lamp or semaphore circuit; most of these, however, can be cleared by the passage of any one car out of the block, and in case of running several cars together, all trolleys but the one on the rear car must be pulled down when passing the switch, or if the leading car clears the block the car proceeding in the other direction must be notified of the number of cars following; this is an element of danger, as it should be absolutely impossible to clear a block while any car remains.

Some device should be used which will record the number of cars entering the block from either end, and hold the setting circuit closed until all cars have passed off the block. It should also be possible to clear the danger signal from both ends of the block, as it is often necessary for a car to leave a block from the same end at which it entered.

There are certain single track blocks on the Old Colony system which are operated by means of what is locally known as the "red stick." This is a small club or billet of wood painted red, which controls the block to which it belongs, and no car is allowed to enter the block unless it carries the "red stick," it being replaced by a red lantern at night. This is a safe but not very flexible system, the absence of the stick showing one that there is a car on the block, but not the direction in which it is going. Nor does it show when the block is cleared from the other end. In case of delay or blockade of cars going in the opposite direction the stick could not be carried back and all cars going in the same direction as the one which first entered the block would be held up. It does prevent effectually the "bunching" of cars at one end of the line.

Double track roads are also feeling the need of some system which will prevent rear end collisions. Where cars are operated on quick headway and a direct view of the track ahead cannot be had, there is always danger of a car overtaking the preceeding one. This is particularly the case at night, and all cars operated on suburban lines should carry a rear end red lantern. This simple precaution is so obvious that it would seem as though it must have been adopted by every one. Such, however, is not the case.

There has been some work done along the line of cutting off the trolley current from a car which has not the right of way, thereby making it impossible for the car to proceed. This scheme seems to us to be a very attractive one, and it is possible that it may be effectively developed.

Too much stress cannot be laid on the necessity of giving careful attention to the proper erection and maintenance of the signal lines and devices. In regard to the lines, their maintenance is more difficult with us than with the steam roads. We are forced to carry many of our wires in streets lined with thick and heavy trees, through which it seems almost impossible to obtain good and reliable construction. In all cases special attention should be paid to keeping the wires clear from the limbs and a tough and impervious insulation should be used.

Regular and careful inspections of all parts of the system should

be made, and everything done which may be necessary to keep it at all times in the best of condition. No devices should be left without care until they fail to work, which they may do at a time when there is the greatest need of their reliable action. Efficient maintenance may be expensive, but one accident which might have been prevented may result in a loss far greater than the combined cost and maintenance of a good signal system.

The Adjustment of Damage Claims

BY MASON B. STARRING,
Chicago City Railway Company

Not many years ago the caption of this paper was a subject which managers regarded in much the same light as that in which the modern horse first looked upon the automobile: It seemed sure enough an invention of the evil one, and dead certain to hurt something or somebody, but with the growth of the street railway and the community it supplies with means of transportation, that cancerous growth, yclept, damage claims, which had already fastened itself upon the steam roads, began to develop in the street railway body corporate, and as it grew so grew the study and care bestowed upon its treatment, and all careful managements have long since commenced to place experts in charge thereof. The successful adjustment of damage claims depends largely upon the personal equation; the personality and mental characteristics of claimant and adjuster are the prime factors in all settlements. No matter how fair a corporation may be, may its adjuster be never so able, yet if the claimant is so constituted as not to know fairness when he meets it, or so determined to bilk the company that no reasonable amount will appeal to his sense of right, then an adjustment must fail and resort be had to law; then, too, the question of locality must be taken into consideration. Some cities are pest ridden with the itch for personal-injury litigation; in Chicago, for instance, there seems to be from five to fifty "drummers" for personal-injury suits to every personal injury, or person willing to claim one, to be drummed; and its taxpayers are even now being asked to add a large number of judges to the already large bench of the county in order to secure the trial of cases within a reasonable period of time after their commencement. What that city needs is not more judges, but an enforcement of the laws against champerty, barratry and maintenance. If I am rightly informed, my own fair city is not by any means the only one suffering from such necessity.

To further the proper adjustment of claims of this class, a proper foundation must be laid at their very inception; preparation for a lawsuit must go hand in hand with preparation for adjustment; the knowledge the claimant has that the adjuster is fully cognizant of all the details, not only of the accident which gave rise to the claim in question, but also of the surgical side of the case, and the etiology of those special ailments which the claimant alleges to have resulted therefrom, goes a long way toward making an unreasonable claimant reasonable. In preparing for the adjustment of a claim of this nature it is always wise to ascertain as much as possible of the antecedent history of the claimant, for, since the growth of the personal injury claimant business into an industry, it is no unusual thing to find one person with a record of several antecedent injury claims, some of them settled amicably and others adjusted at the end of litigation. I have in mind at this writing the case of one woman who, starting in Philadelphia, had, as westward she took her way, accumulated injuries and suits until the one which she prosecuted against the company I have the honor to represent numbered seven upon her list, and it was her lucky number, too. It is very frequently found, especially in the claims of women, that prior to the occurrence of an accident there had existed certain obscure troubles which sooner or later must, by the progress of nature, force themselves upon the notice of their unfortunate possessor and his or her physician or physicians, but which had not aroused in the sufferer, up to the time of the happening of a street railway accident, sufficient attention to cause medical attendance to be secured; but when an accident happens which presages the recovery of damages, every ache and pain is then watched with interest; one might also say with desire, and each and every grunt, whether caused by an actual twinge or by auto-suggestion, is attributed to the "awful" accident and to the wicked conductor who started the car at the supreme moment when an old lady had one foot firmly planted upon the car step and the other deftly poised in the air. Some physicians find it to their interest to humor their patients and having a natural distaste for antagonizing their patients by telling them that the complaints made by the patient and the conditions found by the physician have no reference whatever to the probable consequences of such an accident as that under consideration, leave them firm in the belief that all their troubles are due solely to the violence applied at the time of the alleged accident. This is especially true of pelvic and nervous disturbances of the fair sex; many a woman directs her doctor's attention for the first time to pelvic troubles subsequent to an accident, when her comfort, and possibly her health for a life-time, might have been subserved by consulting him promptly relative thereto when the first manifestations of disturbance made their appearance. Occasionally instances are met with where the courage to undergo voluntary torture for the sake of the few dollars that can be secured out of a claim, attains so abnormal a development as to amount practically to insanity. Of these strange phenomena an extreme example which came under my personal observation is so abnormal as almost to pass beyond belief by any person not confronted with proof. Shortly stated, it was as follows: A woman physician related to a fine family and of independent means, brought suit for damages. The only injury that she was able to show she sustained at the time the accident occurred was a slight sprain of one ankle. She was exceedingly heavy, and in the course of the trial it developed she had both breasts, weighing some 28 lbs., excised, and upon being asked the relation this operation had to the accident to her ankle or why she had it performed, she replied that it was done in order to lessen the burden of weight which her "poor sore ankle" was compelled to sustain. It afterward appeared that at some time antedating the accident she had undergone an operation known as oophorectomy for the purpose of bringing on an artificial menopause, in order that the conditions which nature had imposed upon her sex should not interfere with her attendance upon her duties as a physician. Subsequently to the trial and disposal of the case it was said that, having learned of an operation performed in France for the removal of flesh from the thighs she hied herself to Paris to try this operation.

Science has come mightily to the aid of the adjuster in throwing the tell-tale searchlight of the X-ray machine upon the human anatomy. This marvelous discovery is effecting great and good results in all personal injury departments of those corporations which have had the good fortune to come in contact with, and secure the service of, an expert in its use; many and many are the cases of fraud and imposition which it has exposed, and a great, great many (how many I never have gone into the details to carefully ascertain) of the claims that bones have been broken or fractured in steam or street railway accidents have thereby been shown to be mere frauds, and that no fracture or fractures existed. Previous to the invention of the X-ray instrument it was much more difficult for the adjuster to ascertain the truth in regard to this point. A limb placed in a plaster cast is thereby put beyond the close inspection of a physician, and it is manifestly impossible to compel the removal of the cast for the direct inspection of the wound; this afforded an easy and successful mask for deceit. Now, however, the X-ray reveals, almost at a glance, the real condition of the hidden bone. Could an instrument be invented which would as indisputably and as accurately determine the extent of injuries to nerves and muscles as this machine does to bones, the task of adjusting personal injuries would be greatly lightened and the uncertainty which prevents an always accurate decision would be very largely removed.

Not all the experiences met in the adjustment of personal injury claims are of the depressing order; some, either in or out of court, are relieved with touches of humor which serve to lighten the dreary routine of fighting frauds and imposters. For example: A homeopathic physician of the female persuasion brought suit against a surface road, claiming that a fall received from one of its cars had caused her to suffer so severe a brain and nerve injury that her ability to discharge her professional duties had been seriously impaired. In the course of cross-examination she was asked if she had not fallen down a full flight of stairs in a certain department store. Without hesitation she replied:

"I did, sir, but this fall partially restored me to health. I have had no headaches since." With great suaviter in modo she said to her tormentor: "If you were familiar with the great principle upon which my school of medicine rests you would easily understand why this was a natural result."

Knowing the familiar motto of the homeopathic school, "similia similibus curantur," the company's attorney remarked:

"I believe your motto is——"

And before he could finish his sentence she interrupted him: "Simile similibus, similiter." Bench and bar had hardly smothered their laughter when, in reply to a question concerning the whereabouts of a certain patient of hers, she said: "He has passed beyond my jurisprudence." Certainly the originator of Mrs. Malaprop need not have searched beyond this good lady for a prototype. It may interest you to know that the verdict indicated that the jury thought that the practice of this physician had not been

seriously damaged by the great and severe injuries she claimed to have sustained.

In making investigations leading up to physical disabilities, antedating accidents, with a view to ascertaining whether ailments complained of are a result of traumatism and are properly attributable to that cause or are due to other and pre-existing causes, much delicacy should be displayed so as not to annoy unnecessarily either the claimant or his or her friends or family—and in the trial of damage suits, however solid an array of testimony it may be possible to present reflecting upon the character of a man or a woman, a party to a contention of this kind, it must always be borne in mind that the natural chivalry of our race is prone to resent what may seem to the auditors of such testimony an unnecessary, or to some, mayhap, a malicious attack upon some person for or because of the presentation by that person of a damage claim. The arousing of such prejudices should be avoided, as, in most cases should the introduction of evidence as to intoxication, because, while it is true most of American mankind take a drink occasionally, few like to be charged with taking so much as to cause the enemy in the stomach to take away the wisdom in the head.

I think we will all arrive at the deduction that there is no department in the entire management of street or steam railway properties into which the personal equation more strongly enters, and that personality of the right stamp in the head of that department charged with the adjustment of claims, whatever his title may be—even when dubbed "claim agent," that title now so thoroughly despised more by reason of its adoption by that vast body of ghouls sometimes called "ambulance chasers," which preys alike upon the injured and the railways, than for any other cause—is the most essential requisite to the proper handling of this unfortunate part of our street railway machinery. My first precept, therefore, is "seek the man." Get a combination of absolute honesty and industry, with a moderate supply of brains, and you have a good man; let any one of this trinity be absent and the settlements he makes will be mostly unsatisfactory, if he succeeds in making any at all. If the claimant possesses these same sterling attributes the result will be an adjustment satisfactory to both parties, for in that event there must of necessity be merit to both sides of the case or no claim would be made, and no adjustment sought. If all claims were just and all claimants fair, the matter of adjustment would be simple, but as a rule comparatively few claims are just and fewer yet of the claimants are fair, so that the faculties and perceptions of whoever represents the company's interests must be ever alert not to be duped by dissimulation, exaggeration and guile, and to discover actual and intentional fraud whenever and wherever it exists. Some claimants possess honesty, but not enough to leaven the lump; many possess industry to some degree, and all possess a certain species of brain; most of them possess what might be justly termed a low order of cunning; the doctrine of our homeopathic friend, that like cures like must not be applied to an adjustment.

Precept number two is "get facts." Facts are what win! He who can incontrovertibly and openly place facts before a malingerer puts him at a disadvantage from which he can never recover. Facts, too, are the enemies of some physicians. Look out for the doctor who puts the plaster cast upon the unbroken limb. He is a stumbling-block in the path, but employ to meet him not one who has a beam to pluck from his own eye. Rarely should the attending physician, if honorable and a fair practitioner, be ousted from the care of his patient. Be the recovery of the patient never so good, if the company furnishes the surgeon who attends the injured person, by some perversion of mental vision it is claimed alike by patient, relatives and friends that he is, and has been, sent to the bedside of the patient to injure him in some occult way, and by so doing affect detriment to his interests and protection to those of the street railway company, sight being lost of the fact that the complete and early convalescence and recovery of health of the patient is best for all.

A little book lying on my desk as I write says very appropriately of this theme: "Pettifoggers in law and empirics in medicine, whether their patients lose or save their property or their lives, take care to be, in either case, equally remunerated; they seize both horns of the dilemma and press defeat, no less than success, into their service. They hold from time immemorial the fee simple of a vast estate, subject to no alienation, diminution, revolution or tax; the folly and ignorance of mankind. Over this extensive domain they have long had, by undisputed usage, the sole management and control, inasmuch as the real owners must strenuously and sturdily disclaim all right, title and proprietorship therein."

Meet fairness with fairness; fraud with firmness. "Fighting fire with fire," avoid as you would his satanic majesty himself. Fire cannot be handled without burns, and burns are at least painful. Avoid a reputation for settling everything; it hurts stockholders' pockets; equally avoid a reputation for fighting, but when you do fight, win. Settle all the grave cases that presage loss; litigate all those that possess little or no merit. It is a juster as well as a wiser policy—for once, at least, justice and expediency run hand in hand.

Very often I am asked to furnish copies of the form of release which is used in concluding an adjustment, and willingly comply, but one form of release is about as much like another as peas in the same pod, and in the event that a settlement is contested in court by an ignorant person, and especially by one having no knowledge of the English language, the more technical in its terms and the more involved in its legal phraseology a release is, the more apt a jury is to say that the person who signed it was totally ignorant of its contents and that the execution of the document was obtained by fraud.

Some time ago the writer had occasion to cause a release to be obtained from a German girl who had stepped from a moving car as it was coming to a stop for her to alight, while the car still had sufficient motion to disturb her equilibrium. The girl lost her leg, and an adjustment was made very shortly after the accident, while she was still in the hospital, and was not made because of any liability, but merely to avoid litigation. After she got out and around she was very easily persuaded by somebody—we can all suspect whom—that she had been imposed upon, and the foolish woman went upon the witness stand and testified, under her solemn oath not only to a state of facts which created a liability on the part of the defendant company, but also that she did not know the contents of the paper she had signed; that she could not read English, and that even if the paper had been translated to her in German (which, by the way, it was, although she denied the fact), she would have been unable to comprehend it and understand what it meant, but unfortunately for her and her attorneys, who had a large fee contingent upon the result of her story, she had written in the German language in her own handwriting, over her own signature, on a portion of the hospital record which hung by her bedside, "I got $100 from the railroad company, and I know I can get no more for my leg." Certainly not a very artificially drawn legal document, but without it there is no doubt but what the very perfect release which was properly and understandingly executed by her would have been set aside. It is, therefore, fair to draw the conclusion that in settling with ignorant people it is wise to have them express in their own way their understanding of the purport and effect of documents which they sign, and I have always cautioned adjusters to be particularly careful in this respect—never to make any misrepresentations; never to allow a person who has been drinking to sign a release, and wherever it seems wise to the adjuster, owing to the circumstances surrounding the settlement, to obtain from the claimant in claimant's own handwriting such a statement as that referred to above; and, in the event that claimant signs by mark, to obtain disinterested and reliable witnesses to the mark. Perhaps this little suggestion may seem to many discursive and entirely unnecessary, but to others it may exemplify, as it did to me, the need of the utmost care and precaution in concluding matters of this kind, for, generally speaking, the public maintains a double standard of morals—one for dealing with corporations, another for transactions with individuals. The man who holds himself bound to govern his relations with a corporation by the same rule of morals and ethics which regulates his relation with the natural instead of the artificial citizen, is fast becoming as extinct as the dodo. Almost the universal attitude is that a corporation is not entitled to receive that strict application of the law of good morals and common honesty which is shown to individuals acting in private capacities. Put into common parlance, the public code in dealing with a corporation seems to be that "a man is entitled to all he can get out of a corporation."

The atmosphere of such a feeling is typical of a very large share of the cases which come for adjustment before the metropolitan law or claim department. There is no escaping from the conclusion, enforced by careful observation, that men who could not be induced to deal dishonorably with private individuals, acting as such, do not scruple to make false representations as to the nature and value of any old claim against a corporation. This practice is so common that it may be classed as almost universal. And the men, or a decided majority of them, who justify and indulge in this kind of "sharp practice" in dealing with a railroad corporation, might safely be trusted with a private loan, unsecured and amounting to more than the sum involved in their suits for damages.

Previous to a very few years ago the steam and street railway companies of every kind and the "common carriers" of various descriptions have been the main sufferers from this deplorable attitude of the public conscience which decrees one moral standard for dealings with the private individual and another and a

much lower one for transactions with a corporation. Now the application of this double standard is being made to many other kinds of corporations. The municipality is the worst sufferer of all; but the manufacturer, even the smaller and the private industrial concern, is being brought under the application of this sentiment and practice.

Possibly, of all the varied classes of claims with which the adjuster of damage claims meets, the most dreaded and difficult for him to handle are those which bring to bear the subtle influence of "pull." Not infrequently a conscientious adjuster finds that this influence has reached "above his head," and that the discharge of his duty brings him into opposition with others more easily influenced and of higher rank on the company's roster. Quite generally claims pressed with this kind of backing are either fraudulent or extortionate. Of course, there are exceptions to this rule, but the very fact that the claimant feels called upon to exert a personal or social or political pressure, or add to his claim the weight of some powerful financial interest in the institution in question, is a strong presumption that the claim for which this influence is solicited is too weak to stand upon its own merits. In this connection it might be stated that corporate officers, and particularly those engaged in passenger transportation, are not unmindful of the public attitude of sensitiveness and quasi-hostility toward them, and are, therefore, willing to make a just and liberal settlement without any undue influence exerted upon them, and for that reason adjust rather than contest even doubtfully meritorious claims. But, to go back a little ways, let us always consider an adjuster's trials and tribulations, and not make his pathway too hard, for if he learns that claims which he declines are subsequently increased by reason of the so-called "pull" he soon gets to thinking that if somebody is to be a "good fellow," why should not he be that somebody? And if his superior officers are so willing to give away the company's money to please their friends or to make friends for other departments of the company's service, why is it not perfectly proper for him to do those self-same things? Thus the company soon finds itself with a vastly increasing damage account. It is a good rule for any company to adopt to reverse rarely, if ever, a decision of its adjuster. If upon consultation with an adjuster it would seem that on the merits of the case in question some action different from that already taken by him should be had, let the adjuster attend to that in his own way; do not have him feel disgruntled and overridden. There is no excuse for inflicting personal humiliation upon a man who possesses your confidence, who has your money in his pocket and your best interests at heart. Many and many a good man has been spoiled, I fear, by the unfortunate proclivity on the part of his managers to yield to the so-called "pull." If a company has any friends to make or debts to pay, let them be paid through some other department and in some other manner. Debts paid in this manner are never considered liquidated, and a person who has obtained something for nothing for someone by reason of his influence, nevertheless, thereafter boasts of the amount he has saved the company and the obligation under which it has been placed to him by his getting this or that case settled for them. This brings to my mind the subject of "go-betweens." There is in every community a class of people which seeks its livelihood by preying upon both sides of personal-injury claims. It seeks the individual and impresses upon him how much can be obtained through the go-between, and how little without such influence, embellishing the yarn with wonderful stories concerning that influence, often to the detriment of honest officers, trying to make the claimant believe he has some hold upon them and that they are corrupt, and trying to persuade the claimant to see that the sun of success rises and sets in the great and only negotiator and his Svengali-like "inflooence." And should this creature be treated with any consideration he swells himself larger and larger, and as he himself swells, so swells he the head of the claimant, and at last, if he succeeds in bringing the opposing parties together, his grandiloquent attitude dwindles to the proposition tritely expressed in the words: "How much is there in it for me?" while he assumes all the time the attitude that without his invaluable services claimant and claimee, if I may coin the word, never could have come together or have reasonably disposed of their differences. There is one claim department of which I know into which such an individual is not allowed to enter. Some things in the human race are more despicable than this creature, but he is sufficiently low in the scale to make it unwise, unsafe and, to every fair-minded person, disgusting, to have any dealings with him. Perhaps it is not fair to our sex to use the pronoun he so often in this connection—many and many such a creature masquerades in petticoats. Much success depends upon the care and discrimination shown in selecting cases for trial, and while this paper should mayhap deal only with the "adjustment of damage claims," a word or two upon the corollary thereof, the litigation of damage claims, may not fall amiss. To illustrate, given a company which employs and enjoys the reputation of employing only the ablest counsel obtainable and prosecuting its every defense vigorously and uprightly, and which wins a great majority of the cases which it tries, 90 per cent of the bar will seek settlements in terms not unfavorable to that company rather than meet it in court. Right here let me say another word about trials and their results. Never compromise the verdicts when results are unfavorable. If they ripen into judgments, make the best you can of them after they have been affirmed by a court of last resort, not before. The fact soon becomes known as to who will and who will not compromise for 50 per cent, or some other per cent, of the amount of a verdict, after one is rendered, and that company or person having such contingencies to contemplate, and compromising upon verdicts in the manner heretofore suggested, will soon be confronted with the necessity of trying each and every case brought against it. The results are so much more satisfactory to the practitioner, who gets 50 per cent of the amount recovered by suit and only 33 1-3 per cent or less, in the event of settlement. Then, too, think of the disappointment this same gentleman feels when he cannot add mention of such compromises to his scrapbook of newspaper clippings reciting his recovery of a $10,000 verdict against this company and a $25,000 verdict against that one, which volume he so proudly displays when luring to employ him some unsophisticated, but possibly injured, person whose clientage he seeks, but who never saw or heard of him before his call. The sadness is appalling; weep with me, my hearers! Never, as the expression goes, settle "behind the back" of a reputable lawyer. If in rare instances circumstances compel such action, see that he receives a reasonable fee. On the other hand, never settle with the "ambulance chaser;" it is far better to pay the client of such an one $100 than to pay him $10. Try it and see.

In writing concerning the adjustment of damage claims, I have confined myself to those arising from injuries to persons and omitted referring to those relating to damage to personal property, realty, etc. I have also intentionally refrained from going into the details of the different means of procedure advisable to be followed from the moment an accident happens down to the time at which any claim or claims arising therefrom are finally laid at rest. Every company, I take it, whose claims are sufficiently numerous and whose damages are sufficiently large to invite any special attention thereto has adopted careful, and one may say, almost scientific, methods of caring for the injured person or persons, preventing fraud and starting immediately upon the happening of any occurrence which might give rise to a claim —the rolling of that ball of investigation which as it moves along grows and grows until it assumes and becomes a perfect and symmetrical globe of defense.

The temptation to overstep the bounds of time and space allotted for this disquisition is so strong that it now becomes me to say, with the old dominie, lest, like him, I might fail to hold the interest of my auditors, "I can make this paper longer, but I won't." To which comes surging back on the tide of courteously restrained impatience a reply requiring no straining of the ear to hear: "We don't want it any longer; its present length suits us very well."

Discipline of Employees by the Merit System

BY W. A. SATTERLEE,

General Superintendent Metropolitan St. Ry. Co., Kansas City, Mo.

The merit system of discipline, as applied by managers of steam railways throughout the country, has recently been brought to the attention of street railway managers, through able articles in the STREET RAILWAY JOURNAL and Review, in such a way that the system is now receiving much attention. It has been adopted by a number of roads, and their experience with it has been such that it is surely worthy of deep thought and attention on the part of all street railway officials. It seems to fill a long-felt want in street railway discipline, and, in importance, is second to none of the recent improvements and betterments constantly being adopted and in successful operation.

I know of no single change made in the old methods of operation, unless it be the adoption of the Standard System of Street Railway Accounting, that should receive a more hearty support from all. Certainly no system has been adopted that is fairer to the trainmen, or is more likely to produce in them a desire to keep their record clean, and as many demerits marks from appearing against them as possible.

There are many trivial acts, small in themselves, committed by trainmen in handling passengers, that as a whole tend to produce a feeling on the part of the traveling public either favorable or un-

favorable to the company, which once formed is hard to offset. Small acts of courtesy toward passengers by trainmen are felt by the management in ways unknown to the men who perform these acts, and are as far-reaching for the good of the company as small acts of discourtesy are damaging.

To teach employees to be guarded in their talk, their acts, and their deportment on duty toward those with whom they come in contact, is a problem nearer solved in the merit system than in any other way.

The value of courteous, accommodating and careful trainmen to any street railway system is of such importance, and so eagerly sought for, that any method of discipline which will accomplish that end will be of so great worth as to make management of street railway property a pleasure instead of care and worry that breaks down the health of any but robust men.

As a rule, men who seek employment in the train service of street railway lines are inexperienced in the art of handling the public in the way an exacting public expect, and acquire the tact only by continuous contact and experience, after training under some system of discipline worked out by those who, for years, have watched the needs and exactions of a people who expect the same attention from an inexperienced street car conductor, who may have been in the service only a few weeks, that they get from a steam railway conductor who has been under a system of training with his company for from eight to ten years before he has acquired the position where he comes in contact with the traveler.

To give the street railway public the service which they expect, and which they exact, is the aim and desire of all managers, but is a well-nigh impossible thing to do. To come as near the goal as human ingenuity can, may be done through the different experiences and methods used by well-managed roads, and by discussions and friendly criticisms brought about through the several papers written by different parties for this convention, and it would appear to me that the subject assigned to my company is one that should call forth from all representatives present a most interesting and instructive debate.

In brief, the system consists of a debit and credit account with each trainman, kept in a book ruled for that purpose, or in alphabetical files, his violation of rules being charged against him by a certain number of demerit marks, the number for any one offense depending upon the seriousness of same. As an offset against these demerit marks, he is entitled to receive a certain number of merit marks for acts performed which would be considered by the company worthy and deserving of recognition.

If at any time within one year the demerit marks exceed the merit marks by a certain number fixed upon by the company, then the party receiving them is liable to discharge.

The detail of the working of the system as practiced by the company with which I am connected, but which can be varied to suit the ideas of different operators, is as follows:

A list of violation of rules with the number of demerits imposed for each is posted in frames at each reporting place, that trainmen may know in advance the penalty, and also a list of acts considered worthy of merit with number of merits given for each.

A blank notice, made in carbon copy, which is filed in office, reading as follows, is sent to each trainman, with his name filled in blank space, whenever he gets demerits or merits:

METROPOLITAN STREET RAILWAY COMPANY.
Kansas City, Mo..............190....

DEMERIT MARKS.

Mr....................................

....

You have to-day been given......DEMERIT MARKS on charge No........contained in the merit system of discipline.
Date................
Time................
Place...............

....
Assistant Superintendent.

METROPOLITAN STREET RAILWAY COMPANY.
Kansas City, Mo..............190....

MERIT MARKS.

Mr...............................

....

You have this day been given..........merit marks on No...... contained in merit system of discipline.
Time................
Date................
Place...............

....
Assistant Superintendent.

Another notice, without trainman's name, is posted on board at reporting place, as notice to all other men that a conductor or motorman has been disciplined, with the charge, and number of demerit or merit marks he has received.

METROPOLITAN STREET RAILWAY COMPANY.
Kansas City, Mo..............190....

A..................on..................line has this day been given............marks on charge No..........in merit system of discipline.

....
Assistant Superintendent.

Whenever a man's demerits exceed his merits by 100 he is liable to discharge.

The old system of lay-offs and fines has been done away with and the service much improved in the short time the new system has been in vogue, since June 1, 1902.

Merit No. 10 for conductors (No. 9 for motormen) is broad enough to cover many things coming under the observation of inspectors, that show good judgment and interest in handling the public, and in such cases a liberal giving of merit marks will be appreciated by trainmen, and will redound to the profit of the company. A little praise given any employee by an employer is worth more and is more productive of good work tenfold than any reprimand. We all, no matter what position we hold, are pleased with notice taken of our work by those who are our immediate superiors, and a word of praise coming from a superintendent or manager to any employee working under the merit system will certainly not be lost.

The trainman who takes off his coat and gets to work first in a lay-out caused by a broken-down car or a wire down, etc., marks himself right then and there as a man the company needs, and he should get merit marks. If he takes an interest in clearing up such trouble, it is safe to say he will take the same interest in other matters. Too many men wait for some other man to take the lead and in that way much valuable time is lost in blockades, when there is no incentive or reward to spur them on. Those with demerit marks wait for an opportunity to reduce the number by getting enough merits to offset their demerits, and come to the front in case of trouble, showing by their desire to render assistance an interest in company matters not shown before. Whenever men can be taught to take the same interest in their employer's business they would in their own business, then that employer will get the most perfect service possible, and when the employer succeeds in getting a system of discipline that will bring about that result, then he has what has long been sought for, and until some system has been discovered better than the merit system, the latter should receive the hearty support and assistance of all managers of street railway property. Good train service is the vital cord in operation, and trainmen make it good or bad according to their training.

METROPOLITAN STREET RAILWAY COMPANY.
MOTORMEN AND GRIPMEN—DEMERITS.

Immediate Discharge.

		Demerits.
1.	Disloyalty to company.	
2.	False statements.	
3.	Intoxication.	
4.	Dishonesty.	
5.	Gross ungentlemanly conduct.	
6.	Failing to report accidents	10 to 100
7.	Missing—	
	First time	10
	Second time in one month	20
	Third time in one month	30
8.	Smoking on duty	30
9.	Failure to make safety stop at crossings where required	30
10.	Incomplete and poor accident reports	1 to 5
11.	Untidy condition of dress	2
12.	Recommending unworthy men for employment	5
13.	Neglecting to pick up passengers	10
14.	Running over circuit breakers and overhead crossings without throwing off current	
15.	Allowing unauthorized persons in front vestibule	5
16.	Fast running	5
17.	Front headlight not burning	8
18.	Entering saloons in uniform without good excuse	10
19.	Frequenting saloons at any time	50
20.	Gambling	50
21.	Drinking on duty or before going on duty	20
22.	Disobedience of orders (if flagrant—discharge)	10
23.	Profanity on duty	5
24.	Accidents when avoidable in opinion of superintendent	10 to 100

25.	Unnecessary conversation with passengers	10
26.	Talking to conductors on duty	5
27.	Failing to report trouble with car	5
28.	Not answering signals promptly	1
29.	Feeding current too fast	3
30.	Running away from passengers at transfer points	10
31.	Not ringing bell in passing car	2
32.	Running ahead of schedule time	3
33.	Not slowing up in passing cars	5
34.	Skinning the cable	25
35.	Starting car without proper signal, except to avoid collision	20
36.	Following car in front too close	10
37.	Starting electric car before closing gates	10
38.	Opening electric gates before car stops	10
39.	Running too close to wagons upon track before getting car completely under control	10
40.	Bad judgment on special occasions	1 to 10
41.	Leaving car without taking reverse lever	10
42.	Flattening wheels	10 to 20
43.	Injury to car equipment that could be avoided by proper care and judgment	10 to 20
44.	Not stopping for passengers to get on (if at proper place)	10
45.	Not obeying conductor's signal	5
46.	Running crossings without proper flagman's signal where required	20
47.	Cutting rope	25 to 50
48.	Trouble with passengers when gripman or motorman is to blame	10
49.	Garnishee—	
	First time	10
	Second time	10 to 50
	Third time	50 to 100
50.	Assignment of wages or security deposit	25
51.	Talking to others than proper officers of company about accidents	20
52.	Careless and indifferent operating of car	3 to 10
53.	Criticising management of road in presence of passengers	3
54.	Failing to report delays	2
55.	Not having proper tools	3
56.	Plugging car except to avoid accidents	5
57.	Running without sand in sand box	3
58.	Acts detrimental to good service in opinion of superintendent	3 to 20
59.	Incompetency	25 to 100
60.	Holding train with cable	10

MOTORMAN AND GRIPMEN—MERITS.

1.	Warning persons in act of jumping on or off moving car to wait for car to come to stop	2
2.	Securing names and addresses of witnesses who saw accident, other than those on accident report	2 to 5
3.	Politeness and attention to passengers noticed by inspectors	3
4.	Assistance rendered in case of accident, such as to bring commendation from passengers	3
5.	Informing company of matters in the interest of good service, etc.	3 to 10
6.	Complete and perfect accident reports	2
7.	Good stop in avoiding accident	5
8.	Good judgment and work in handling lay-out or blockade	2 to 5
9.	Special meritorious act calling for recognition from company	10 to 50
10.	Careful handling of car	5

CONDUCTORS—DEMERITS.

Immediate Discharge.

1. Disloyalty to company.
2. False statements.
3. Intoxication.
4. Dishonesty.

		Demerits.
5.	Gross ungentlemanly conduct.	
6.	Failing to report accidents	10 to 100
7.	Giving bells too quick	5
8.	Smoking on duty	30
9.	Error on trip sheets	1 to 5
10.	Shortage }	
11.	Overage (except when pay check is turned in) } Over six in one month, each	2 to 5
12.	Missing fares	3 to 10
13.	Failing to ring fares	5 to 20
14.	Failing to properly flag crossings when required	10
15.	Incomplete and poor accident reports	1 to 5
16.	Inattention to passengers	2
17.	Trouble with passengers when conductor is to blame	10
18.	Missing—	
	First time	10
	Second time in one month	20
	Third time in one month	30
19.	Dirty car	5
20.	Untidy condition of dress	2
21.	Recommending unworthy men for employment	5
22.	Back headlight burning except in case of fog	1
23.	Reading on duty	10
24.	Sitting down in car on duty (when running)	5
25.	Talking to motorman or gripman on duty	5
26.	Letting boys change trolley	5
27.	Entering saloon in uniform without good excuse	10
28.	Frequenting saloons at any time	50
29.	Unnecessary conversation with passengers	10
30.	Accident when avoidable in opinion of superintendent	10 to 100
31.	Failure to announce streets	1 to 5
32.	Profanity on duty	5
33.	Disobedience to orders (if flagrant—discharge)	10
34.	Error in punching transfers	2
35.	Deliberate punching of transfers to permit passengers to lay over	20
36.	Gambling	50
37.	Drinking on duty or before going on duty	20
38.	Running away from passengers at transfer points	10
39.	Bad judgment on special occasions	1 to 10
40.	Bad judgment or carelessness in regulating heat on cars	2
41.	Criticising management of road in presence of passengers	3
42.	Neglecting to get transfers enough at barn to avoid borrowing	2
43.	Talking about accidents to others than proper officers of company	20
44.	Register not turned at end of line	10
45.	Not in proper place on car	3
46.	Careless and indifferent operating of car	3 to 10
47.	Giving bells when not in proper place	5
48.	Impolite remarks to passengers	5 to 25
49.	Garnishee—	
	First time	10
	Second time	10 to 50
	Third time	50 to 100
50.	Assignment of wages or security deposit	25
51.	Failing to report register when out of order	3
52.	Not going ahead and trying to locate cut rope or broken trolley when same is cut or down	5
53.	Failing to report delays	2
54.	Acts detrimental to good service in opinion of superintendent	3 to 20
55.	Incompetency	25 to 100
56.	Bunching fares	5
57.	Carrying people free	5 to 10

CONDUCTORS—MERITS.

		Merits.
1.	Warning persons in act of jumping on or off moving car to wait for car to stop	2
2.	Securing names and addresses of witnesses who saw accident, other than those on accident report	2 to 5
3.	Politeness and attention to passengers noticed by inspectors	3
4.	Assistance rendered in case of accident such as to bring commendation from passenger	3
5.	Adjustment of shades and windows to please passengers	1
6.	Informing company of matters in the interest of good service, etc.	3 to 10
7.	Reports as to defects in equipment while operating car	1
8.	Complete and perfect accident reports	2
9.	Good judgment and work in handling lay-out or blockade	2 to 5
10.	Special meritorious act calling for recognition from company	10 to 50
11.	Turning in passes or badges ordered up by company	5

Report of Committee on Standard Rules for the Government of Employees

The committee on Standard Rules for the Government of Employees, comprising J. C. Brackenridge, E. C. Foster, T. E. Mitten and W. E. Harrington, submitted the following form of rules as its report:

RULES FOR THE GOVERNMENT AND INFORMATION OF CAR SERVICE DEPARTMENT EMPLOYEES OF THE .... RAILROAD COMPANY.

In effect 12.01 a. m., ...

(Modeled on the standard code of the American Street Railway Association.)

GENERAL NOTICE

The rules herein set forth apply to and govern on all lines operated by the .... Railroad Company.

They shall take effect ...., and shall supersede all prior rules and instructions in whatsoever form issued which are inconsistent therewith.

In addition to these rules, special instructions will be issued from time to time, as may be found necessary, and such instructions posted on the various bulletin boards, whether in conflict with these rules or not, which are given by proper authority, shall be fully observed while in force. Bulletin boards are located at the following points and must be consulted daily by each employee of the transportation department:

....	....
....	....
....	....

Every employee whose duty is in any way prescribed by these rules must always have a copy of them at hand while on duty and must be familiar with every rule.

The head of each department will supply copies of these books to his subordinates, see that they are thoroughly understood, enforce obedience to the rules and report all violations to the proper officer.

All employees are required to be polite and considerate in their dealings or intercourse with the public; the reputation and prosperity of the company depend upon the promptness with which its business is conducted and the manner in which its patrons are treated by its employees.

All employees will be regarded in line for promotion, advancement depending upon the faithful discharge of duty and capacity for increased responsibility.

While for the effective management of a large system the observance of stringent rules and the maintenance of strict discipline are necessary, that enforcement must be impartial as between emplyees.

Employees may be charged with and required to pay for any damage done to the property of this company for which they are responsible, or for any loss or expense incurred by the company by reason of carelessness, neglect or disobedience of these rules.

Employees must refrain from the use of profane or indecent language and from improper or ungentlemanly conduct; politeness and courtesy must be observed in their dealings with one another as well as with every one with whom they come in contact in the performance of their duties.

In the absence of the proper officials to whom they may apply for advice, assistance or authority all employees are expected to use good judgment and discretion in dealing with matters not covered in these rules.

....
Chief Executive Officer.

GENERAL RULES

1. The safety of passengers is of the first importance; all work must be entirely subordinated to safety, first, and then to the regularity and punctuality of the service and the comfort and convenience of the passengers. Line repair men, emergency crews and track men will be required to subordinate their work in accordance with this rule to the requirements of the operation of the road.

2. Employees of any grade will be considered as accepting or continuing in employment subject to the dangers incident to this hazardous occupation.

(a) The fact that any person enters or remains in the service of the company will be considered as an assurance of his willingness to obey its rules. No one will be excused for a violation of them even though such rules are not included in those applicable to his department.

(b) Employees of this company will not be identified with or engage in any other business except with the specific permission of the head of the department in which employed.

(c) Employees shall not make assignments of pay; such assignments will not be recognized or honored by the company.

3. If in doubt as to the meaning of any rule or special instructions, application must at once be made to the proper authority for an explanation; ignorance is no excuse for neglect or omission of duty.

4. If an employee become incapacitated from sickness or any other cause, the right to claim compensation will not be recognized; an allowance, if made, will be a gratuity justified by the circumstances of the case and the previous good conduct of the employee.

5. When an employee is discharged from the company's service, he will not be re-employed without the consent of the head of the department from which he was discharged.

6. Employees, when leaving the service of the company, must sign receipt for their final pay and return to the company all of its property with which they have been entrusted; in default of such return they will be charged in final settlement for all such articles short.

7. No employee will be allowed to absent himself from duty without special permission from the proper officer, nor will any employee be allowed to engage a substitute to perform his duties while he is absent.

8. The use of intoxicating drink on the road or about the premises of the company is strictly forbidden; no one will be employed or continued in employment who is known to be in the habit of using intoxicating liquor; smoking by an employee while on duty is forbidden.

9. In the event of any of the company's apparatus, breakage of the overhead line, charging a pole in the public street, unsafe settlement of building or structures, etc., whereby imminent danger of personal injury is caused, the first employee discovering the fact must arrange to protect the danger point, advising the proper authorities by the first available means of the character and location of the trouble; he must not relinquish such responsibility until properly relieved.

10. All medical examinations in behalf of this company of injured persons will be conducted by the regularly appointed medical examiner. Medical attendance to injured persons, whether employees or other persons, will not be supplied by this company except in unusual emergencies.

(a) Whenever, in emergency, any authorized official deems it advisable to call an outside physician such official must immediately notify the claim department, giving the name of the physician called and the reason therefor.

(b) In ordinary cases of personal injury, if proper attention to the injuries cannot be given by an employee using the "emergency cases" provided for rendering first aid to the injured an ambulance call is usually sufficient, accompanied by prompt notice to the claim department.

(c) In case of an accident wherein the question may be raised as to the condition of the car, either motor or trailer, such car must be "run in" at once to either the home or nearest depot, passengers thereon transferred and the car immediately and thoroughly inspected by the shop foreman who will promptly make special report thereon to the superintendent.

11. Information concerning the affairs of this company must not be given to any one except its authorized representatives, who, if unknown, shall in all cases show proper credentials before information is given.

12. Each employee of the transportation service must have a reliable watch, maximum variation allowed —— seconds daily, which shall be kept in good and accurate condition and compared daily with the standard time of the road.

13. The collection or solicitation of money by employees of this company from other employees or any other persons in the nature of fees, gifts, etc., is forbidden.

(a) The solicitation of advertisements or contributions for entertainments or similar purposes by or on behalf of any employee or employees of this company is also prohibited.

14. Intoxicated, disorderly or otherwise obnoxious persons are not allowed on the cars operated by this company; conductors are authorized to refuse to carry any such person.

15. Large, bulky packages will not be carried in the passenger cars of this company—passengers will be accepted with only such bundle or packages as can conveniently be carried on the lap or satchel or valise of reasonable size. Freight will be carried only under the conditions of the tariff as bulletined.

16. Under no circumstances shall any article be hung on any brake handle of any car nor shall any obstruction be so placed or allowed to remain as to hinder access to and use of any brake.

17. Dogs or small animals will be transported in the passenger cars of this company only under the conditions bulletined.

INSPECTORS

18. Inspectors report to and receive instructions from their superintendent, daily, before they are due to go on duty.

19. They will be expected to set an example to the other uniformed employees in the neatness of their attire, the excellence of their deportment and their loyalty and devotion to the company's interests.

(a) Each inspector will be supplied with the following equipment:

One pair rubber-handled pliers.
One pair rubber gloves.
Small roll adhesive insulating tape.
Ten feet insulated wire.
Supply of fuses—where used.
Light switch plugs.

20. Inspectors must be thoroughly conversant with all rules and instructions issued, render all assistance in their power in carrying them out and report all violations to their superior officer.

(a) They will be responsible for all time tables, running times and time points; they will see that cars are operated on schedule time and properly spaced; when blockades occur the movement of cars will be under their direction.

(b) They will also satisfy themselves that all new men under instruction within their territory by regular motormen or conductors are properly instructed.

21. Inspectors will arrange for any extra service needed and withdraw unnecessary service on their lines in accordance with the requirements of the traffic, keeping their superintendent advised thereof; at all times their effort will be to improve the service.

(a) They will facilitate the movement of cars or trains carrying mail and give special attention to chartered cars.

22. Inspectors must be familiar with the different types of motors and controllers and be able to remedy slight defects occurring on the road.

23. Inspectors have authority to relieve conductors and motormen on duty while on the road on account of sickness or any other cause that would prevent them from properly doing their duty.

(a) They must remain on that part of the line or division assigned to them unless it is absolutely necessary to take a car in charge.

(b) They will see that line repair and track men and emergency crews while at work do not unnecessarily interfere with the regular operation of the road.

(c) When a fire occurs to interfere with the operation of the cars they must notify terminal depots of the lines affected, order out the emergency crews of that district and see that hose jumpers or other appliances are procured as promptly as possible.

(d) During the winter season they will see that heaters in cars are regulated in accordance with outstanding instructions; electric heaters must be turned off to one notch in case the power runs low; if necessary they will be cut out altogether.

24. Inspectors will note in detail the condition of the cars, whether properly cleaned, heated, ventilated, lighted and equipped, and that all signs are properly displayed.

(a) When a car becomes disabled so that it cannot be repaired on the road they will have the following car push it to the first turnout and transfer the passengers to the next car of the same line: after the delayed cars shall have passed, such car will be hauled to the nearest depot. When a car is being pushed a drawbar must be used to connect the two, movement must be slow, proper care exercised and the reversing switch set on the disabled car in the direction in which the car is moving.

(b) They will carefully check the load with the register on every car they board; in case of discrepancy they will take up immediately with the conductor, reporting the occurrence to the superintendent.

(c) When transferring passengers from one car to another (Sec. A) they will require the conductor to whom transferred to ring up the number in their presence and will then note on that conductor's day card the number transferred, with statement of cause, signing the memorandum.

(d) They will be familiar with the transfer points of all lines and be able intelligently to direct the traveling public.

25. Inspectors will promptly report all defects in track or overhead work to the proper officer at once and take necessary precautions to avoid accidents.

(a) In case of break in the overhead line or serious derailment of cars they will at once notify the nearest emergency station, stating cause and location of trouble, which must be promptly repaired; for this purpose the nearest telephone will be used—if charge therefore be made the superintendent will refund the amount.

(b) Should the armature, terminal wires, brush-holders, brush or any part of a motor break that motor must be cut out.

(c) They must see that the track is properly sanded when necessary, especially on grades, approaching junction points, terminals and crossings; they must see that switches and guard rails on curves are kept clean and properly lubricated.

(d) If any buildings are to be moved across the track or any excavation under or alongside the track, the fact must be reported to their superior officer at once.

(e) In the event of a snow storm they will report to their superintendent promptly for duty and assignment as required.

(f) They will render every assistance possible upon arrival at the scene of an accident, secure the names and addresses of as many witness as may be possible and make written report to the claim department, giving in detail all the information obtainable. Their aim will, however, be to so thoroughly train car crews that no accident occurring could have been avoided.

20. They must arrange to be notified in case of fire, blockade or severe storms, and must at once take charge of the operation of the line or lines until properly relieved.

(a) In case of snow storms they must arrange for snow plows and sweepers to be run and the lines kept open. They must arrange to sand and salt the rail when necessary, giving special attention to grades, junction points and railway crossings.

RECEIVERS OF THE COMPANY'S MONEY.

27. Receivers will report to and receive their instructions from the superintendent; they will comply with instructions from the accounting or treasury department.

DEPOT MASTERS

28. Depot masters report to and receive their instructions from the superintendent or the inspector.

29. The depot master will have charge of the depot, barn or terminal and the company's property at which they are located, and will see that all worn-out, broken or defective articles are returned for new; they will have charge of all persons employed thereat, unless otherwise instructed, and will see that every employee reads the bulletin board at least once daily.

30. They must attend to the proper arrangement of cars, see that they leave promptly on time and that all cars are properly cleaned, heated, lighted, inspected and equipped.

31. They must see that all employees reporting at that depot, terminal, line or division are prompt and efficient in the discharge of the various duties.

32. They must see that conductors and motormen are ready for duty at the time required and are provided with all the appliances necessary for the safety and proper management of the cars.

33. They must preserve order about the depots, preventing confusion, delays, lounging, drinking of liquor, gambling, etc., eating in cars is permitted only at those termini having no other facilities.

34. They must not allow conductors and motormen to go on duty unless they present a neat and cleanly appearance, are properly uniformed and are physically fit for duty.

35. They must require all articles found in the cars or on the company's property to be promptly delivered to the designated office or person, all such articles to be plainly marked with the name of the finder, time and date when found, together with place or car in which found; persons inquiring for lost property will be directed to the lost property clerk.

36. No transfer of cars or property shall be made from the depot without an order from proper authorities, and they must immediately notify their superintendent of the transfer desired or made.

37. They must see that all the blank forms and reports used in the transaction of the company's business are properly filled out and forwarded—especially accident reports, which must be given utmost despatch.

38. They must see that conductors and all others handling the company's money turn in the money, transfer and other tickets, etc., to the designated persons promptly in accordance with the requirements of the treasurer—they must promptly call to account any one failing to so do.

39. In case of snow storms they must report promptly at their depots to assist in getting out plows, sweepers, sand and salt cars, etc., and assisting in so far as they may in keeping the road open.

GENERAL RULES FOR CONDUCTORS AND MOTORMEN

40. Conductors and motormen report to and receive their instructions from the superintendent or his authorized representative; conductors will also be governed by the instructions of the accounting departments which may be issued relative to the handling of transfers or receipts.

(a) The bulletin board must be consulted before starting and at the end of each day's work.

41. The conductor has charge of the car; the motorman is under his direction and will obey his orders (so far as reasonable). The motorman is directly responsible for the handling and condition of the equipment.

(a) Under no circumstances shall both motorman and conductor be away from the car at the same time, unless properly relieved; in the absence of the conductor the motorman is held responsible for the car and its management and must notify the conductor the number of passengers who have entered in his absence.

42. Conductors and motormen must be neat and clean in appearance and wear the uniform and badge prescribed by the company—the badge must be kept in good condition and worn on the front of the cap, the uniform must be clean and in good repair.

(a) A deposit will be required for the small property of the company entrusted to conductors and motormen; this deposit will be returned at termination of service, when such property must be returned; in default of such return deduction from the deposit will be made in accordance with the bulletined penalties.

(b) Under no circumstances shall employees exchange badges with each other; the official badge must never be worn by another than the person to whom issued.

43. Before leaving the car house or starting from a terminal or after relieving a crew, motorman and conductor will see that all signs are properly adjusted and displayed—each will be held responsible for his end of the car.

(a) While on the road all safety devices must be in place and the different articles of car equipment fully operative; for this the motorman and conductor will be held severally responsible.

44. It is the duty of both motorman and conductor to be on the lookout for passengers; motormen must never run by or pass passengers unless instructed so to do by the conductor or an inspector, when they must either point to the rear or call out "Take the next car."

(a) When approaching passengers on a street on which several lines of cars are operated or on which the cars run to different destinations conductors and motormen must announce to intending passengers the route and destination of their cars.

(b) Should a motorman at any time attempt to diminish the receipts of his car by running ahead of time or too near his leader or by not promptly stopping car for passengers, or shall directly or indirectly harass a conductor or be guilty of any misconduct, the conductor must report the fact at once to the inspector or the superintendent.

45. When any fire department vehicle, ambulance or this company's emergency wagon is running on the street, cars must be promptly stopped until such vehicle has passed, avoiding as far as possible stopping on a cross street or alongside standing cars or wagons.

(a) Motormen will receive and carry on their platforms, in lieu of a baggage compartment on the car or train, all mail sacks with which they may be entrusted, either United States or company mail. They will stow securely and handle carefully all such mail matter.

46. Conductors and motormen must conform to time table in running their cars, be particular in making time points as laid out on the time cards and avoid loitering on the line.

(a) When unavoidably delayed on the line the time lost is not to be made up by fast running as soon as the fact is noted, but by running slightly faster over the entire remaining length of the trip, and then only when this can be done with safety.

(b) When running through dark spots on the road or through fog banks or at any other time when the clear view of the tracks is limited, the motorman shall, except on private right of way, check the speed of his car and run at only such rate as will enable him to stop within the limit of his vision. Conductors for permitting a violation of this rule will be held equally responsible with the motorman.

(c) Crews of all specal, express, chartered, mail, supply or other cars while on the road are subject to and must be familiar with the rules, regulations and requirements of the lines on which they are to run; all cars running on the road are subject to the jurisdiction of the superintendent.

(d) When, in case of blockade, a car is run around such obstruction and on tracks not usually used by cars of that line, or in handling mail, express, chartered, official or special cars, the crew must see that all switches used are left in the same condition as when found. When under these circumstances a motorman has occasion to turn a switch he shall, after passing over it, stop, give the conductor the proper bell signal notice and the latter will then reverse the switch, making sure it is fully and properly thrown before boarding his car and giving the signal to start.

(e) In case of blockade it may be that several cars of one line will be bunched; upon the block being lifted such cars will spread again and not crowd together to destination. For the observance of this rule conductors will be held equally responsible with motormen.

(f) When either on or off their time a crew will not switch a car back or turn short of its signed destination without specific authority from an inspector or authorized representative of the superintendent, excepting in the single case of an accident occurring and the car being disabled or required, under these rules for inspection.

47. Conductors and motormen on duty are not allowed to sit down while the car is in motion except seats are provided for that particular purpose by the company, and then only on specified sections of the line as bulletined.

(a) Conductors and motormen on duty must not shout, signal or telegraph to motormen or conductors on passing cars or on the street nor carry on any unnecessary conversation with each other or any other person.

(b) The reading of newspapers, books or any other matter that pertains to the immediate conduct of the company's business, while on duty, is prohibited.

48. No one but the duly authorized officers of the company will be allowed to stand on the front platforms of passenger cars or ride on any other cars run over these lines. Exception can be made only in favor of policemen on duty and then only in emergency cases.

49. When passengers attempt to get off the car while it is in motion the motorman or conductor must call out to them, "Wait till the car stops." When passengers are alighting and a car is approaching in an opposite direction notify them to look out for the car on the other track.

50. Employees while riding free must not occupy seats to the exclusion of paying passengers or hold any conversation with motorman or conductor of the car. This rule applies generally to all free passengers.

51. When cars are run in the house in the day or night the conductor will see that the lights are turned off and the seats in closed cars turned up; the motorman must see that the controller is on the "off" position, the brakes are set, the power circuit is broken from the car (by removing the trolley from the wire, securing the shoe up from the rail, throwing off the main motor or overhead switch) and the power handles (also air when used) are deposited with the proper custodian or in the proper place, together with switch iron and all other tools or implements as required by bulletin.

52. On double track when a car or train is standing still, receiving or discharging passengers, any car or train approaching in the opposite direction must make a full stop directly opposite the front of the standing car or train; on single track when a car or train is approaching a car or train standing on a siding the motorman of the oncoming car or train will have has car or train under absolute control and run with extreme caution.

53. No car or train shall under any circumstances be backed up more than —— feet without the pole (in overhead construction) being changed, and then only with the conductor on the last or rear platform to give the back-up signal when the way is clear and to protect the rear against accident.

54. The motorman must bring the car to a full stop at steam railroad crossings, not nearer than one hundred (100) feet to the nearest track. He will not proceed until the conductor has gone ahead to the track to be crossed, looked both way and from that point given his signal by hand, flag or lantern to start. The motorman will also observe the utmost watchfulness for approaching trains and should, in his judgment, danger be imminent from any source he will refuse to start until the crossing is clear and free from all danger. When the conductor has gone ahead of car the motorman before starting will look back and see that no one is about to get on or off the car. This rule can only be abrogated by bulletin notice covering such crossings as are protected by gatemen or flagmen or tower-switchmen at points where the crossings are protected by interlocking signals and derail switches; in such cases the conductor will remain on the car or train, holding the trolley rope over the crossing.

55. The motorman must bring the car to a full stop at all trolley or electric road crossings and junction points, and must not proceed until he receives the proper signal from the conductor. (This rule can be abrogated only as the preceding and only at similar points.) The conductor must not give the signal to go ahead until a full stop has been made. Conductors and motormen will be held jointly responsible for a violation of this rule.

56. If for any cause the motorman has stopped the car without a signal and a passenger should want to get on or off, the conductor will give the signal to stop the same as if the car were in motion. The motorman must wait for the conductor's signal before starting the car, whether he has received the signal to stop or not.

57. Cars must not pass on curves unless the motormen know there is ample clearance.

(a) Speed must be reduced on all curves and switches; on pub-

lic thoroughfares the speed at such points must not exceed —— miles per hour.

(b) The car must not be stopped on a curve except to avoid accident.

(c) When running on public streets the conductor on any trolley line will signal the motorman to go ahead if he has the trolley rope in his hand when approaching a curve; should the motorman fail to receive the signal he will signal the conductor, and, failing response, should stop before reaching the curve. The conductor must hold the trolley rope around curves and under special overhead work.

58. Time tables of the different lines will be posted at ———— for the government and information of employees. They will show the assignment of crews to the different runs and the starting time from the terminal of the several trips of each run.

(a) Employees will receive notice of temporary changes (or patches) of time tables by the posting at ———— of a sign reading "new table" or "table changed." They will be expected to keep themselves posted concerning current time tables and all changes thereof.

(b) New time tables will be posted not later than —— o'clock p. m. of the day previous to their becoming effective. Temporary changes (or patches) of time tables on account of weather or other variable conditions are likely to occur at any time.

59. There shall be a seniority list at each depot which shall show the names of all conductors and motormen in consecutive order according to the date of their assignment to that depot, excepting that for purposes of discipline a man shall have lost any numbers in his chronological standing. When vacancies occur conductors and motormen, each on their own list, will be advanced in seniority in accordance with their then standing on the list.

(a) When changes are necessary in the assignment of crews and runs on time tables (old or new) they will be made according to the seniority listing of the men, to take effect as far as possible on Mondays only.

60. Compensation will be a certain rate per hour or per trip, according to the line where employed; the rate will be the same for conductors and motormen.

(a) In assigning men for duty on regular runs or week-day time tables it shall be done in accordance with the seniority list and the runs given away in the following manner:

1—Full pay stright runs (early and late and night cars in sequence).

2—Full pay swing runs (early and late in sequence).

3—Straight trippers (early and late in sequence according to pay).

4—Swing trippers (early and late in sequence according to pay).

61. All conductors and motormen shall be considered as either regular or extra men; regular men are those that have regular runs on the week-day tables; extra men are those that are not assigned to regular runs on the week-day tables. When first appointed conductors and motormen will serve as extras, working up gradually to regular runs.

62. There shall be at each depot a daily working list which shall show the names of all extra men in the order in which they stand for work on the following days.

(a) The daily working list shall be a revolving list: that is, when first for work is assigned for work his name (provided his work for that day shall have amounted in value to at least $——) shall be dropped to the bottom of the working list and work shall not fall to him again until every man whose name followed his on theworking list of that day shall have been excused, jumped, suspended, discharged or put to work.

63. There shall be a daily excused list at each depot which shall show the name of all men, regular and extra, who have been excused, suspended or discharged, and the names of those who will fill their places for the day.

(a) When an extra man is excused for but one day his name shall be dropped to the bottom of the working list for that day, irrespective of whether work would have fallen to him or not.

(b) No conductor or motorman will be excused from duty until he sees his name posted on the excused list, except in case of sickness, when his written statement of the fact must be sent to the agent to whom he reports at the depot by at least such time as he would personally report for duty were he going to work; no telegraph or telephone message will be accepted.

(c) It shall be understood that conductors and motormen excused on account of sickness and so marked on the excused sheet are off for an indefinite time, which shall be not less than two days nor more than thirty days. At the end of thirty days, unless the sick leave shall have been extended upon proper application, the absentee may be dropped for non-attendance.

(d) When an extra or regular man who has been marked off sick desires to return to work he must report to the designated agent before —— o'clock p. m. of the day previous to the one on which he wishes to return to work so he may be marked up for work the next day.

(e) Any conductor or motorman absenting himself for ten days or more without having been excused, and without being heard from, shall, in the discretion of the superintendent, have his name dropped from the seniority list and be discharged for non-attendance. Should he return within ten days he shall give satisfactory explanation of his absence to the superintendent before resuming work.

64. The working and excused lists shall be posted at each depot daily not later than —— o'clock p. m.

(a) The names of conductors and motormen not shown on the time tables as in charge of regular runs will be shown on the excused list or the working list.

(b) Unless otherwise marked on the excused list or the working list, extras must be in attendance at the depot at least —— minutes before starting time of the first car out in the morning and be prompt in attendance on all changes during the day thereafter until assigned for work.

65. Regular men shall be assigned, in so far as possible, on Sunday, holiday or special day time tables according to the seniority list; extra men shall be assigned on such tables after the last regular man desiring it has been assigned, according to their standing on the daily working list—that is, the extra standing first for work on Sunday morning, for instance, shall be given the first run following the regular men, and so on. An exception may be made to this when necessary to insure to certain men their proper amount of rest between the time of their week-day and Sunday assignment.

66. Conductors and motormen having regular runs must report verbally to the designated agent not less than —— minutes nor more than —— minutes before their starting time from the depot. If he is not at his post they will await his return and then report.

(a) When a crew is to relieve another crew at a distant point from the depot the conductor and motorman must report to the above designated agent not less than —— minutes nor more than —— minutes plus the running time before the starting time from the point of relief.

(b) No compensation will be allowed for reporting as required in the above rules.

(c) The above rules apply as well to the latter part of swing runs.

(d) Extras when assigned temporarily for regular runs are subject to the above rules.

67. A conductor or motorman shall be considered to have been "jumped" when he has been superseded for work by another for the following reasons:

1—Failure to report to the designated agent in accordance with the requirements of rules 63 to 66 inclusive.

2—Failure of conductor or motorman to be on his car at the starting time, even though he had reported to the proper agent at the proper time. This is applicable to all trips, unless the conductor has been excused by the same agent or authority.

3—Failure of extra men to report in accordance with the rules governing regular men when they are assigned for regular runs.

4—Failure of extra men to respond to call for work during changes.

5—Failure to respond to call for work or to report at the expiration of time for which they have been excused or at time marked or the working list.

(a) When necessary to assign conductors and motormen from one depot for temporary service at another depot, their names shall be shown on the working or excused list at their own depot with the time they are expected to report at the depot where they are to work; and failure to so report in accordance with these rules will result in being jumped.

(b) In case of delay from blockade, especially at hours of the day when headway is long, should it be clearly proven that a conductor or motorman was prevented by such blockade from reaching his depot previous to his reporting time, and providing there was no other way for him to reach the depot, the jump shall not be counted.

(c) In the matter of discipline for being jumped, regular and extra men shall be upon the same footing and so far as possible they shall be treated alike. An accurate record of each and every jump will be kept.

(d) Penalties for jumps shall be as follows:

68. Bell signal rules:

Conductors to motormen—

CONDUCTORS MUST KEEP THEIR HANDS OFF THE BELL SIGNAL CORD OR ROPE EXCEPT WHEN IN THE IMMEDIATE ACT OF TRANSMITTING A SIGNAL.

One signal, car standing at transfer point, motorman will then signal the number of passengers boarding the car by the front platform.

Two signals, car standing, go ahead—all clear.

Three signals, car standing, back the car slowly—all clear.

One signal, car in motion, stop at the next street, station or other designated point.

Two signals, car in motion, conductor has hold of trolley rope and is on the rear platform ready to take the curve; or, on answer to the motorman's signal of a possible obstruction standing or moving alongside the track near the car, that the car can pass slowly.

Three signals, car in motion, danger—stop immediately, emergency.

Four signals, car in motion, passengers to be transferred to the intersecting line—motorman will so signal.

Conductors will be careful to give each signal clearly and distinctly.

Motormen to conductors—

Motorman must not assume any signal is INTENDED—they must require a clear and distinct stroke of the bell for each.

One signal, car standing, one passenger has boarded car by front platform this is to be repeated after the conductor's signal for the information as often as necessary to cover the case.

Two signals, car standing, conductor will reverse switch over which car has just passed.

Three signals, car standing, car must be backed. Is all clear?

Four signals, car standing, conductor is needed forward.

One signal, car in motion, approaching a curve, conductor will hold rope; or, on approaching a possible obstruction standing or moving alongside the track near the car, on receiving this conductor will promptly respond after taking proper action, as above.

Two signals, car in motion, conductor will immediately set the rear brake and stop the car.

A succession of quick signals is notice to conductor that trolley has left the wire.

(a) Air, gong or whistle signals—

One signal, ...

Two signals, to be sounded on approaching a cross street or any danger or to give notice of approach.

Three signals, another car is following on the same time and rights, a headway behind. ON SINGLE TRACK LINES THIS SIGNAL MUST BE REPEATED IN ACKNOWLEDGMENT BY THE MOTORMAN OF THE CAR OR TRAIN PASSED.

Four signals, approaching an intersecting line is notice to the crew of the car on that line that passengers are to be transferred to them.

(b) Classification signals—

These are conveyed to all concerned by a lamp or flag on the forward end of the car, carried in the bracket provided for the purpose. Their significance is as follows: WHITE light or flag signifies the car or train is an extra and running on no scheduled time.

GREEN light signifies another car or train is following a space distance behind and running on the same time and rights. Motorman on any car carrying this signal must notify the motorman on each car passed (on single track lines) by the signal (Rule 68a), as provided, and the motorman so notified will repeat the signal in acknowledgment; in case a reply is not promptly made the motorman giving the signal will stop and verbally notify the other, reporting the occurrence to the superintendent on reaching the end of the run.

(c) Color signal rules—

RED invariably signifies danger, and a red flag by day or a red light at night is the order to stop. Under NO circumstances will such a signal be passed without a full stop having been made within not less than ten nor more than one hundred feet BEFORE the signal is reached, and the conductor must make certain that any further order or instructions intended are received and thoroughly understood before he gives the signal to start.

GREEN signifies the necessity for caution, and a green flag by day or a green light at night is the order to proceed with the car or train under absolute control.

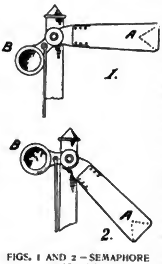
WHITE, when used for signaling, indicates safety; but the swinging of a white lantern at night over or alongside the track is a signal to stop. A white lantern is also used at night hung on the gates protecting a railroad crossing to indicate the position of the gate.

(d) Fixed signal rules—

SIGN signals, such as "stop," slow" or "breaker" signs, are placed at points requiring special protection; special instructions will be issued covering their position and use.

SEMAPHORE signals, as shown in Figs. 1 and 2, are of two classes, "HOME" and "DISTANT."

The home signal is supplied with a red lens, *B*, and the blade, *A*, if the signal is painted red and is square-ended, as shown by the full lines in the illustration. When in the position shown in Fig. 1 this signal will show a red light at night and the signal in this position is an absolute order to stop (see Section C above). Such stop must be made not less than 10 ft. nor more than 100 ft. distant from and BEFORE reaching the signal, and the car or train must not proceed, when so stopped, until the signal is "cleared." The clear or safety position of the home signal is shown in Fig. 2 by the blade being in an inclined position which will show white light at night, and when in this position gives permission to the car or train to proceed.



FIGS. 1 AND 2 — SEMAPHORE SIGNALS

The distant signal is supplied with a green lens, *B*, and blade, *A*, is painted green and is "fishtailed," as shown by the dotted lines on Figs. 1 and 2. When in position shown on Fig. 1 this signal will show a green light at night and the signal in this position is an order to proceed only with the car or train under perfect control, this order to remain in force until the next signal is reached or the point or obstruction to be protected by slow speed has been passed. The clear or safety position of the distant signal is shown in Fig. 2 by the blade being in an inclined position, which will show a white light at night, and when in this position gives permission to the car or train to proceed without slackening speed.

When two or more semaphore signals of the same class are located on the same post the top blade (and light) governs the right-hand track or route; the next lower signal governs the next track or route to the left of the first, etc.

A SIGNAL IMPERFECTLY DISPLAYED OR THE ABSENCE OF A SIGNAL AT A PLACE WHERE A SIGNAL IS USUALLY DISPLAYED must be regarded as a danger signal and the fact reported at the first opportunity to an inspector or the superintendent.

SPECIAL INSTRUCTIONS FOR CONDUCTORS

69. Conductors must be civil and attentive to all passengers, especially ladies, children and elderly persons. They will endeavor to provide seats for all, when necessary requesting passengers to sit closer together.

(a) Conductors must announce distinctly the names of streets and stations, in each case calling the following street or station immediately on leaving or passing any street or station. They will also announce the approach to any point of considerable travel and at transfer stations or points will announce the lines to which transfer is made and their destinations.

(b) Conductors must keep the rear platform, doorway and brake free from obstruction as far as possible and not allow passengers to stand in front of the controller box. When the platform becomes crowded they will request passengers standing there to step inside the car.

(c) On closed cars when passengers crowd inside the rear door the conductor must request them to move forward and make room for others. Under no circumstances will conductors allow passengers to ride on the bumpers, roof or side step (especially when crossing a bridge) except ——————

(d) Conductors must see that passengers do not place their feet upon the seats.

(e) Conductors must give particular attention to the ventilation of closed cars. No set rules can be issued to cover; good judgment must be employed to secure the comfort of passengers.

(f) Conductors will be governed in the handling of heaters in the cars by the instructions as bulletined.

(g) Smoking will be permitted ——————

70. Conductors must never under ANY circumstances operate the controlling mechanism of the car or train; should the controller on the head end of the car or motor car prove defective and inoperative the conductor will take position at the head end of the car or train and transmit signals to the motorman, who will then

run the car or motor car from the rear end of the car or from the rear end of the forward motor car of the train. In this event only half speed shall be used in such movement and the conductor have protected the rear end of his car or train from any following car or train as per detailed bulletin instructions. While in this position the motorman will look out for any passengers desiring to leave the car. Should the motorman become incapacitated the conductor will at once stop the car or train and protect it.

(a) On double-track lines the in-track gates front and rear must be kept closed and the in-track side steps securely fastened up. Should such appliances become out of order on the road the conductor will be particular to guard against accidents occurring therefrom and will turn the car in upon reaching the end of trip or depot.

(b) When possible to avoid it conductors must not give the go-ahead signal from any point other than the rear platform of the car or forward car of the train, and then only after being careful to see that all is safe.

(c) The conductor shall never leave the car for any purpose while on the road without first notifying the motorman, who will then be in responsible charge of car and passengers.

(d) In case of thunder storms the conductor will turn on the light circuit and keep lights burning until all signs of lightning are past; in case any considerable stop is made the conductor will remove the trolley wheel from the wire until ready to proceed.

(e) When another equipped car is being towed its pole must be drawn down and tied to the dash rail.

(f) When two cars are coupled for running or a trailer is used the signal for starting must be given by the conductor on the rear car first, after each stop, and promptly repeated by the conductor on the forward car, each conductor being careful to know that passengers are safely on or off his car. Should the two cars be under the charge of a single conductor he must not give the starting signal unless standing on one of the platforms between the cars, and then only after satisfying himself that all is safe.

(g) Except in case of absolute necessity to avert accident, the conductor must never remove the trolley from the wire until after the power has been shut off and the car stopped.

(h) When not other wise engaged the conductor must be on the rear platform of the car, or if a trailer is used on the front platform of the trailer on the lookout for passengers who wish to board or leave the car; while on the stand the conductor must be near the rear platform of the car or train to solicit passengers and give information; when on a grade the conductor must be on the rear platform of the car or the front platform of the trailer used, ready to apply the brake if necessary; when passing any transfer point the conductor as well as the motorman must be on the lookout for the transfer signal from an approaching car on the other line, in order that passengers may make the transfer without undue delay.

(i) The conductor will see that the light circuit of the car is in good order before leaving the depot and will turn the lights on and off as needed; in case other than electric lights are used he will be sure to see that they are always ready for use and light them when necessary, but will not fill kerosene lamps. He must, with the motorman, make sure the headlight is burning brightly on the head end of the car after nightfall.

(j) Where tail lamps are used the conductor must see that they are in proper condition for use and at sunset he will see that they are lighted and kept burning on their proper position of the car.

71. Conductors must not take charge of or become responsible for any article not paying transportation charges as per freight tariff posted, except only articles used in the company's service and placed on their car by an authorized employee of the company.

(a) Conductors must promptly turn in to the authorized receivers of such property all articles found in their car or on the company's property, noting on a tag attached to each article their name, trip, date, time and place of finding.

(b) Conductors will prohibit all begging, peddling or vending on their car or train except by the agents of the company authorized by this company to so sell; in no case, however, should any attempt be made to remove such vendor, etc., from the car while it is in motion, and no threat or intimidation should be used to such persons.

72. A day card or train card will be furnished the conductor upon reporting for work by the agent to whom he reports, such card calling for information which must be filled out in detail and in accordance with bulletined instructions for each half-trip. Conductors will make up this card at the end of every half-trip and will be held strictly responsible for the accuracy of each and every statement made thereon. On the back of this card conductor will note any occurrence on each trip of which memorandum should be made; such card shall be turned in with the transfers and money collected to the receiver of moneys at the end of each day's work or at the end of any number of consecutive trips.

(a) Conductors will receive transfer pads and a punch from ———— before starting work each day or swing and will return the unused transfers with the punch to ———— after each swing or day's work; when making such return they will be given a properly numbered check which will serve as a receipt for the punch.

(b) Each conductor must provide himself with $—— in change before going on duty.

(c) Before taking car out of house or from terminal when beginning work, conductor must see and know that the register is securely bolted and locked to the register block; for the condition of the register the conductor will be held strictly responsible.

(d) The conductor will see that the register is set in the proper direction in which he is about to move and will turn the direction only as instructed by bulletin notice.

(e) The conductor must promptly collect and register the fare of each passenger on the car, if possible within a block after boarding it, except at such points where an agent of the company shall have made the collection—as shown in buletined orders—and excepting in such cases as scheduled herewith where the passengers are entitled to free transportation:

(f) Conductors must not collect fares when approaching railroad crossings, transfer points, curves or switches.

(g) After making collection of fares conductor shall count the number of passengers on the car or cars and know that, excepting for the free, collection has been made from each and registration properly made. Fares must be registered singly as collected and not in bunches. When compelled to make change he will face the rear of the car, or, if on a trailer and working the train alone, face forward.

(h) If, after his fare has been collected and registered, the passenger discovers he is on the wrong car, the conductor will exercise his judgment as to the return of the fare; if refunded, the conductor must not fail to ring up each other fare collected thereafter, but will make a note of the occurrence on the back of his day card and deduct the amount from the amount thereof called for to be turned in to the company's receiver. Also, when a conductor registers more fares than he collects such mistake can be corrected only by reporting it to the office.

(i) When passengers are transferred from one car to another at any place other than a regular transfer point the number of persons transferred, cause of such transfer and number of each car will be noted on the back of each day card and signed by each conductor engaged in the transaction; such persons will be registered on the car they board, but no further fares will be collected from them. If an inspector be present his signature must be secured on each day card as authorizing the transfer. The conductor must remain in charge of the disabled car until relieved.

(j) Should a conductor for any reason change his car after commencing his day's work he must not only note the number of the new car on the face of his day card opposite the half-trip on which the change occurred, but as well note on the back of the card the reason for the change and any damaged or filthy condition in which the new car or its equipment may be found.

73. When any conductor has any personal knowledge of an accident occuring in which any property may be damaged or any person or animal is likely to or may have been injured he will make prompt report of all the facts in the case to his depot immediately upon arrival at that point, and as soon as possible fill out in exact and full detail a blank form provided for his use in such cases headed Conductor's Accident Report." If the conductor was a passenger on a car involved in the accident or a nearby eyewitness of the occurrence or reaches the spot in time to do so, he will render every possible assistance to the conductor of the car and secure the names of as many witnesses not on the car as he can. If in charge of a car involved in any disturbance or accident he will secure the names and addresses of all possible witnesses, whether they actually saw the occurrence or not; in any event securing the name and address of every lady on the car. It is much preferred to have a witness write his own name and address if he can be induced to do so. Soon as the accident report is filled out it must be delivered, with the name slips of witnesses, as promptly as possible to the authorized representative of the superintendent.

(a) In case of serious accident the conductor or, if he so delegate, the motorman must immediately report the case by nearest telephone or telegraph to the nearest operating depot, despatcher or division point, stating briefly the nature and probable extent of the trouble, so that adequate assistance can be sent.

(b) The conductor must never eject a person from the car for disorderly conduct or non-payment of fare unless they get the

names and addresses of witnesses. They will use no more force than is necessary in making the ejectment, first bringing the car to a full stop at a traveled road, street or highway, a regular stopping point for passengers or a station.

(c) For each light of glass maliciously or wantonly broken by a passenger or bystander the conductor will collect from the offender the sum of $— and turn in such collection with his fare returns for the day or swing; a note must be made on the back of the day card to cover the occurrence and refer to the remittance.

SPECIAL RULES FOR MOTORMEN

74. While the car or train is in motion responsibility for safe running and its safe handling lies with the motorman; he must never attempt at such time to do anything but handle the controlling mechanism and watch the road ahead, being prompt to give warning of his approach to danger points or on the appearance of danger.

(a) Under NO circumstances will any motorman permit another motorman or any person, other than a student placed by proper authority with him for instruction, to run the car or train of which he is in charge while he is on duty.

(b) Upon leaving the operating position, box or platform for any reason whatsoever when the train or car is standing, the motorman must remove and carry with him the controller and reverse handles (together with the power brake handle where power brake is used), and must in all cases have shut off the current through the controller, broken the circuit through the car (by throwing the overhead circuit breaker, main motor or cut-out switch) and fully set the brake.

(c) Under no circumstances and for no cause whatsoever shall the motorman leave the operating position, box or platform of any motor while the car or train is in motion, except in the single case that an accident endangering himself is imminent and he shall have done all he can to stop and reduce to a minimum the impending damage to person or property.

75. Motormen are expected to become familiar with the electrical and mechanical construction of the cars in order to be able to meet emergencies arising on the road; they will be held directly responsible for the condition of that equipment.

(a) They must make it their special business to carefully examine all parts of the car before leaving the barn, depot or terminal or taking charge of the car to see that all safety devices, signal gong, foot gong, air whistle, fender, controller reverse, sand boxes, etc., are in place and in good and fully operative condition, headlight glass and reflector clean and after sunset the light on the forward end of the car or train is burning properly and brightly.

(b) They will see that all tools required to be carried are on the car or motor; where fuses are used they will be sure to have a sufficient supply of the proper design and amperage and shall never use heavy wire or any substitute therefor for a fuse. They must have at all times an ample supply of sand to cover any possible demand.

(c) Motormen must apply to the shop foreman in charge of cars for any specific information regarding operation which they do not thoroughly understand or regarding any part or parts of machinery or electrical apparatus or wiring which is liable to get out of order on the road or during service.

(d) They will never attempt to do any work on motors unless the circuit through the car has previously been broken by throwing the main motor switch, the overhead circuit breaker or withdrawing the trolley from the wire; they will never do such work with any loose metal article in an upper pocket, which is liable to fall out and cause ultimate if not immediate damage.

(e) They will examine motor and journal bearings as often as may be possible, and if too warm the fact must be promptly reported; the armature, field coils, diverter coils and commutator should never get so hot that it is impossible to hold the hand on them. Motormen must never try to run a motor that is seriously out of order, but shall promptly cut out the motor at fault.

76. When current is cut off between the power house and the motors the motorman shall throw the controller handle to the "Off" position and come to a stop to ascertain the cause; if in the day time he will turn on the light circuit to determine if the power is on the line. If the rail be dead or dirty and power is on the line, connection must be established with the nearest live rail and the wheel by the conductor, contact being broken with the wheel first to avoid a shock. Both controllers should be tried; if one works the trouble is in the other; if neither works, with power on the line, a fuse has probably been blown. In that event the conductor will remove the trolley from the wire or the motorman will break the circuit through the car before anything else is done, and then if on examination a new fuse is found to be necessary the motorman will remove and retain to be turned in the stubs or ends of the former fuse and, after placing the new fuse in position, set up the binding screws, holding it tightly in place, being very careful to secure a good contact at each end. Should the new fuse be blown the motor at fault, as designated by the position of the controller handle at which the blowing occurred, should be cut out. If both motors prove disabled so as to prevent the self-movement of the car the circuit must be broken through the car and assistance called for; in the case of a multiple-unit train, if the other motors in the train can propel it, the train will be moved in accordance with Rule 70.

(a) In case the power is cut off and the brake is found to be defective, the motorman before signaling the conductor to set the rear brake will set the reverse handle opposite from the direction in which the car is moving, throw the controller handle to the last position and allow it to so remain until the effect takes place, then, being careful to throw the handle to the "Off" position. Should this for any reason prove inoperative the motorman will promptly signal the conductor to apply the rear brake.

(b) The motorman must not reverse the power under usual running conditions; reversing is a severe strain upon the apparatus, especially when the car is under high speed. When necessary to reverse, and the car has been brought to a full stop, the motorman will return the handle to the "Off" position and apply the brake fully.

(c) When tracks are covered with water or slush motormen will run slowly and carefully, with power off where possible in order that the splash of the water may not cause a short-circuit in the motors or wiring of the car. They must never try to run through water so high as to touch the bottom of the motor-shell.

77. Before completing the circuit through the car on starting to work the motorman will see that the controller handle or cylinder indicator points to the "Off" position; main motor switch or overhead circuit breaker will then be closed and the brakes released before the power is applied to start the car. In starting at any time power should be applied gradually and fed with only proper speed in order that no damage may be done the equipment or injury caused to passengers by the sudden jolt. The controller handle must never be thrown on the last point if the car does not start on the preceding points.

(a) Motormen must conform to time table requirements as closely as possible, regulating speed in accordance therewith and with the limits of the time point cards. If a motorman should be delayed he will not undertake to recover the time lost in the minimum distance, but, IF IT BE ENTIRELY SAFE TO DO SO, he will run slightly faster during the entire run, aiming to reach destination or end of trip as nearly on time as may be possible.

(b) Motormen shall never run ahead of time unless directed to do so by an authorized officer of the company.

(c) On descending grades the motorman shall allow the car to coast as much as possible with power thrown off, always being careful to keep the car under control and never allowing it to run down hill faster than the motors will take it up the same hill. Coasting being good and economical practice, will be done wherever possible.

(d) In stopping, brakes will be applied gradually to reduce the deleterious effect of a sudden retardation of motion in all service stops; just before the car or train comes to rest the brakes will be released slightly or partially kicked off so as to obviate the recoil that would otherwise ensue.

(e) Brakes must never be applied while the current is being used, nor current applied while the brakes are on; serious consequences are liable to follow disregard of this rule.

(f) When, on applying brakes, the wheels are felt to be slipping, the motorman will release the brakes partially, start sand to running and again set up the brakes.

78. Motormen will sound the gong with a double signal when approaching a station, standing car (see rule 68a) or at any other times when necessary to call attention to the movement of the car; where air whistle is used this signal will be given thereon.

(a) Motormen will use particular care when approaching or passing school houses or any other places where children are wont to congregate, having speed materially slackened and cars under control.

(b) Where streets are dug up or excavations are made under, alongside or near the tracks, motormen will observe particular care in running, taking no risks. In passing men at work in the streets or along the tracks particular care will be used.

79. Motormen will observe the minimum spacing distances as bulletined allowed between any two cars moving in the same direction on the same track.

(a) On limited curves (where two cars cannot pass) when two cars arrive at the same time the car on the outer track has the right of way.

(b) On double-track lines a car will be run slowly approaching and passing a car in slow motion in the opposite direction.

(c) Motormen must throw off power immediately before

striking a curve, or before passing over or under any circuit breaker, special work, insulated joint, slip joint, frog or any similar mechanical contrivance.

(d) When any vehicle is seen in the track ahead or so close thereto that a car may not pass it the motorman shall slacken speed and not approach nearer than —— ft. until he has received the conductor's signal that the car will pass.

(e) Motormen will not run over any sticks, stones or other small obstructions on the rail, but will see that the track is at all times clear.

80. Motormen must never run against a facing switch point when meeting a car without first coming to a full stop and then proceeding only with the car under perfect control. This rule refers particularly to all crossovers and curves having switch points facing opposite to that in which the car is going.

(a) Motormen must not pass over any switch until they KNOW that the tongue is properly and fully turned, and then only at reduced speed. Particular care must be taken when switches are covered with snow or water.

81. Every motorman, after having run any car, whether for a day or but a single trip, will, upon being relieved and before leaving the depot, report the condition of the car or cars he has handled on the shop sheets provided; these sheets will show the run number, and the motorman will enter thereon opposite his run number (or below the regular runs if he has been on an extra car) the number of the car he had on that run or any part thereof on that day, any defect of the car or its equipment, and sign his name thereto. No excuse will be accepted for failure to so report.

(a) When any motorman has any personal knowledge of an accident occurring in which any property may be damaged or any person or animal is likely to or may have been injured he will make prompt report of all the facts in the case to his depot immediately upon arrival at that point and soon as possible fill out in full and exact detail a blank form provided for his use in such cases headed "motorman's accident report." If the motorman was a passenger on a car involved in the accident or a nearby witness of the occurrence or reaches the spot in time to do so, he will render every possible assistance to the crew of the car. If running a car that becomes involved in any disturbance or accident, he will see to securing as many names from witnesses to the occurrence from the sidewalk or adjacent stores as may be possible, giving such names to his conductor.

Annual Report of the Brooklyn Rapid Transit Company

The official statement of the Brooklyn Rapid Transit Company for the year ended June 30, 1902, has just been issued. It shows that the receipts from all sources of $12,788,168, or an increase of $652,609 over the previous year. The increase in the cost of operation was $993,389, of which $457,272 was expended in maintenance of way, structure and equipment. Net earnings as a consequence decreased $382,591. The surplus after fixed charges was $18,893, a decrease of $330,232.

Following are the figures with comparisons for years ending June 30, 1902 and 1901:

	1902.	1901.
Total earnings	$12,510,622	$11,899,824
Operating expenses	8,209,397	7,216,008
Earnings from operation	$4,301,225	$4,683,816
Gross income	$4,578,771	$4,919,551
Total deductions	4,475,450	4,341,748
Net income	$103,321	$577,803
Special appropriations	84,428	228,678
Surplus	$18,893	349,125

The consolidated general balance sheet shows:

ASSETS.

Cost of road, equipment, etc., of properties owned in whole or in part by the Brooklyn Rapid Transit Company		$ 88,299,310
Advances account construction for leased companies		8,161,283
Guarantee fund—Securities and cash		4,005,755
Total permanent investments		$100,466,348
Current assets		3,326,459
Cash on hand	$ 1,589,756.03	
Due from companies and indiduals	336,605.61	
Materials and supplies on hand	536,732.51	
Prepaid accounts	79,084.08	
Accounts receivable	529,052.40	
Bonds and stock in treasury	255,228.00	
Acconnts to be adjusted		4,374
Total assets		$103,797,181

LIABILITIES.

Capital stock		$ 47,717,305
Brooklyn Rapid Transit Company	$45,000,000.00	
Outstanding capital stock underlying companies	2,717,305.05	
Bonded debt and real estate mortgages		52,666,100
Brooklyn Rapid Transit Company	7,000,000.00	
Bonded debt of constituent companies	45,524,000.00	
Real estate mortgages	142,100.00	
Total capital stock, bonded debt and real estate mortgages		$100,383,405
Current liabilities		2,422,382
Audited vouchers	$ 376,684.27	
Due companies and individuals	28,056.54	
Taxes accrued and not due	1,070,479.63	
Interest and rentals accrued and not due	866,415.76	
Interest accrued on real estate mortgages and not due	741.14	
Sundry charges accrued	39,955.13	
Insurance	40,000.00	
Surplus account—Balance June 30, 1902		991,444
Total liabilities		$103,797,181

The New Orleans Strike Settled

The strike of the employees of the New Orleans Railway Company, which has been on since Sept. 28, was settled on Oct. 12 by compromise and mutual concessions made by the company and the men. As has previously been stated in the STREET RAILWAY JOURNAL, the original demands of the men, made when the strike was declared, were modified on Oct. 2 to 25 cents an hour and an eight-hour day. Settlement was finally made on a basis of 20 cents an hour, which is an increase of 10 per cent, and an eight-hour day.

Before a settlement was reached, however, it was found necessary to make a most formidable show of force, the militia being called upon to suppress rioting. Mayor Capedevielle, when the strike was called, asked the company not to attempt to operate cars for a few days, believing that the difference could be settled. But he soon became disgusted with the arrogance of the strikers in rejecting the propositions that were made for a settlement of the controversy, and, convinced that a firm stand was the one thing necessary, on Oct. 9 called on Governor Heard for military protection. The Governor made himself thoroughly familiar with the situation, and as a result he proposed a basis of settlement which was accepted with reservations and qualifications by the company, but was absolutely rejected by the men. The flat and unconditional rejection of the Governor's good offices left him no other course but to issue his proclamation announcing the intention of using all the force of the State to maintain order and enforce the laws. Orders for the State troops in other parishes to report for duty in New Orleans with the least possible delay were then given, and for the first time in the history of Louisiana all the State troops were assembled in the city. This array of force on the side of right had the desired effect, for a settlement was speedily effected.

Pressed Steel Car Replacer

In the description of the car replacer that is being put on the market by the Heitzman Tool & Supply Company, of Hoboken, N. J., which appeared in this journal on Oct. 4, the weight should have been given as 55 pounds and the guarantee of the amount it would hold as made by the company at 50 tons. These replacers are being recognized as a very essential part of the equipment of electric railways, and they are receiving very favorable consideration wherever they have been used.

PROCEEDINGS OF THE A. S. R. A. CONVENTION

President Vreeland called the Friday morning session to order at 10:40 o'clock, and announced that the first business would be the report of the committee on standard rules for the government of street railway employees.

STANDARD RULES.

Mr. Harrington, Camden.—Mr. Brackenridge, the chairman of the committee, is not here, and it seems to be the sense of the committee that the rules which have been submitted express only the preliminary work of the committee on this subject, and we would therefore request that either the committee be continued, if it is your pleasure, or that a new committee be appointed.

President Vreeland.—It seems advisable that the work of this committee should be done in a very thorough way, before any set of rules is adopted. The matter of framing a standard set of rules has taken a great deal of attention in connection with the work of other associations. The New York State Street Railway Association has a committee now working on this subject, which made a preliminary report at the meeting of that association last month. It has been suggested that inasmuch as Mr. Brackenridge, of the Brooklyn Rapid Transit Company, has given up the operating department, there be a substitution in his place, and that another gentleman be added to the committee so that the committee can go forward with the work during the next year. It seems advisable, to my mind, that the same members of the committee, with additional appointments, should go ahead with the work next year so that we will not lose the value of the work which has already been done. It has been suggested that Mr. Connette, of Syracuse, be appointed in place of Mr. Brackenridge, and this will give us the advantage of having two members of the committee, Mr. Mitten, of Buffalo, and Mr. Connette, of Syracuse, who are now also members of the committee on standard rules appointed by the New York State Street Railway Association. This will undoubtedly facilitate the work, and the chair will therefore appoint as the committee on standard rules for the ensuing year, T. E. Mitten, of Buffalo; E. C. Foster, of Lynn; W. E. Harrington, of Camden, and E. G. Connette, of Syracuse, Mr. Connette to be the chairman of the committee.

Mr. Beggs.—There are a number of roads throughout the United States, including the road with which I am associated, that have been waiting for two or three years for this association to give the stamp of its approval to a set of rules that might ensure greater uniformity in the conditions under which our employees throughout the country work. I, for one, will feel compelled to take this report as a basis—or the report of the committee of the New York State association, which I think is much better. You will find on page 11 of the rules as submitted a set of conditions to conform to which would, in my judgment, make it absolutely impracticable to operate a street railway in any metropolitan city. These rules may be very well for an interurban line, but are absolutely impractical of application in any city of any considerable size. I furthermore think that there should be some representative on this committee from a large city, like Chicago or St. Louis. We know that in different sections of the country there are different conditions confronting the operators of street railways, and this committee, as organized, is largely confined to the East. I am perfectly satisfied with the committee as it is now constituted, but I think there should be some one from a great city like Chicago or one of the Western cities, to give expression to their views in the formation of these rules. I have read the rules very carefully. The rules on page 11, Sec. 52 to Sec. 55, inclusive, require a car to come to a full stop every time it passes another car; to come to a full stop before it crosses any other intersecting street railway, etc. In a large city that would be absurd. It is absolutely impractical to conform to these rules. I would like to suggest, Mr. President, that the committee be increased by at least one member, who should come from, say, the city of Chicago. This would more nearly represent the practice throughout the West.

President Vreeland.—The chair will very gladly do what Mr. Beggs suggested. It has been my experience in dealing with this subject, and other subjects handled by committees, that it is wiser in appointing a committee, to select members from one section of the country where the members can get together and hold a meeting. Questions connected with other cities, as a rule, can generally be covered in a satisfactory manner by correspondence; but inasmuch as the appointment of an additional member will not make any difference to the committee, the chair will follow the suggestion made by Mr. Beggs and appoint Mr. Robert McCulloch, of Chicago, as an additional member of the committee.

On motion the report of the committee on standard rules, as presented at this meeting, was accepted.

REPORT OF COMMITTEE ON STANDARDS.

President Vreeland.—In order to dispose of the reports of the committees, as some of the members find it necessary to leave the city rather early to-day, we will have the report of the committee on standards, of which N. H. Heft, of Meriden, Conn., is chairman.

Mr. Heft presented the report of the committee on standards, but owing to numerous changes that were made at the last meeting of the committee it was impossible to give the report out for publication. It will, however, be presented at an early day.

President Vreeland.—There is no member of the association who has to do with the larger questions connected with the present electric systems of operation, whether in city, interurban or suburban traffic, that does not appreciate the fact that the standardizing proposition is an important one at the present time. In the light of the experience of the last half-century of steam railroad operation, it is hardly worth the while of the members of this association to go ahead spending money in as many different directions as there are managers represented. The era of consolidation is at hand, not approaching, and we will find ourselves, through consolidations with many interurban roads, having as many different standards as the ideas of the managers handling the property. You have heard the recommendation of the committee, and inasmuch as the chairman stated that the standards selected by the committee are the established standards of the United States through the M. C. B. rules, it is hardly worth while to take up much time in the discussion of the report. If there is no one present who desires to discuss the subject, a motion is in order that the report be received and the recommendations be accepted, and that the full report on standards, as recommend by the committee, be printed in the proceedings of the association. The chair will be glad to entertain such a motion.

Mr. Dickinson, Seattle.—I move that the report be accepted and printed for the information of the members of the association.

Mr. Heft.—I think it is in order that the matter should be disposed of in some way. If the association wishes to bind itself to the M. C. B. standard, it would be necessary to adopt the recommendations of the committee. The committee asks to be discharged and have a new committee appointed.

Mr. Dickinson.—I add that to my motion.

Mr. Dickinson's motion was carried.

Mr. Lang.—I move that the incoming officers and the executive committee be empowered to appoint a committee on standards.

The motion was carried.

COMMITTEE ON RESOLUTIONS.

President Vreeland appointed as a committee on resolutions William Worth Bean, of St. Joseph, Mich., and G. W. Dickinson, of Seattle, Wash., with instructions to report at the afternoon session.

STEAM TURBINES.

Upon invitation of the chairman, Mr. Sniffen, the author of the paper on steam turbines, briefly stated what points he wished to bring out for discussion. Mr. Sniffen explained that while a good deal has been written on the subject of the steam turbine, it has been almost entirely confined to the engineering aspect of the machine, dealing with its economical features and questions of design and construction; consequently, he thought that at this meeting it would be more interesting if a paper was prepared upon the commercial aspects of the steam turbine, dealing with such things as its reliability, its economy, and also such features as the comparative costs of foundations, buildings, space occupied, and treating of the subject of its cost.

Mr. Beggs.—There is one point which has not been touched upon as fully as many others, and that is the relative cost of the generator by itself to be connected to the steam turbine; in other words, you have left out apparently the differentiating cost of the turbine itself and the generator to be connected to it.

Mr. Sniffen.—That question is not so material when you consider that these companies are either offering or expect to offer turbine units as complete outfits. It makes no difference what the steam or electrical end costs individually, so far as we have the comparison of the cost of the complete unit. In a general way it may be said that the electrical end of the unit is lower in cost of manufacture than the large revolving generator that goes with a reciprocating engine, while the steam end itself is, perhaps, comparatively expensive. The price of the complete unit, however, compared with the cost of the reciprocating unit, including its generator, is the comparison I made in my paper. It is not the purpose

of the Westinghouse Company to furnish the steam turbine alone, but to furnish the generator with it as a complete unit.

Mr. Beggs.—This is really a manufacturers' paper, and Mr. Sniffen has proceeded with the conclusions urged in that paper as a maximum cost upon lines which it is hardly possible can be followed by those who are going to pay for these units. There are two or three concerns in the United States at the present time which are developing the steam turbine in connection with generators, but I do not think that those of us who are spending millions of money in the construction of power plants, are going to be satisfied to depend upon two electrical manufacturing concerns for the construction of the steam turbine, which is a mechanical device and entirely independent of the electric generator. For instance, the largest manufacturers of steam engines in the world are located in the city of Milwaukee, the Allis-Chalmers Company, and I do not suppose for one moment—I know as a matter of fact—that they would permit their business to be taken from them by the Westinghouse or General Electric Company. They are to-day experimenting on a large steam turbine. Therefore, it is important that we know what the differential cost is, and know how the varying elements are reached in considering the expense of constructing a power plant, including that of the generator. One of the important points, which is entirely ignored in the paper before us, is the effect of the greatly reduced cost of the generator to be attached to the steam turbine, because of the high speed at which it must necessarily run. I believe the lowest speed at which it is considered you can make a large turbine operate successfully is about 750 r. p. m. Is that correct?

Mr. Sniffen.—Yes; that is about the minimum speed.

Mr. Beggs.—Those gentlemen who know the difficulty we have had of getting the electrical manufacturers to build a generator of sufficiently low speed to operate satisfactorily with the larger types of Corliss engines that are now being built, know how much they have had to pay for slow speed. I thoroughly understand the great wish of the two or three large electrical concerns to compel the purchase of the entire unit; but where there are now only about two electrical manufacturers that we might feel safe in, there may be a third in the future, and very likely a fourth, who can build a 5000-kw generator which we would be justified in making a contract for—there are almost a score of concerns in this country that can build a turbine to run at 750 r. p. m., because of the greatly reduced size and weight of the parts to be used. If Mr. Sniffen has any data on that point, I would like to have him give it to us, because, when I go into the market to buy a steam turbine, I want to buy it as a piece of mechanical apparatus and not as a piece of electrical apparatus. It becomes a very different proposition whether you buy it in two parts from two concerns, or buy it as a complete unit from one concern; the saving in the generator may be absorbed in an excessive profit on the turbine.

Mr. Heft.—I would ask Mr. Sniffen what history the steam turbine manufacturer has behind him, and what he proposes to give to the purchaser in the way of a guarantee as to the cost of maintenance if we buy this steam turbine?

Mr. Sniffen.—In my paper I believe that I said something about the cost of the maintenance that was found in a station in England, where something like a dozen turbines have been used. It is true the steam turbine has not behind it as many years of history as the reciprocating engine. It has, however, sufficient to show that there is no reason why a steam turbine, properly built, should not cost less in maintenance than a reciprocating engine. I do not know what to say about a guarantee of repairs. You could hardly get such a guarantee on a reciprocating engine or other piece of moving machinery. That feature is gaged not only by the excellence of design and construction, but by the way in which it is handled. I think I can best answer that question by saying that the Westinghouse Company is willing to make for the turbine the same guarantee as to maintenance which it will make for any other piece of machinery it produces. It will be responsible for its sufficiency of design and construction, and it will make good any defects that appear in it within any reasonable time after its installation. What more can you ask?

Mr. Heft.—It depends entirely on how the contract was drawn.

Mr. Sniffen.—Nevertheless, that in substance is about all you can ask of any manufacturer in regard to his machinery. I might say further that there is no hesitation on the part of the manufacturer of the turbine in making guarantees of economy that are a great deal more valuable as guarantees than those made on reciprocating engines. We all know that it is common to ask and obtain guarantees on reciprocating engines, but they are almost a dead letter. The value of the guarantee is practically never demonstrated as far as the engines are concerned; the engines are constructed, and partly assembled in the shop, but it is a physical impossibility to test large engines at the works. The engine is shipped and put into service, and it is only once in a blue moon that we find efforts to make tests on these engines, and when we do there are always many questions introduced affecting the actual results we get in such tests. Now, in the case of the steam turbine, a guarantee is not only made, but it is demonstrated. If you purchase a 1000-kw turbine on the guarantees of efficiency, based upon different conditions involving so many degrees of superheating, so many inches of vacuum, and so much steam pressure, it is a fact that that turbine will be tested for efficiency under those conditions. At the particular works I know most about, there are facilities for making such tests, large boiler plant, superheating and condensing apparatus, and it will be found quite advisable and possible, and will be the regular practice, to put these turbines under service condition tests. I think, therefore, that the assurance had in that way is much greater than we have ever had on reciprocating engines, and I think it is a great step forward in the engine-building practice.

Referring to the question of sub-dividing the cost of the steam turbine, I can only say that the turbo-generator unit itself is to be developed as a complete machine. You cannot have a good turbine and a good generator, and put them together and conclude they are going to make a good unit, unless they have been developed with the view of working together. As our friend has said, there are not many concerns in the turbine business at the present time. There will doubtless be many more. There are a good many generator builders, and doubtless many of them are expecting to build generators for steam turbine use. If any engine builder can build a good steam end, and any generator builder can build a good electrical end, and if they can put them together and make them run, that is all we want.

Mr. Heft.—I think Mr. Sniffen should be commended for his frankness, but I think it would have been a great satisfaction to the members if he had brought some data here with some history behind it, so that we could look upon the question from the commercial side and not from the engineering side. I have been trying to get some data as to steam turbines for a year. I have gone to Hartford three times to see the plant that was erected there, but have never found it running. It was always shut down because they were changing something. I asked the General Electric people to direct me to a plant in operation. They replied that they had one at Schenectady that they were experimenting with, and that they were taking many orders for steam turbines. That won't go with me. I have got to know what you are going to do before I will buy one.

Mr. Beggs.—One of the claims made for the steam turbine is the greater reliability in its regulation; its ability to accommodate itself to varying loads. What the steam turbine will do when it comes to large units is as much a matter of conjecture on the part of the manufacturers of to-day as on the part of those who are considering buying steam turbines. We do know what a reciprocating engine will do, because large machines have been built and are in practical operation. Now, if the steam turbine is going to simplify the matter of regulation, and make it possible to run generators in parallel with a greater degree of success and a reduction of all the contingencies likely to arise which cause trouble, it seems a much simpler matter to build a generator to operate with that piece of apparatus, than it is to build a generator to operate with a reciprocating engine, the governing of which is such a delicate matter. Therefore, I take it that instead of there being one or two concerns in this country, which will build steam turbines, there will be a score of them.

Mr. Heft.—I want to say to the members that I am not opposed in any way to steam turbines, but am a believer in them. I believe a manufacturer coming before this body, should have some data to present, some history regarding the turbine, so that we might know under what conditions we were buying the machines.

Mr. Bean.—If I had the money I don't know that I would buy a steam turbine, but I think the members who have spoken are in the same position as the association was before we adopted electricity. Where did we have any experience before we put our money in? The steam turbine, like the electric motor and generator, is a new thing, and we should not be afraid to put our money in as we were obliged to before. That is the way we developed the other industry. Let us do that now with the turbine.

Col. Heft.—That is all very well if you have the money, but I have had a little experience developing the street railway motor up to its present standard. If I had not been in a position to contract with the electric companies in such a way as to bind them to exploit these machines at their own expense, they would have put the New Haven road into bankruptcy. When I buy a machine to-day I want to know something about it. I want it as good as it can be made, and I want the fellow that made it to pay for the experiment.

Mr. Wyman.—I cannot speak from a technical point of view, but our company has made some investigation into this matter, both

for the larger units and the smaller ones. I want simply to say that we have been treated with the utmost courtesy by the Westinghouse people and the General Electric people, and I think they have been good enough to give us whatever information they themselves possess.

S. A. Palmer, Fall River.—I would like to ask the gentleman whether or not the cost of the condensing plant for use of the turbines is greater than it is with engines.

Mr. Katté.—I want to ask Mr. Sniffen if a central condenser plant could be used in connection with a turbogenerator instead of independent condensers for each unit. For instance, in a small size, up to 750 kw, or in a plant of two or three or less units an independent condenser would be necessary for each unit that is installed.

C. O. Mailloux, New York.—I can answer the question of the gentleman who just spoke from my own information. I am now about installing a plant containing two turbine units, which we intend to operate by the same condensing plant. I see no reason why it would not be possible to operate any number of units with the same condensing plant, though it might be desirable in very large units to have a condenser for each unit. The cost of the condensing apparatus, as far as my investigations have disclosed, is somewhat larger than the cost with an ordinary steam engine. This is due to many reasons. It is also a fact that the exhaust piping has to be done more carefully, and should be of larger diameter. That, however, is offset by many other advantages, one being the ability to use superheated steam of almost any temperature without mechanical detriment to the engine. I have had occasion to design large plants in which I have seriously considered the question of using superheated steam, and found, much to my sorrow, that in many of the engines, as at present constructed, there is a limit to the temperature that can be allowed in high-pressure steam. When you reach very high temperatures lubrication becomes almost impossible. With a steam turbine, on the contrary, there is no limit to the temperature of superheating that you may attain. Its only limit is the melting point of the material of which the engine is made. I see no reason why you could not run a steam turbine at a point where it would be cherry red, and glow in the dark, if there was any advantage in it. Of course, we all know there is a great advantage in superheating steam. I believe that the steam turbine, in that respect, is bound to be a very important element in a new way of using steam. I have observed it carefully for the last five or six years. I first met it abroad and was surprised to see the extent to which it was used, although in smaller units. Until two years ago, I think, no units had been attempted which were of greater capacity than 200 kw. The two units which I have ordered are 400 kw each. My own observations lead me to believe that instead of there being difficulties in the large units, the larger turbines will really be much simpler machines, more practical, as well as a more economical. The reciprocating engine is in a high state of perfection. It is not a machine to be despised, but I believe at the same time that the turbine is the coming machine. I am not prepared to say that I believe that it has arrived, but I believe in a very few years, perhaps in a year, it will be possible for us to say conscientiously that it has arrived and is going to stay. The difficulties of steam turbines to-day are not so much mechanical as electrical. The turbine is admitted by its best friends to-day to require alternating generators, and these machines make considerable noise. You must remember that the first generators which were made, had, in addition to other imperfections, the fault of making a great deal of noise. That fault has been greatly remedied, until to-day we are not complaining on that score. I believe the turbine will doubtless be developed in the same manner. I do not think that there need be any apprehension on the part of regulation. I have myself watched carefully, both here and abroad, and find that the direct regulation of the machine will compare at least favorably with any of the existing reciprocating steam engines, and it is my opinion that on the score of economy we should use it to-day.

President Vreeland.—I will ask Mr. Sniffen briefly to close this discussion and answer the questions that have been asked.

Mr. Sniffen.—The last question, in regard to the character of the condensing apparatus, seems to have been answered. I would only add that we like to have the exhaust pipe large, and leading off in such a way as to get the steam away from the turbine readily, and so long as the pipe is tight and the vacuum maintained, I don't see that it makes much difference which method is employed. I think that the questions that have been asked, and the answers made to them may leave in the minds of the association generally a feeling that the turbine is still something of an experiment. I think I can disprove that. Col. Heft mentioned his visit at Hartford on two or three occasions when he found the turbine shut down for changes. In my paper I very frankly explained the troubles we had at Hartford. That turbine now has been running for some months, whenever they wanted it. I think if Col. Heft were to interview the people who bought that turbine, and who paid for it, and have operated it for several months, he could probably get an assuring answer. I may say that that turbine was sold as a 1500-kw machine, and that it carries from 1800 kw to 2000 kw right along, and it has carried, without any apparent trouble, 2800 kw. I think you have all seen the results of test made by Prof. Robb on this turbine carrying about 1900 kw, running with 150 lbs. steam pressure, about 27 ins. of vacuum and some 50 degs. of superheat, and consuming 19.1 lbs. of steam per kilowatt-hour. That I believe would be admitted to be well within the line of the very best engine efficiency. There is a turbine at Stamford, Conn., of 400 kw which has run since the first of February ten hours a day, carrying its full load, for factory power and lighting. The Westinghouse Air Brake Company has four 400-kw machines that have been running for about three years. That plant is running to-day, and it is doing all the work of the manufactory. Its economy is very high, and its repairs are practically nothing. Now there is some history. History grows quickly, and my friend who has stated that we did not know whether a 5000-kw turbine will operate, should remember that up to three months ago, we did not know that same thing about the piston engine. So far as I am aware, there was not a 5000-kw generator driven by piston engine in this country until those in New York in the Manhattan power house were started up. Prof. Thurston, acting as engineer for the DeBeers' Company, will conduct a series of tests on the two 1000-kw turbines which are now about ready to be shipped, before they go forward, and I believe the data thus secured will be very valuable. We are rapidly adding to our information, and it will not be long before we shall know more about the steam turbine than we do about the piston engine. A large number of these turbines are being built; they are building for people who have investigated them, witnessed their operation, visited the works, seen how they were put together, and in the most careful way formed their own conclusions on which to act. I think that answers the two questions.

HANDLING DAMAGE CLAIMS

President Vreeland.—The next paper is upon damage claims, but the writer is not here. I requested Mr. Beggs to make a few remarks as an opening to this paper. It will not be necessary for me to refer to the paper in any way, or have it read, as Mr. Beggs will discuss some of the points in his remarks on it.

Mr. Beggs.—If I could take issue with some of the points embodied in this admirable paper, I could talk upon it very much better, but there is not a single line in Mr. Starring's paper with which I can take issue. It outlines, in a very general way, the practice we pursue in our own company. Mr. Starring has brought out here the fact that the personal element enters into the adjustment of injuries and damage claims to such an extent that it is almost impossible to realize the difficulties that there can be in the case of adjusting claims for damage between the various companies where that personality is observed. There are one or two points in Mr. Starring's paper that I particularly desire to lay stress upon, and that is the maintenance of an absolutely rigid policy as to dealing with all classes of claims regardless of who may be affected or what influences may be brought to bear to compel or induce the company to make more liberal settlements. It is not an unusual thing to have influential directors of the company, influential politicians, and sometimes directors influenced by politicians attempting to prevail upon the agent to adjust some claim or to allow something in a case of some injury for which there is no legal liability. I may say as far as that is concerned, if the entire board of directors, if all of the officers and all the politicians of the city in which I am located, were to enter into a petition to make some adjustment more favorable than the conditions would warrant, I would not permit it to be done. But when that policy is known throughout the city, it has much to do with deterring the pettifogging lawyers from instituting suits against the company. I might say that in the history of the company I represent, my orders are that in every case where there is a fair belief that the company is liable, to make a settlement if it can be done on any fair basis, and to make it as quickly as possible. As an indication of that I may state that during the year 1890 we had eleven cases tried in court, of which we obtained a verdict in nine of them. One of the two that went against us was afterward reversed by the court of highest jurisdiction in the State. Last year we won nine out of ten cases which was all we had go to the courts. That is the best way of preventing pettifogging lawyers from sandbagging our companies. One of the great difficulties to contend with in dealing with accident cases is to know exactly what the facts are. This is sometimes rendered more difficult, because of the inclination of the employees who may be responsible for the accident to attempt to shield themselves even under a sworn statement. I might say that the practice of our own company

is that we require a sworn statement from both the motorman and conductor in every case. We prepare every case, no matter how trivial, as though it were to go to court, and we require a sworn statement, and we obtain as many sworn statements in the fewest possible hours, as is possible, and as is practicable, from as many witnesses as possible. A great mistake is often made in looking only for evidence for the company. We always look for all the evidence, even the worst that can be said by the adverse party, in order that we may be in possession of all the information that will enable us to determine whether we shall contest that case. My policy, in the treatment of accident claims, is that if we could settle a claim for $10, which would require $100 to defend it, we would far rather spend $100 than to give $10 to any pettifogging lawyer. I will not permit the purchase of any pettifogging lawyer. That policy has been persistently pursued for two years with very beneficial results. There are companies, unfortunately, that will, if they can, pay one of these lawyers to avoid litigation. They say it may cost $100 or more if it be contested. I say, if it cost $500 go into court and beat them by going into court. In this way you will stop it. I have taken issue with our attorneys and have won out on it, that I would either settle or would not settle. At times I have argued, let us settle that case. Well, they would say, we can win out. I would not consent to this because it was not fair. I may say that in the last year our accident cost was reduced to a fraction over 2 per cent of our gross receipts. We carry 4 per cent of our gross receipts every month to the injury and damage reserve. Year before last it was about 29-10, I think. Last year, we reduced it to 21-8 per cent. This year it is less than that, and it is largely due to this persistent pursuit of the policy of the application of fair common sense to the settlement of every case and permitting no case to be settled simply to get rid of it, if you do not feel that you are justly liable. Therefore, I say, gentlemen, do not permit the influence of boards of directors, nor of politicians to affect the settlement of any injury or damage case. Cross-examine your own investigators and employees to find out the real facts in connection with it. We are very often confronted with the evidence of the attorney for the plaintiff and dumfounded to learn that we didn't know what was going on in our own cars. As I said before, we have only lost on an average one case out of ten in the last two years. That we consider is phenomenal, considering the juries before whom these cases are tried.

Mr. Sloan.—I would like to ask Mr. Beggs whether or not he makes all his investigators notaries, so as to obtain the sworn statements from the witnesses. We find it very difficult in many cases to get statements signed. Witnesses object to it.

Mr. Beggs.—I might say that all our investigators, in fact everybody connected with our claim agency, are notaries. Every motorman and conductor in connection with these cases, who makes a statement, has to swear to it, and sign it.

Mr. Bean.—I would like to ask Mr. Beggs whether, in a majority of the cases, the juries are from the city or from the country?

Mr. Beggs.—They are nearly all city jurors. I might add to what Mr. Sloan said a moment ago that every division foreman, or division superintendent, is likewise a notary, so that the statements when taken are finally submitted to them and sworn to. We employ counsel, and pay them a large compensation to defend all cases of injury or damage of whatever kind, either to person or property. We likewise employ a physician. Furthermore, a policy which we inaugurated two or three years ago was to render no medical attention unless there was a case of liability.

Mr. Robinson.—During the last year, the corporation that I am connected with in New York tried 1145 cases. Out of that number, we were successful in about 650. With this great amount of litigation, of course it is very difficult to handle it as Mr. Beggs has suggested. I insist, generally, on the taking of affidavits of the motorman and conductor, but as far as getting a statement in writing and having it signed or under oath, it was very difficult to obtain from a large number of witnesses. It is very difficult in handling a large number of cases to get these statements. Some days we have a large number of reports come in, and it is very difficult for the claim agent to say from reading the report whether the injury is severe or whether there may not be some elements which make it a case of liability on the part of the company. The number of cases of injury some days runs as high as 110 or 115, so you will see it is impracticable at times to adopt all the methods suggested by Mr. Beggs. The only point that I think Mr. Beggs is mistaken in is that relating to the examination by a physician. It seems to me that in all cases where the injured party is not known, an examination by a medical man should be made. One of the great difficulties we have to contend with in New York is the unscrupulous character of the doctors who attend the plaintiff. Old injuries of years' standing are palmed off on the company, if possible. Injuries which develop four or five months after the accident are made to relate back to the accident itself. And the greatest exaggeration is promoted on the part of the plaintiff's doctor, unless there has been an examination by a surgeon of the company. We have in the company's employ six physicians, and even with the hard work they do it is not infrequently the case that we have to try suits in court without a medical examination. I think the best method of handling this class of claims which come in in large quantities, is to have an examination made of everyone of them by a medical man.

There is one point in the paper which I think this association should consider, that is to say, the execution of the general release by the injured party. It must be conceded that it is quite ridiculous to put to the ordinary class of man the general release which is the standard in the United States, containing the legal verbiage such as bills, specialties, and judgments of whatsoever demand and nature, etc. A great many lawyers learned in the profession of the law would have some difficulty in explaining it. It seems to me we should formulate a release which would take care of all these propositions without the great use of verbiage, which is used in the present document. I do not know all the decisions in the United States, but we have had in New York cases which went to our Court of Appeals, and which were decided in some very early cases. In one case of Kuhn vs. Knapp, the receipt read as follows: "Received $40 in full for damages done to us, for all demands, on the 13th of June last." The Supreme Court held this to be a full release, and could not be attacked by the injured party, and the only claim on it was to recover the amount of compensation set forth in the receipt. In another case, I find the following language was used: "Received $50 as a compromise for the full amount of my claim." The court said in that case the use of the word compromise was sufficient to make this appear as a settlement, and there could not be any demand made except to recover the $50. It seems to me that this association might do well to draft some form of general release which might be used by all its members. I have no doubt there would be litigation, but I think in most of the States it has been held that some form of release would be upheld for the benefit of the corporations and greatly to facilitate all claim agents in taking care of these matters.

BLOCK SIGNALS

President Vreeland.—We will now take up the next paper, the title of which is, "Signals for Urban and Interurban Railways." The paper was prepared by G. W. Palmer, Jr., and we would like Mr. Palmer briefly to bring out some of the points in his paper.

Mr. W. B. Potter, Providence.—What provision is made in the signal system for the second or third car on the Old Colony system?

Mr. Palmer.—We have several systems in use on the Old Colony road, one of which is the United States system, which is operated by an overhead contact and does not provide for the counting in of the cars after the block. The first car passes over the contact, sets the signal, and the first car out, unless the trolley is removed from the wire, clears it. That feature I regard as a very valuable one. I think for any system to be reliable and safe, that it should be absolutely impossible to clear the block while there is another car on the block from one end to the other. We have also in use the Randall system, which, as you all know, is simply a circuit of incandescent lamps, hard at one end, and hard at the other end of the block, and which, with us, is more efficient as a lightning arrester than as a signal. I do not know that it should be considered a signal.

President Vreeland.—Mr. Wason, whom I asked to say something on this subject, was unexpectedly called home last night. I then asked him if he would not briefly give some of his views on this subject, and he prepared a paper which I will read.

Mr. Vreeland then read the following statement:

Mr. C. W. Wason, Cleveland (contributed).—Any system of signals that will prevent accident is most desirable in street railway work. This is one of the most serious problems the railway manager had to contend with. In trying any new scheme the question at once arises—If the signals fail to work, will the results be more dangerous than at present? I think that is the general feeling among railroad men. They are anxious to find a signal, but do not feel warranted in trying new inventions.

I do not believe any employee should be discharged on the first offence. He may be an old man in the service, and before you are able to educate a new man he has cost the company much money. I think men running urban and interurban cars should be well paid for their services. You cannot get something for nothing. Men with capacity to fill positions on fast-running cars cannot be hired at the old horse-car rates. A signal system, to be satisfactory, must work at all times and in all weathers, and with any number of cars running in either direction. As lightning frequently burns out lamps on the trolley any system depending upon the main line current must be unreliable.

On the double track roads the end-on collision is eliminated, but rear-end collisions occur even under the best management. The red lantern ought always to be carried on the rear of the car. I think it is required by law in some places. When a car follows the regular the green lantern should be carried on the regular. Where an electric headlight is used the throwing of a portion of the rays in a perpendicular direction often shows the motormen the location of other cars. In this connection, it seems to me that too much attention cannot be given to the braking equipment of the car. This, of course, includes the sand-box and contents. Money spent in eliminating the curves of a road is well invested in more ways than one.

President Vreeland.—Ira McCormick, now with the New York Central Railroad Company, promised to make some remarks on this question, but he also found it necessary to leave last night He promised he would prepare a paper in connection with the subject. He has done so and left the paper with us. His paper is largely of a statistical nature, and he makes quotations from several authorities on this subject. The paper is of considerable value in connection with the proceedings of the association, and we will order the paper printed in the proceedings. It is as follows:

Mr. McCormack (contributed):—At the last meeting of the American Street Railway Association held at New York, a paper entitled: "The Adoption of Electric Signals on Suburban and Interurban Railways of Single or Double Track, and their Economy of Operations," was read by William Pestell, and, after having been discussed at some length, Col. Heft recommended that the executive committee ask the committee on standards to make a report at the next convention of the best signal system. No doubt this committee has looked into the matter very carefully and has some report to offer.

I wish to quote from the address of President G. Tracy Rogers, of the New York State Convention as follows:

"The unfortunate recurrence of some half dozen severe and fatal accidents within the present summer brings to the members of this association, in the most forcible manner, the ever present obligation of ceaseless care and vigilance in the management and operation of their respective roads. It is such a simple matter to lay down a formula for the prevention of such accidents, but so long as human nature is fallible, railway accidents can never be wholly prevented. You all know what elements of care, of prudence, enter into this consideration—substantial construction, complete equipment, good discipline, and last of all, but of the highest importance, constant inspection and accountability. We owe it to the public, as well as to ourselves, and to the reputation of industrial and mechanical intelligence, that every safeguard which experience, caution and liberal expenditure of money affords shall be applied to the carrying on of our several enterprises."

Inasmuch as the president of one of the foremost street railway associations of the United States has brought to the attention of the members of his association not only the number of accidents that have occured during the last year, but very properly calls their attention to what they owe to the public, as the prosperity of a company depends very largely upon the safety of its patrons.

The accidents that he referred to occurred largely on suburban roads. C. R. Barnes, the electrical expert of the Railroad Commission of the State of New York, read a paper at the convention of the New York Street Railway Association, which was held at Caldwell, N. Y., on Sept. 9, 1902, and as all the accidents are reported to the railroad commission, Mr. Barnes was in a position to talk and speak authoritatively on the matter in question.

In his paper he states that the percentage of passengers injured in proportion to miles of road operated in 1898 was .462, in 1899, .480; in 1900, .450, and in 1901, .559. This shows a steady increase in the percentage of passengers injured in reference to mileage of road except in the year 1900, when the percentage was less than in the year previous. There has been an increase between the years 1898 and 1901 of .097, an increase of about 21 per cent.

These figures include all the accidents on all of the electric railroads in the State of New York, including city and other roads, and are compiled from the annual reports the companies made to the railroad commission. It was the intention of the commission to classify these accidents, and also to have made a percentage comparison based on car mileage, but the investigation of the number of serious accidents which have occurred recently has occupied so much time that the commission was unable to make a detailed statement of accidents.

The accidents referred to include the killed and injured resulting from all classes of accidents. The greatest loss of life and injury to passengers on electric railroads in the last five years has been caused by rear-end collisions. The next largest loss of life and injury to passengers has been caused by head-on collisions, and in this comparative line of the causes of death and injury to passengers are the collisions at grade crossings of steam and electric railroads.

After an investigation of the methods of operation of railroads in reference to accidents, he states that it can safely be said that in a large majority of these accidents the primary cause of the accident can be traced to inefficient management of the road, and a large number of the rear-end and head-on collisions, resulting in serious injury to passengers, were caused by motormen running past switches where they were due to meet a car. Several were caused by misunderstanding of train orders transmitted over a telephone system, several by conflicting orders being given by different officers of the company, some by crews attempting to "steal" a switch, several by crews taking it for granted that a car due at a junction of two lines had passed that point, others by a failure of the block signal system.

There were two cases where motormen have seen a car approaching them on the same track and they continued at full speed with the intention of making the other car back up to the switch, the speed continuing on both cars for the same purpose until it was impossible to stop either.

Two were caused by running special or work cars over the road without notice being given to regular cars.

One head-on collision was caused by a passenger car being used as a work car and not being placarded as such; a regular car met it on a switch where another car was due, and supposing it was the regular car crew ran out onto main line and the two regular cars met in a head-on collision.

Among the causes of rear-end collisions may be mentioned the 500-ft distance rule in use on a large number of suburban and interurban railroads; cars coming to a stop at points on the road where the view of an approaching car is limited; cars "running away" on grades and on wet and slippery tracks; regular cars running into work cars standing on the main track without protection; broken trolley wheels leaving the car standing upon the main track without lights; trains being run in sections without the rear end of the first sections being properly protected, and a number of other causes.

The Street Railway Journal of Aug. 16, 1902, in an editorial headed "Block Signal System for Electric Railways," states that several bad accidents which have occurred on electric railways during the past three or four week have called attention to the demand for reliable block signals on electric railways, and states justly that the electric railway is at a disadvantage in some respects with a steam railroad when it comes to the introduction of a block signal system, because on the latter the rails can easily be insulated from each other, so far as the voltage of a low primary battery is concerned. This fact can be utilized in a block signal system, so that the passing of a train over the track can be used to short circuit the rails through the car axles and thus operate the block signal apparatus. On the other hand, the electric railway has an advantage over the steam railroad through the fact that a 500-volt circuit is always available and this current can be employed for signalling purposes in a way not possible on the steam railroads.

The editor did not claim by this that any, or all, of the present methods of block signalling in use on electric railways are perfect, but he did believe that the greatest factor in any system of this kind is the carefulness of the employees, and the maintenance of an intelligent set of rules for the manipulation and use of the safety appliances.

In another editorial in the same journal they state another example of the importance of having some reliable system of block signalling on high-speed interurban electric railways was shown last month, by a very bad head-on collision on the new third-rail electric railway extending from Milan, Italy, to Porto Ceresio. This line, which was formerly operated by steam, extends from Milan north to Lake Lugano, and is equipped with the third-rail electric system. The precautions against accidents have seemingly been fairly good, in that the trains were despatched from regular turnouts by employees of the company, and no train was allowed to proceed beyond a turnout without special orders. The accident in question, however, indicates that any system of this kind which depends upon human judgment is fallible. The station master at Porto Ceresio station, finding that the train which was due at that point at a certain time was late, assumed that he could stop it at the preceding turnout, and telegraphed to the station master at that point to hold the train there. Then, without waiting for an answer, he ordered the train at his station to proceed. The north train, however, had left the other station before the receipt of the telegram, and the result was a bad collision between the turnouts, in which two passengers were killed and thirteen badly wounded. Unfortunately it did not occur to either of the despatchers after the trains had left their stations, and they

knew that an accident was almost inevitable, to switch off the current from the third rail. This, of course, would have brought both trains to a stop, and the engineers of both could have been notified of the condition of affairs. This possibility of the control over a train after it has left the station is one great safeguard in electric operation, although in this particular case no advantage was taken of it.

Mr. H. D. Emerson in an article in the Street Railway Journal of Aug. 16, 1902, on "Block Signal Systems for Electric Railways," states that it would appear that the English "train staff" system, which is operated by nearly all of the single track steam railroads in Great Britain, and which with various modifications is used all over the world, is the best system for operating on single track roads; but he only recommends this until a company is a prosperous one and is earning dividends so that the directors would be willing to have expenditures made for permanent improvements, permitting permanent block signals which can be operated either automatically or by hand. He also states that if operated by hand they should be so arranged that the lever is out of reach of people standing on the ground, so that when it is thrown for the block it cannot be changed until the car has passed the next block. Any block signal system should be so arranged that if any accident happens to it or the line becomes deranged, or the mechanism gets out of order, it will show the danger indication.

He further states that if it is desired to use the block theory and operate by means of permanent signals controlled either by electricity or air at the ends of the block, certain principles thoroughly established by many years of disastrous experience should not be overlooked. The first is that the signal should be simple and should have but two indications; it should say definitely, clear or definitely blocked; that is, it should say "go" or "stop." This can be best accomplished by the semaphore arm. When it is horizontal or extending over the track everyone understands that it means "stop," whereas if it is dropped at an angle it indicates "clear," and the car can proceed. In the same way the lights for night signalling should be position signals; two red lights horizontally placed indicating "stop" and two green lights vertically indicating "clear." This is the result of signal practice the world over, and is understood and is understandable by all concerned in railway operation, and by most of the patrons of railroads. The cost of providing signals as described would not be any greater than the cost of providing the present signals now installed on many lines.

In quoting from the articles as I have, I not only wish to impress upon your minds the importance to you as individuals in managing electric suburban railways, but also the duty that you owe to the public of installing some efficient and safe block signal system on high speed electric roads.

The American Street Railway Association at the last year's convention, held in New York, had a paper on this same subject, and in assigning the subject for the convention this year has realized the importance of block signalling, and from the fact that they have taken this action, in my opinion, no manager who is a member of this association can afford to neglect considering and installing some system of signals which will add to the safety of the patrons of his road.

There are at present two kinds of electric automatic block signals patented. One for overhead trolley lines, whereby the trolley striking a mechanical appliance sets the block signal behind the train, and also sets one ahead of it.

The other is the third-rail system whereby a section of the third rail behind and a section of third rail ahead of the train are used and the power is taken from the third rail setting signals behind and ahead of the train so that it is almost impossible for trains to have head-on or rear-end collisions.

There is, of course, mechanism attached to both of these systems that is liable to get out of order and a collision result therefrom, but the principle, to my mind, to work on, is to adopt something that has some merit of protection. You cannot afford any longer to operate a single or double-track, high-speed railroad without some kind of protection.

For the information of the members I wish to state that the automatic blocking of trains in steam railroad practice within the last year has received more attention from steam railroad managers than it ever has in the past. This is due primarily to the fact that the large trunk lines have acquired larger terminal facilities for the handling of a business which is larger than the capacity of the main tracks under the present manual blocking system. In the past all the manual blocks were placed at considerable distances apart, which was done owing to the large cost of maintenance and help. The traffic handled over lines with such a system was greater than the capacity of the terminals, but, as stated, the terminal facilities have been increased and there must be an increase in the traffic over the main line, and in considering this the managers have taken up the question of placing automatic signals at short distances apart.

Last year at the New York convention I was asked by the then president, Walton H. Holmes, to open the discussion on the paper read by Mr. Pestell on this subject, and I stated at that time, that the suburban roads must go to steam railroad practice in formulating rules and operating signals on the same principles as the steam roads operate them.

In connection with this there is at present in operation on steam railroads block stations operated manually under the Skyes Lock & Block system; the pneumatic system, whereby the semaphores are thrown by air after being manipulated in the towers by men; the Union Switch & Signal Company's automatic system, which is a rail circuit system, and when a train goes out of a block the circuit is broken and the mechanism sets the signal at danger behind the train, and when it passes the next signal it breaks the circuit and sets the signal at danger, and then after going a certain distance it closes the circuit on the second signal in the rear which puts it at safety or clear.

The Hall Signal Company has two systems for automatic blocking. In one they use a track instrument which breaks the circuit, setting the signals after it at danger or safety as the case may be; and the other is a rail circuit system wherein in breaking or closing the circuit the semaphore is put to danger or safety by the use of gas, which is placed at the signal in a large holder, and which has the capacity for a great many operations.

I was connected with the Hall Signal Company when they installed the disc signals on the Galena, Wisconsin & Milwaukee Division of the Chicago & Northwestern Railroad, and on the Chicago Division of the Illinois Central Railroad, for the handling of the World's Fair business. The system put in on the Chicago & Northwestern was the track instrument, and that on the Illinois Central was the rail circuit system. Both systems worked perfectly and they handled the large business due to the World's Fair without a single accident or failure.

The track instrument used by the Hall Company is a lever which works on a balance and is held down by compressor springs, so that when the tread of a wheel runs over the instrument it either breaks or closes the circuit, whichever the instrument is designed for. This system could be used on interurban roads, and is at present installed on the Metropolitan Underground Railroad of Paris and the Fairmount Park Railway of Philadelphia, both of which are operated by electricity.

The third-rail system that I have mentioned is the Farnham system where the circuit is taken from a section of the third rail ahead of and in the rear of the train. While I made an inspection of this system I cannot speak assuredly of it, as its introduction has not been long enough to give the system a thorough trial, but it has a great many things to recommend it.

The Miller system which we are installing in the tunnel in New York City on the New York Central & Hudson River Railroad is a visible signal in the engine cab, which shows the block signal ahead to be either clear or at danger, and it has a great many things to recommend it.

For instance; the signal is in the cab of the engine in view of the engineer or operator.

As a suggestion I would recommend to the committee on standards that they procure the details of operation of the several signal systems used by steam railroads, and their recommendations. As the price of the different kinds of signals varies, a road could then adopt whichever its circumstances would permit.

Mr. Vreeland.—I will call attention to one point in connection with this paper, and that is the recommendation with reference to the proper signal on the rear of cars. On railroads which I have been asked to investigate during the last two years, they were operating cars under steam railroad conditions that prevailed fifteen years ago. I recommended proper signal systems, but these suggestions were not regarded, as they were considered to be the views of a steam railroad rather than of a street railroad man. Each of the electric railroads in question has had a rear-end collision, the least of which cost $10,000; now they are carrying the rear lights, and also the other signals that go with them. There are many methods of signals that are open for inspection throughout the country; and as a result of twenty-five years' of operating experience in steam and street railroads, I can say that there is no more important question to you, not even excepting track construction and car construction, than that of proper methods of car despatching and protection of cars on high-speed interurban roads. As I said at the last convention, there is no collision in the transportation world that can compare with a collision between two electric cars in its dire results. I have had any number of collisions and wrecks to clear up, but in all my steam railroad experience I have never seen as bad a collision between steam trains as between two electric cars. There are two enormous bodies of steel—baggage or express cars—interposed between the points of contact and your passengers on

steam trains, but in electric railroad work generally the front ends of the cars are of the flimsiest construction, although that is the point where the motorman rides, and on many roads passengers are allowed to ride on the seat back of the motorman. In two or three collisions which occurred in New York State last year, and in other parts of the country, there were more people killed and injured than in any steam railroad wreck in the properties I have had to do with, simply for the reason that all on the front seats were killed in the collision. I would rather, if I were operating a railroad, have two steam trains come into collision at 50 miles an hour, than two electric cars at 20 miles an hour. I am satisfied the results would not be so disastrous in the case of the steam cars. It is very important in the interests of interurban operation, before you are compelled by State and municipal regulations to do these things, to take them up and consider them and do them yourselves. The history of steam railroading is open to you. It is not the theory of any one. It is a scientific development. It has developed from the staff system up and onward. I operated as a conductor twenty-five years ago under the staff system of signalling spoken of in the paper, and this reference reminded me of something that occurred on the New Haven road. They used the staff system on a single track across one of the bridges, and there were positive orders that no trains should proceed over the bridge unless the engineer had the staff in his possession. It was a brass staff. A train came across the bridge and the fireman handed the staff to an engineer on a train which was about to proceed over the bridge, and the staff fell through the trestle and went into the river. The road was tied up until some method was discovered of getting across the bridge without the particular brass staff that had been used. Col. Heft will undoubtedly defend the New Haven road.

Mr. Heft.—What you say only goes to show what a perfect system we have on the New Haven road.

Mr. Dickinson.—There seems to be a mistaken idea here that the steam roads have a perfect system of signals. They have not; neither have the street railroads. They all depend on human agency, and that will fail sometimes. In the steam practice the desire and the effort have been to reduce the number of chances of misunderstanding by reducing the number of people who control the movement of trains. In Seattle we are doing the same thing. We originally installed our interurban service with a telephone system for signalling, and we are about to take the telephone out and put in the telegraph, because we find it impracticable to protect our train orders by telephone. Persons who have no right to answer the telephone will do so, and the despatcher will send orders and they get mixed up. We are going to run under the standard rules governing train orders, both as to lights and signals; fuses, rear lights—all in accordance with the standard system of train despatching.

DISCIPLINE OF EMPLOYEES

President Vreeland.—We have been fortunate in having sufficient time at our disposal to give each paper and topic presented ample attention. There is only one paper left. It is the paper on "Discipline of Employees by the Merit System," by W. A. Satterlee. There is little in the paper except what is statistical, and as it has been distributed to the members there will be no need for reading it. I ask Mr. Harrington to open the discussion on this paper.

Mr. Harrington, Camden, N. J.—The paper just presented by Mr. Satterlee is a valuable contribution, and is a clear and concise statement, indicating the tendency of recent practice in disciplinary methods. The interest taken in the subject of discipline, the method, the rule of procedure and the relation the employer should bear to the employee has never been greater than at the present time. The individuality of the employer has much to do with the results of any system of discipline. A system is not the panacea. It is conceded by all that the old method of suspension for violation of rule was not fruitful of results. Certain facts have become patent as being essential to any system of discipline, to wit:

The keeping of a thorough history of each employee from the date of his employment, showing clearly all irregularities, violations of rules, relation to complaints, accidents, and secret service.

The employee to receive a hearing, to be treated with consideration, to be given opportunity to explain under proper conditions and surroundings his position, before discipline be ordered.

Any system in which the employee is disciplined conforming to the thirty-two features will conduce to better feeling and be followed generally by better results.

Experience has dictated that in exercising discipline great care must be observed in not passing judgment until all facts have been thoroughly investigated. Experience has furthermore demonstrated that the misdeeds, violations of order, breaches of discipline of the employee, in some way or another, are brought to the attention of the employer. Whereas, the commendable acts, the little refinements of courtesy, the observance of duties and rules, that may be the practice of the employee are seldom known and are really and legitimately expected. Threats are not conducive to good discipline, nor producing of good results. What good can possibly come from balancing bad against good? Bad is from the very nature of things bound to crop out and be known, while good is less apparent, less known and never as strenuously obtruded upon us. Wherein does the good, conscientious, able, trustworthy employee profit from a system of merits and demerits? It does not seem that the merit and demerit system reaches the core. I have in mind men who would not care in the slightest whether they had ten or one hundred demerits, or merits; they would run the chances of detection in just the same fashion that certain conductors do in the matter of irregularities in fare registration. However, let these men actually lose something, though it be but a little, in their standing in the grade, class or seniority—it need not, and in fact better not, be a threat of discharge—and what is the result? The punishment is immediate, the penalty is paid at once, the evil-doer suffers, and what is more advantageous, the worthy, painstaking employee receives immediately what he is entitled to, recognition and advancement.

I have tried the suspension system, the merit and demerit system, and abandoned them both after careful and persistent trial and effort. The demotion system was first put into effect upon our railway just about two and a half years ago, and has been gradually developed into a thoroughly operative, practical system and conducive to the best results. Under this system an employee for any irregularity is notified that be will be demoted one or more points on the seniority list if proper explanation be not made on or before a specified date. This notice with an account of the irregularity is posted on the bulletin boards at the meeting-places of the men. This usually results in the men whose names are posted arranging to meet the general manager, affording an excellent opportunity to exercise judgment in enforcing discipline. The wholesome effects are most noticeable, and efficient and reliable employees under this system forge gradually and surely ahead, obtaining the best and most profitable runs at the disposal of the company, and in such men the general stability of the working force is maintained against any possible disaffection upon the part of the man suffering from demotion. It can be seen that this system, while not directly taking cognizance of the efficient employee, in fact does take the most pronounced action in his behalf.

President Vreeland.—I will read the following announcements:

ANNOUNCEMENTS

The pronounced success which has characterized the business meetings of this convention has been due to the fact that papers have been presented upon subjects which are of vital importance to every street railway, no matter what its environments may be, and these papers have been actively discussed by a large number of our members. For this reason we hope that all of our members will give thought to the matter of subjects on which papers shall be presented next year. The secretary will issue a request to members, asking for suggestions as to topics for papers, and we hope the members will give the subject careful consideration, and that when they suggest subjects they will also indicate a proper person to write on the subject.

John G. Holmes, of Pittsburgh, one of the past presidents of the association, to whom I extended an invitation to be present at this meeting, sends a letter in which he regrets his inability to be present on account of business engagements, recalls his many pleasant acquaintances among the members and wishes to be remembered to them.

Secretary Penington desires to thank personally the writers of all the papers for their promptness in forwarding copies of their papers so that they might be printed in ample time before this meeting. This helps the work of the secretary very greatly. All of the papers were received about five weeks before the date of this meeting, which enable the secretary to have them in the hands of the members fully two weeks before the convention.

President Vreeland.—We will have the report of the committee on resolutions.

REPORT OF THE COMMITTEE ON RESOLUTIONS

The following report was presented by Messrs. Bean and Dickinson, and was adopted:

Resolved that the thanks of this association be tendered to Jere C Hutchins and his able assistants for their efforts in our behalf during the convention;

To the exhibit committee, especially its chairman, John H. Fry, for the very complete arrangements made for the exhibit and the satisfactory manner in which they were carried out;

To the supply men for the magnificent manner in which they have conducted their exhibits at this meeting;

To the local press for the very complete and intelligent reports of the transactions of the convention;

To the several passenger associations which have granted the reduced rate of fare and a third to the persons attending this meeting;

To the president and the other officers of the association for the admirable manner in which the affairs of the association have been conducted during the last year, and to all who have in any way contributed to the success of this most interesting convention.

NEW OFFICERS

The committee on nominations then presented the following report:

Your committee on nominations respectfully report recommending the following officers for the ensuing year:

President, Jere C. Hutchins, president Detroit United Railways, Detroit.

First vice-president, W. Caryl Ely, president International Railway Company, Buffalo.

Second vice-president, W. Kelsey Schoeff, president Cincinnati Traction Company, Cincinnati.

Third vice-president, P. S. Arkwright, president Georgia Railway & Light Company, Atlanta.

Executive committee.—H. H. Vreeland, president Metropolitan Street Railway Company, New York; R. T. Laffin, general manager Worcester Consolidated Street Railway Company, Worcester; Andrew Radel, vice-president Middlesex & Summerset Traction Company, Bridgeport; Walter P. Read, vice-president Consolidated Railway & Power Company, Salt Lake City; Willard J. Hield, general manager Twin City Rapid Transit Company, Minneapolis; secretary and treasurer, T. C. Penington, treasurer Chicago City Railway, Chicago.

The committee has received but one invitation for the place for holding its next annual meeting. Mr. J. W. McFarland, superintendent of the Chattanooga Electric Railway Company, Chattanooga, Tenn., appeared before the committee and extended an invitation on behalf of his company and the city. Owing to the limited information in possession of your committee, we do not feel warranted in recommending Chattanooga as the next meeting place, but do recommend that the matter be referred, with full power, to the incoming executive committee.

On motion of Mr. Root, of New York, the secretary was authorized to cast the ballot of the association for the officers named by the nominating committee. The secretary cast the ballot and the gentlemen were declared duly elected.

President Vreeland.—We will adjourn, to meet at the banquet tonight, and in accordance with the usual custom, the installation of the new officers will take place at the close of the banquet.

Officers of the Accountants' Association

At the meeting held Friday morning of the Street Railway Accountants' Association of America, the following were elected officers of the association for the coming year:

President—Henry J. Davies, secretary Cleveland Electric Railway Company, Cleveland, Ohio.

First Vice-President—Irwin Fullerton, general auditor Detroit United Railway, Detroit, Mich.

Second Vice-President—D. Dana Bartlett, general auditor Boston & Northern Railroad Company, Boston, Mass.

Third Vice-President—J. B. Hogarth, auditor Denver City Tramway Company, Denver, Col.

Secretary and Treasurer—W. B. Brockway, consulting accountant, Birmingham Railway, Light & Power Company, 25 Broad Street, New York.

Executive Committee—The officers and H. C. Mackay, comptroller the Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; O. M. Hoffman, treasurer Conestoga Traction Company, Lancaster, Pa., and Elmer M. White, cashier Hartford Street Railway Company, Hartford, Conn.

A fourth member of the executive committee was not elected, but his selection was left to the committee, pending the determination of the next place of meeting.

On Dec. 2, in San Francisco, there is to be held a special election for the purpose of submitting to the people propositions for acquiring the Geary Street Railroad at the expiration of the present franchise on Nov. 6, 1903. All will await with interest the result of this vote.

The Banquet

As usual the banquet was the crowning feature of the meeting, and its most important social event, and on this occasion it was an unusually brilliant assemblage. There were at least 400 in attendance, about one-third of whom were ladies, and the scene presented was unusually attractive. The banquet was given in the large dining-room of the Cadillac, which was decorated for the affair. From the marble pillars which divide the mirrored room into sections, long, drooping streamers of smilax were strung to all sides of the room. The middle of each table was a solid bed of American Beauty roses set in their own foliage, and there were also huge clusters of these flowers on every table.

The tables were placed in four rows, with the president's table at the head, facing the gathering. President Vreeland acted as toastmaster, and at the table beside him sat the newly elected president, Jere C. Hutchins, Mayor Maybury, Gen. Russell A. Alger, Secretary T. C. Penington, W. Caryl Ely, of Buffalo; Michael Brennan and James T. Keena, of Detroit, and others, speakers and officers of the association.

President Vreeland, in opening the proceedings, spoke of the work done by the companies represented in the association, the character and value of the properties operated, and the services performed. He formally installed the new officers of the association and bespoke for them the same hearty co-operation which he has received. The newly elected president, Jere C. Hutchins, received an ovation in which the Detroit representatives joined most heartily. Mr. Hutchins responded, thanking the members of the convention for the great honor which they had conferred upon him, and through him, on his company, the city and the State. He also referred to the work which electric railroading is doing for mankind. Mayor Maybury responded to the toast, "The Growth of Detroit," and thanked the convention for honoring President Hutchins with the highest office in its gift.

Michael Brennan responded to the toast, "How the People Would Run a Street Railway," and spoke particularly of the newspapers. The next speaker, W. Caryl Ely, of Buffalo, spoke on "The Future Electric Railway," and James T. Keena, of Detroit, spoke in a humorous vein on "The Trolley; Its Future State," referring to possibilities in the worlds we know not of. The programme was interspersed with singing by a quartet and soloists.

In conclusion Mr. Brennan moved a vote of thanks to the toastmaster, Mr. Vreeland, and in acknowledging the honor Mr. Vreeland thanked all who had aided in making the convention such an unqualified success.

Master Mechanics' Association

A notice posted near the main entrance to the convention hall at Detroit stated that all master mechanics in attendance at the convention were invited to meet at Station A of the Detroit United Railway at 3 o'clock on Thursday afternoon. In acceptance of this invitation about a dozen or fifteen gentlemen attended the meeting, the purpose of which, as announced by Thomas Farmer, superintendent of motive power, was the organization of an association to be composed of the master mechanics and electrical engineers of the different companies. The proposition met with general approval, and at the meeting a committee of six members was appointed to meet on Friday at the office ol Detroit United Railway, 12 Woodward Avenue, and take further action. The name suggested for the association, but not formally adopted, was "The Mechanical and Electrical Association of Electric Railways."

The committee elected at Thursday's meeting consisted of Thomas Farmer, superintendent ol motive power of the Detroit United Railway, chairman executive committee; E. W. Olds, superintendent of rolling stock, Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; William Pestell, superintendent of motive power and machinery, Worcester Consolidated Street Railway Company, Worcester, Mass.; G. W. Palmer, Jr., electric engineer, Old Colony Street Railway Company, Brockton, Mass.; C. A. Brown, master mechanic, Toledo Railways & Light Company, Toledo, Ohio; W. O. Mundy, master mechanic, St. Louis Transit Company, St. Louis, Mo.

At the meeting on Friday, it was voted to increase the membership of the committee and to hold another meeting at Cleveland on Jan. 12, 1903.

The Columbus, Delaware & Marion Railway will inaugurate "cold weather" trolley parties to the new hotel at Stratford. A "cold weather" trolley party sounds like an innovation in electric railway business, but it also sounds like a good way to develop new business.

THE EXHIBITION AT DETROIT

THE AMERICAN BLOWER COMPANY made no exhibit at the convention hall, but those of the delegates who visited the company's plant at Detroit were impressed with its magnitude and the excellent facilities there provided for manufacturing the blowers, fans, engines, etc., for which the American Blower Company has established so enviable a reputation. The company will gladly send a handsome booklet containing illustrations of its various departments to any one interested.

THE AMERICAN ELECTRIC SWITCH COMPANY, of Pittsburgh, was represented by W. S. Berry, who made an exhibit in connection with C. J. Harrington

N. A. CHRISTENSEN, of Milwaukee, made a separate exhibit from that of the Christensen Engineering Co., in the annex. Here he showed a Christensen motor-driven air compressor for use in shops, power houses, etc., for furnishing compressed air for cleaning purposes, for pneumatic tools, etc. Mr. Christensen stated that he now had facilities for turning out these self-contained compressors in sizes up to 175-hp. The motor for driving the compressor is provided with the standard type of automatic cut-in and cut-out control, which throws the load onto the motor direct without resistance control.

THE CLIMAX FENCE POST COMPANY, of Chicago, was represented by H. E. Overstreet, general manager. The patented posts of this company consist of a steel top, for strength, with a clay base to prevent destruction by corrosion.

CRANE COMPANY, of Chicago, had its usual line of high-pressure steam valves and flanges on exhibition, in charge of Captain George A. Hurd. A flange in which the joint between the flange and wrought iron pipe was made by rolling the pipe outwardly into grooves in the flange was shown. This rolling is done by machinery, developed by Crane Company, and the joint seems likely to be the most popular one yet devised, since it is so easily made with special machinery and so tight.

THE UNION STOP & SIGNAL COMPANY, of Fall River, Mass., has an apparatus for enabling a despatcher on an interurban road to stop a car by means of a danger signal at any siding. This is done by automatic counting apparatus in the signal. But two wires in addition to the usual despatchers' telephone circuit are required. A time stamp system of triplicate train orders is used in connection with the system, and a record is kept at each telephone booth of the orders. No order can be taken from the booth without being first released by the despatcher. O. W. Hart, general manager, was present explaining the system.

THE G. P. MAGANN AIR BRAKE COMPANY, of Detroit, of course had an excellent exhibit in the form of its system in actual operation on all the interurban lines of the Detroit United Railway. A special car with Magann air brakes was also at the service of all those desiring to make use of it. E. C. Rutherford, general manager, put up a small exhibit in convention hall, consisting of a miniature car equipment, a 1-hp air compressor, and a large storage tank for use where the air is compressed. This tank was 15½ ft. high by 36 ins. diameter, and a smaller tank was also provided for the first storage of the air and as a place for the newly compressed air to drop its moisture. The space was surrounded by a fence of brake cylinders. The company was also represented by Vice-President J. C. Grace.

THE STUART HOWLAND COMPANY, room 320, Cadillac, was ably represented by H. W. Smith from the Boston office and H. De Steese, of the New York branch office. A full line of overhead specialties were shown at the Cadillac, consisting chiefly

LOOKING FROM THE GALLERY OF EXHIBIT HALL

of standard types of flexible brackets and their now well-known forms of overhead suspensions, for both single and double trolley, of which 808 miles have been sold and delivered within the past seven months. The parlor was constantly filled with street railway delegates, who were loud in their praise over the "tasty" arrangements. Each guest was appropriately decorated with a unique souvenir, in the form of a medallion, bearing the legend "808, Detroit, 1902," to which was suspended a miniature facsimile of their famous "III rib" trolley wheel, which is now known throughout the country for its excellence in wearing qualities.

THE STANDARD POLE & TIE COMPANY'S exhibit consisted of the corner posts at the space occupied by the Consolidated Car Fender Company, together with sections of their Southern white cedar or juniper poles. They also had samples of Florida heart pine, the timber of which their cross arms and octagonal poles are manufactured. E. G. Chamberlin, the vice-president of the company, was in charge of the exhibit, and the secretary and treasurer, Fred. L. Merritt, was also in attendance. A neat little souvenir in the shape of an octagonal pen-holder, a fac-simile of its poles, was distributed.

THE ARMSPEAR MANUFACTURING COMPANY, of New York, made an exhibit of "Armspear" steel tail lights, switch-lights and hand lanterns, which served to impress the casual visitor with the importance of interurban work. C. E. Nicol, of New York, and C. K. Freeman, of Freeman & Buckley, Western representatives, Chicago, were in attendance.

HAROLD P. BROWN, of New York, exhibited, for the first time, a new plastic bond called the plastic socket bond, which consists of a flat copper plate with ball-tipped lugs on one edge, which goes inside the fish-plate. The lugs rest in holes drilled into the base of the rail. The plastic plug bond used in the Baltimore & Ohio tunnel at Baltimore, was also shown. The usual motor generator testing, set with laboratory standard testing instruments, which Mr. Brown has had at several previous conventions for testing conductivity of bonds, was installed and in operation. A novel device, rather out of the previous lines followed by Mr. Brown, was a motorman's mirror, so mounted at the right of the motorman on the front platform as to enable him to see the rear step. The mirror necessarily hangs out further than the car but is mounted on a swivel so that in passing obstructions it will swing back. An iron cross-bond, with plastic plug bonds at each end, was also shown.

THE FEDERAL SUPPLY COMPANY, of Chicago, represented by J. E. Gavitt, showed samples of the Rogers improved journal box packing, which is a mixture of steel wool and cotton waste, which tends to prevent hot boxes. The Rogers packing receptacles, a steel netting for holding the packing, enable the packing of a journal with much less waste than would otherwise be required.

MESSRS. PORTER & BERG, of Chicago, were both on hand, and though making no exhibit themselves, the goods they handle were shown by various companies. E. R. Mason, the New York representative, was also there.

THE NEW YORK SWITCH & CROSSING COMPANY, Hoboken, N. J., was represented by M. W. Conway.

THE GREEN ENGINEERING COMPANY, of Chicago, had President P. Albert Poppenhusen looking after its interests.

THE CONSOLIDATED CAR FENDER COMPANY, of New York, exhibited all four of its types of fenders, including the one for interurban cars. The Campbell snow broom and the Millen car-step lifter were also included in the exhibit. The extent to which this company controls the successful fender business in this country is shown by the large number of roads

A GENERAL VIEW OF THE EXHIBITS

using the Consolidated fenders, and the few good fenders offered by other companies. L. W. Haines and George Hollingsworth explained the fenders and other devices to visitors.

F. H. LOVELL & CO., of New York, were represented by A. Hall Berry, general manager. They had on exhibition all kinds of overhead material manufactured by themselves at their own plant at Arlington, N. J.

THE NILES CAR & MANUFACTURING COMPANY, of Niles, Ohio, was well represented in the person of George E. Pratt, assistant general manager and contracting agent. Mr. Pratt, in addition to his other responsible duties with the company, has just been appointed purchasing agent.

THE PITTSBURGH REDUCTION COMPANY, of Pittsburgh, exhibited a full line of aluminum cables, both bare and insulated, which made this booth one of the brightest in the exhibition hall. The company was represented by Secretary and General Manager Arthur V. Davis, of Pittsburgh; J. A. Rutherford and C. M. Harris, of Cleveland; Ernest H. Noyes, of Chicago; William Hoopes, electrical engineer; Safford K. Colby, manager New York office; Percy Hodges, Boston, and A. K. Laurie, general sales agent.

THE MAYER & ENGLUND COMPANY, of Philadelphia, was represented by C. J. Mayer, president; W. A. Armstrong, Philadelphia; J. M. Gallagher, of Chicago, and W. A. Cockley, of New York.

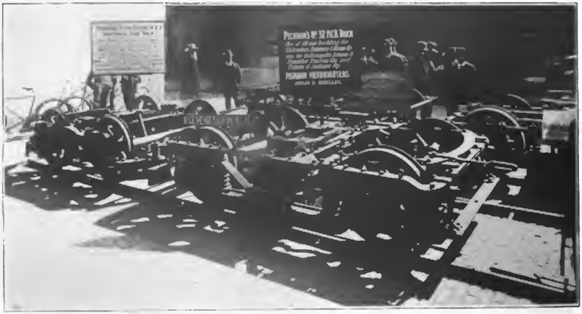
THE AMERICAN OIL FILTER COMPANY, of Philadelphia, distributed circulars describing its automatic oil filters.

THE R. D. NUTTALL COMPANY, of Pittsburgh, exhibited a full line of gears, pinions, trolley bases and bearings. The company was represented by F. A. Estep, president and treasurer; George W. Provost, of Pittsburgh; W. A. Armstrong, of Philadelphia; the Frank Ridlon Company, of Boston; Arthur S. Partridge, of St. Louis, and J. H. McGill, of Chicago. The new book on gearings this company is publishing contains a great quantity of valuable engineering data.

THE PULLMAN AUTOMATIC VENTILATOR COMPANY, of York, Pa., was represented by William Rufus Reitzell, general manager, and by Lowell Williams, special representative. These gentlemen exhibited their ventilator on the special train from New York, and were awarded for doing so by several orders, received before reaching Detroit. They also equipped with their ventilator system a Detroit car, which was run on tracks near the hall, and attracted much attention from the delegates.

GEORGE S. HASTINGS, the Cleveland sales agent, who handles Smith heaters, St. Louis cars and numerous other lines, was in constant attendance. His tin "cricket," labeled "I chirp for Hastings," was one of the most popular souvenirs of the week.

MERRITT & CO., of Philadelphia, exhibited their expanded metal lockers, and were represented by Stephen Morris. The peculiar advantages of the Merritt lockers are their durability and



THE EXHIBIT OF THE PECKHAM MANUFACTURING COMPANY

EXHIBITS OF THE DUFF MANUFACTURING COMPANY, GILES S. ALLISON AND THE UNITED STATES STEEL COMPANY

neatness; the freedom with which they admit light and air; the ease which they are kept clean and the adequate protection which they furnish. They are already in use in the power stations and car houses of some of the largest electric railway systems of the country.

THE STERLING LUBRICATOR COMPANY, Rochester, N. Y., had several styles of its force feed lubricators in actual operation in a prominent stand on the main floor. The device has a positive feed, it will pump against any pressure and can be regulated to supply any amount of oil to any cylinder. An automobile lubricator was featured. J. Sherry was in charge.

GEORGE F. BRANDAU, of Utica, N. Y., exhibited an automatic life guard and combination car brake. One of the devices was attached to a Detroit United Railway car, and many of the delegates witnessed an actual demonstration as to its advantages on Larned Street Friday afternoon.

DALLETT & CO., Philadelphia, dealers in new and second-hand material, showed a sample of a G. E. 1000 motor, a number of which they have for sale.

THE GREAT WESTERN SMELTING & REFINING COMPANY, Chicago, was represented by Nathan Alper, who exploited the XXXX nickel babbitt and copper hard babbitt.

THE FEDERAL MANUFACTURING COMPANY, Cleveland, represented by A. J. Johnson, showed the Federal trolley pole and the Johnson trolley retractor. The device draws down the trolley pole full 15 ins. below the line whenever the trolley wheel leaves the wire. The device attracted much attention. The Ludlow Supply Company, Cleveland, are agents for the device.

THE GARRY IRON & STEEL COMPANY, Cleveland, was represented by E. C. Powers, secretary, who assisted the Ludlow Supply Company in explaining the features of the Garry pneumatic car jack, pit jack and Dolly bar.

THE BETHLEHEM STEEL COMPANY, South Bethlehem, Pa., showed several samples of hollow-forged open hearth steel, and distributed a fine pamphlet describing and illustrating its product in detail. Clifford B. Hansen was in charge.

THE AMERICAN TRACKBARROW COMPANY, Lowell, Mass., presented a wheelbarrow with flanged wheel for running along track, and a pony car and timber track truck. Edward B. Peirce, manager of the company, demonstrated the articles.

THE VAN DORN & DUTTON COMPANY, of Cleveland, showed a new track cleaner, an automatic lift, and gears and pinions of various kinds. W. A. Dutton, secretary and treasurer, was in charge of the exhibit.

THE VAN DORN-ELLIOTT ELECTRICAL COMPANY, which is affiliated with the above, showed a rewound armature field coils, armature coils and commutators. The stand was nicely decorated. W. A. Dutton and J. N. Elliott were in attendance.

THE UNIVERSAL SANITARY CUSPIDORE COMPANY, Worcester, Mass., was represented by N. R. Thibert and N. J. Beaudin. On exhibition were several styles of their sanitary cuspidores for car and office use. The former are built into the car floor, and covered with grating flush with the floor. They are connected in parallel to a single pipe, and can be flushed at the barns or end of the line by attaching a hose.

THE NATIONAL LEAD COMPANY, New York, was represented by F. B. Pierson, the Detroit manager; Walter H. Baker, St. Louis; Arthur Jones, Cincinnati; Richard L. Weithas, New York; Walter F. Marks, Chicago, and A. G. Marks, Detroit. The exhibit consisted of bar and wire solder, coach and car lead, Phœnix babbitt metal journal bearings, armature bearings and motor-axle bearings. Samples of motor-axle bearings, lined with Phœnix babbitt, which had been in use for many months on Detroit United cars, were shown.

EXHIBITS OF ELECTRIC STORAGE BATTERY CO., STANDARD PAINT CO., STANLEY ELECTRIC MANUFACTURING CO. AND GOLD CAR HEATING AND LIGHTING CO.

THE STANDARD VARNISH WORKS, New York, showed a number of armature coils insulated with its various varnishes and compounds. J. C. Dolph was in charge.

THE PANTASOTE COMPANY, New York, showed its well-known Pantasote and Climax curtains and curtain fixtures for open and closed cars. The stand was handsomely decorated with palms. John M. High represented the company.

THE ADAMS & WESTLAKE COMPANY, Chicago, New York and Philadelphia, made an exhibit of various kinds of oil and electric headlights, lanterns, classification lamps, switch and tail lamps, Adlake and Kling brake handles, and a contratwist door fixture for double doors. A large electric headlight in operation attracted attention to the stand. E. L. Langworthy and A. S. Anderson, of Chicago, and James A. Foster, of Philadelphia, were present.

THE HALE & KILBURN MANUFACTURING COMPANY, New York, had on exhibition fifteen seats of various kinds. A specialty was made of its canvas-lined rattan seats and a new seat, showing steel construction throughout. H. I. Bigelow entertained customers.

THE CURTAIN SUPPLY COMPANY, Chicago, had a very comprehensive exhibit of curtains, curtain materials and curtain

A GROUP OF ATTRACTIVE EXHIBITS

fixtures for open and closed cars. This company claims to hold important basic fundamental patents on curtain fixtures. It supplies a majority of the leading traction companies of the country, and in many cases furnishes roads with original and exclusive designs of curtains. It has recently opened an office at 2131 Park Row Building, New York city, in charge of A. L. Whipple, sales manager. W. H. Forsyth, general manager of the company, was in charge of the exhibit.

THE STANDARD PAINT COMPANY, New York, showed samples of P. & B. paints, electrical compounds, tape, car roofing and insulating papers. J. C. Shainwald, Western manager, B. C. Beckman and E. R. Willard, of Chicago, were in charge. Favored visitors were presented with a very fine leather card case.

THE NATIONAL CARBON COMPANY, Cleveland, had its usual complete exhibit of various products of the Cleveland and Sandusky plants. Among other goods were shown Partridge, Solar and National brushes in various grades, including Columbia wire gauze and plumbago types; Columbia arc carbons for headlights and enclosed arc lighting; also auto cells and Columbia dry cells for automobile and gasolene engine sparking. James Partridge, manager of the Partridge works, Sandusky, and R. K. Mickey, of Cleveland, were in charge. A useful article in the shape of a letter opener was distributed.

EXHIBIT OF THE J. G. BRILL COMPANY

THE D. & W. FUSE COMPANY, of Providence, R. I., was represented in a neat exhibit, made by A. Hall Berry, 100 William Street, New York.

THE KALAMAZOO RAILWAY SUPPLY COMPANY, Kalamazoo, showed samples of the Kalamazoo ratchet and friction jacks, models of the Kalamazoo cattle guard, and the Kalamazoo hand-car wheel, which is built with malleable center and weldless steel tire.

THE ROOT TRACK SCRAPER COMPANY, Kalamazoo, Mich., exhibited the Root track scraper and a flange cleaner. The two devices are separated, the flanger being in front of the scraper. They may be fastened either to the body of the car or to the trucks. The flanger is made for any style of rail, and it may be adjusted and set by means of a lever for any pressure or depth of snow. F. N. Root, manager, was in charge. The company will shortly bring out a new sleet cleaner for the trolley wire.

THE GLOBE TICKET COMPANY, Philadelphia, showed various styles of tickets, transfers and order books. A feature was made of a new form of transfer, on which the hour and minutes may be punched at one time. A souvenir cigar cutter was distributed to the company's friends by W. C. Pope, D. C. Griffiths, P. C. Snow and H. N. Brown.

THE NATIONAL TICKET COMPANY, Cleveland, had samples of tickets and transfers. A. J. Reynolds and C. F. Bates were kept busy distributing small bottles of "ink," which for some reason or other were in great demand.

THE LUMEN BEARING COMPANY, of Buffalo, was represented by E. P. Sharp, manager of the street railway department, who explained the advantages of Lumen bronze bearings and trolley wheels, Alpha bronze check plates and Lotus lining metal. Samples of new molds for the G. E. motors on the Manhattan Elevated and Aurora, Elgin & Chicago high-speed cars, were displayed.

THE PITTSBURGH BLUE PRINT PAPER & MANUFACTURING COMPANY, Pittsburgh, represented by S. B. Whinery, general manager, and Robert Gibson, salesman, demonstrated the new Pittsburgh transfer ticket machine. This is secured on the wall on the rear platform, and by turning various thumb screws the conductor sets the machine for the desired streets, time and direction; then by turning a crank the type is inked, impression made on a roll, and transfer clipped off. The transfers are counted and indicated by a dial at the side. The date line may be locked before starting, and the type cannot be turned back. The machine may be set for any predetermined hour, and it is impossible to turn beyond this point. It is claimed that by the use of this device it is impossible to issue a fraudulent transfer, and it is obviously impossible for a conductor to dispose of a package of blanks.

THE PETER SMITH HEATER COMPANY, Detroit, had a handsomely furnished booth at the left of the main entrance. In the center was a large painting of the "King of Car Heaters," illuminated by a frame of incandescents. Three styles of this well-known heater were shown. The heaters on the Detroit United Interurban cars and the heater installed in one of the Brill cars on trackway formed part of the exhibit. Peter Smith, president, and E. W. Smith, superintendent, were in charge and entertained their friends. George S. Hastings, the Cleveland supply man, who is general sales agent for the Smith heater, spent much of his time at this stand.

THE ATLAS RAILWAY SUPPLY COMPANY, Chicago, had a large exhibit, consisting of Atlas rail joints and braces, straight line and compromise or step joints, raised joints for paving purposes, raised braces, tie plates, Atlas primer and surfacer for coaches, paints for trucks, trolley poles, car roofs, etc. A feature was made of the new Atlas trolley sleet cutter, a simple and inexpensive device, which can be attached without removing the trolley wheel. J. G. McMichael, president and treasurer; R. B. Kent, vice-president and secretary, and C. D. Porterfield, engineer, were in attendance.

THE CLIMAX STOCK GUARD COMPANY, Chicago, had on exhibition samples of its well-known Climax vitrified clay stock guard, which is in use on a number of important interurban lines. H. E. Overstreet was in charge.

THE DORNER TRUCK & FOUNDRY COMPANY, Logansport, Ind., had its exhibit on the trackage on Larned Street. The feature was the new Dorner high-speed truck, which shows several good features. It has large springs on each side of the journal boxes, working in unison with elliptics. The top frame is extremely rigid, there being a truss-steel bolster in the center. It is claimed this is one of the easiest riding trucks in the market. The Burke safety switch lock was also shown. This device is especially advantageous for roads employing double-truck cars, as the switch remains locked in position until turned by the next conductor. The well-known Reliance track cleaner was another feature, demonstrated by H. A. Dorner, sales agent for the company.

THE SPRINGFIELD MANUFACTURING COMPANY, Bridgeport, Conn., exhibited its car-wheel grinding outfit in the annex. Both wheels are ground on the axles at once. In shop practice the wheel turning device and the grinders may be operated from a counter shaft by a single motor, but in the exhibit three motors were used. The wheel head is on a compound swivel and slide, so that the cut may be made at any angle. G. W. Jackman was in charge.

THE LUDLOW SUPPLY COMPANY, Cleveland, exhibited several of the line for which it is sales agent; others were displayed by the manufacturers. The feature was a model car arranged for demonstration of the pneumatic car lift, used for

raising cars and removing motors, built by the Garry Iron & Steel Company, Cleveland. Another center of attraction was the Johnson trolley retractor, which instantly pulls the end of the pole down to 15 ins. below the overhead construction. Chisholm & Moore rail braces, chair braces and joints; Milwaukee reinforced trolley poles, Nichols-Lintern air sanders were also shown. The Simplex Electric Heating Company exhibited various forms of its electric heating apparatus at this stand. Colonel W. E. Ludlow was in charge.

THE BRADY BRASS COMPANY, Jersey City, manufacturer of Cypns bronze specialties, exhibited a complete line of motor bearings, journal bearings, check plates, babbitt metal, solder, trolley wheels, etc. The company makes the statement that its journal and motor bearings are in use in 20,000 electric cars in this country. Daniel M. Brady, Charles M. Reubens and Clarence P. King were in charge.

THE LE VALLEY VITÆ CARBON BRUSH COMPANY, represented by its president, J. V. Clarke, displayed an assortment of the various shapes, sizes and grades of carbon brushes in its line. Long life, high conductivity and smooth wearing qualities are claimed for this brush. Exhibited in a case were a number of brushes which had been in use on prominent roads for remarkably long periods of time. One sample used on a Westinghouse No. 49, on the Tarrytown, White Plains & Mamaroneck Railway, showed but ½-in. wear in 16,836 miles. Another brush, tested by the Lorain Steel Company on one of its motors, showed 7-16-in. wear in 14,000 miles. Souvenir brushes were distributed.

THE MALTBY LUMBER COMPANY, Bay City, Mich., had an exhibit in the smoking room, consisting of a number of photographs of views in its lumber yards, saw mills, forests, etc. Displayed were sections of cedar poles and cedar ties. A. Maltby and I. A. Maltby were in charge.

THE SCARRITT CAR SEAT WORKS, St. Louis, had five of its seats in a neat display. Two were of the walkover type and the others reversible. Cane, imitation leather and plush upholstering were shown. A recent contract of importance taken by this company was for 1000 seats for the St. Louis Transit Company. R. R. Touhy, assistant superintendent, was in charge. George E. Howard, superintendent, was absent on account of press of business.

THE SPENCER, OTIS COMPANY, Chicago selling agents for the Hart tie plate, made a neat exhibit of this specialty. The top surface of this plate is cambered and corrugated, preventing the accumulation of sand under the rail, thereby minimizing a sand-cutting effect on the plate and rail. It acts as a natural shed for water, brine or other drippings from the car and increases the adhesive qualities of the plate to the tie by minimizing the wave motion on the plate, also prevents buckling. The under surface of plate is provided with longitudinal flanges, designed to compress the fibers of the wood as they penetrate, thereby increasing its density. It is designed for greatest transverse strength. W. L. De Reiner and H. H. Hart were in charge.

EXHIBITS OF PETER SMITH HEATER COMPANY, HEYWOOD BROTHERS & WAKEFIELD COMPANY, HAROLD P. BROWN AND THE PENNSYLVANIA STEEL COMPANY

F. H. NEWCOMB, of Brooklyn, displayed in a large case a line of uniform caps and badges. Mr. Newcomb makes a specialty of these goods and supplies many of the leading steam and electric roads of this country.

THE HEYWOOD BROTHERS & WAKEFIELD COMPANY, Wakefield, Mass., had an attractive booth in which it showed a full line of its railroad specialties, consisting of car seats, spring seating, rattan webbing, mats, etc. The Wheeler No. 42 was shown in rattan, with backs offset, by which means aisle space is gained at a point where it is desirable. The seat has a brass grab handle on the back for passengers standing. A handsome sample of this seat was shown in plush, with high back, head rest

and spring edge cushion; a most comfortable seat for a long ride. It has a pedestal base, which is convenient when cleaning the car, and a movable foot rest, allowing space under seat for grips and packages. A sample of the double revolving chairs used in Brooklyn and other cities was shown, as were samples of spring seating furnished in rattan, carpet, plush and artificial leather. The company is a very large manufacturer of rattan webbing, and uses selected stock hard-enamel finish rattan for car seat work. Samples of this were shown unlined and with canvas lining. Snow brown rattan and cocoa mats for elevated cars were shown in large quantities. F. H. Henry, of Wakefield, and Bertram Berry, New York office, were present for the company.

THE KINNEAR MANUFACTURING COMPANY, Columbus, Ohio, showed a steel rolling door for car houses. It is composed of flexible steel slats, and when raised rolls into a hood. Around this hood passes the trolley circuit, and when the door is raised a breaker drops flush with the trolley wire, making a clear surface for the trolley wheel. F. B. Billheimer, who was in charge, passed out a pasteboard model of the door, the operation of which puzzled many of the best brains at the convention.

THE AMERICAN CAR SEAT COMPANY, Brooklyn, showed several samples of pushover car seats in rattan, plush and pantesote. The company is a large producer of sweeper rattan, and imports direct from its own plants. It introduced a new feature in mechanical pushover action, embodying so few parts that it is claimed the cost of replacements cannot be considered. Hiram E. Ackerly, sales manager, and Lewis Jansen, superintendent, were in charge.

THE GRIFFIN WHEEL COMPANY, Chicago and Detroit, had a plain but prominent display, consisting simply of four sets of its well-known car wheels. The stand was tastefully decorated with palms. W. S. Harpell and C. K. Knickerbocker were in charge.

THE NUNGESSER ELECTRIC BATTERY COMPANY, of Cleveland, had an exhibit of its dry batteries for use on the call bell on cars.

THE AMERICAN CIRCULAR LOOM COMPANY had an exhibit of circular loom with especial reference to car wiring and street railway needs. J. L. Kirkland, of New York, and Thomas G. Grier, of Chicago, Western manager, were in attendance.

THE A. & J. M. ANDERSON MFG. CO., of Boston, made a leading feature of a new section insulator, which they have recently devised and which was one of the neatest novelties in overhead material exhibited. The insulating section on which the trolley wheel runs was detachable instantly for renewal, and the ends to which the trolley wire was fastened were so hooked to the main frame that they could be taken off by taking the tension off the wire. The device was very favorably commented on. Ernst Woltmann and H. F. Sanville, of the Philadelphia office, represented this well-known firm of overhead material manufacturers.

THE SHERWIN-WILLIAMS COMPANY, of Cleveland, whose paints are used as standard by a great many electric railway lines, made a strong showing at this convention, demonstrating the great amount of attention this great paint company is giving to railway needs. E. M. Williams, manager street railway department; F. A. Elmguist, special street railway representative, and Thomas Madill, manager of the street railway department in the West, did the honors. Sherwin-Williams paints were used on the Kuhlman car exhibit mentioned elsewhere.

SEVERAL ATTRACTIVE EXHIBITS

THE UNITED STATES STEEL COMPANY, of West Everett, Mass., made a much stronger showing of the Neal duplex brake than ever before, the exhibit this year being in charge of J. S. Hamlin, manager of sales, who was well known as a master mechanic and brake expert previous to his connection with this company. The Neal duplex brake is so simple that there was little to make an exhibit of impressive size, and it is this simplicity and small number of parts that constitutes one of the numerous strong points of the brake. Three types of axle-driven oil pumps were shown, one of which can be placed on the same axle with a G. E. 57 motor, so little room does it take up. The oil is constantly circulated by the pump, the flow being throttled

to produce pressure for braking. The control valves are under the car and worked by rods from a motorman's handle. The motorman's handle is either independent of the hand brake or in conjunction with it, as the railway company may desire. The company has received a number of large orders the past few months. O. B. Gage, superintendent of works, and C. S. Miller, treasurer, were also present.

THE STERLING-MEAKER COMPANY, of Newark, N. J., represented by C. S. Ackley, president; E. B. McLean and C. F. Wickwire, exhibited all four types of registers, the Sterling brake and the Sterling sand box. The Sterling No. 5 register, just placed on the market, has been redesigned throughout and is remarkable for its simplicity of design, great strength of parts, large wearing surfaces, and other important features. This register could not fail to attract much favorable attention.

THE SPEER CARBON COMPANY, of St. Marys, Pa., exhibited a full line of carbon brushes in three grades. J. S. Speer was in attendance.

THE NEW HAVEN CAR REGISTER COMPANY, of New Haven, Conn., had a large representation both in the way of men and exhibits. Willis M. Anthony, president; F. C. Boyd, vice-president and general manager; John S. Bradley, secretary and treasurer, and representatives, H. E. Beach, M. DeF. Yates and J. M. Hayes. This company exhibited all its types of single,


EXHIBITS OF THE CLIMAX STOCK GUARD COMPANY AND DEARBORN DRUG AND CHEMICAL WORKS

double and triple, round and square registers, and also a new controller device to prevent the motorman from advancing the controller handle more than one notch at a time. There was a full line of badges, punches, trolley and bell cord and various other specialties, including telephone equipment for street railways.

EUGENE MUNSELL & CO. and THE MICA INSULATOR COMPANY were represented at the convention by Charles E. Coleman, manager for both concerns at Chicago. Mr. Coleman had a very prominent location in the center of the hall. In the space selected by William Wharton, Jr., & Co., Philadelphia. "Micanite" and "Empire" insulating materials were exhibited in their various forms, and the company's circular matter was distributed, which included a very neat blotter, which was at the writing rooms of the various hotels. The company reports a heavy demand for all its mica and micanite specialties, and has just completed an addition to its already extensive works at Schenectady, which will give it an increased capacity of 6,000 square feet of floor space, enabling it to execute all orders speedily.

THE GOULD STORAGE BATTERY COMPANY, of New York, had a neat exhibit, which included samples of all sizes of plates, from small 3 x 3 inches to those for large central station batteries. Glass and lead tanks were both shown, with special glass covers for preventing the spraying of acid and to keep down the fumes. Photographs of several railway battery and booster installations formed part of the exhibit. Gould booster systems were treated in Bulletin No. 2, which was distributed. W. W. Donaldson, sales manager, was in charge, and E. L. Draffen, manager of the Chicago office, and A. B. Herrick, electrical engineer, were also present.

ALFRED JOHNSON, electrician for the road at Quincy, Ill., has patented and is manufacturing what he has named the "Reliable Trolley Harp," the peculiar feature of which is that the contact springs are held in by a method which makes them much more easily renewable than riveting, according to the usual practice.

THE AMERICAN UNION ELECTRIC COMPANY, of New York, the recently formed consolidation of interests which operates the Morris Electric Company and several others, was represented by Elmer P. Morris, E. Packer and J. Fountain, Jr. One corner of the north gallery was artistically decorated with Morris rail-bonds, Morris fare registers, Falcon switches, trolley wheels, trolley harps, pole brackets, overhead line material, signs and other Morris products. Mr. Morris distributed a neat brochure among his friends containing illustrated yarns of salesman life.

THE TAYLOR ELECTRIC TRUCK COMPANY, of Troy, N. Y., represented, as usual, by John Taylor, showed three trucks, all being swivel trucks for long cars. One of these was a short-wheel base truck with swing motion, another a swing-motion truck of a more common size, and a third an extra heavy swing-motion double truck for high-speed interurban service.

THE SAMSON CORDAGE WORKS, of Boston, made an exhibit of trolley and bell cord.

THE REVERSIBLE CAR SIGN COMPANY had its interests looked after by H. S. Kemp and R. H. Lancaster. The novel type of reversible car sign which this company is putting on the market was exhibited to excellent advantage and attracted much favorable comment.

THE DUFF MANUFACTURING COMPANY, Pittsburgh, Pa., exhibited the Barrett track jacks, car jacks, car house jacks, journal jacks and in addition the Barrett armature lift and truck combined for transfering armatures from the motor frame or replacing them. Barrett jacks are to be found everywhere that electric railways operate, and now are being adopted for automobile work, having been endorsed by the Automobile Club of Paris. George F. Freed, superintendent, and Thomas A. McGinley, treasurer, represented the company.

THE AMERICAN ARITHMOMETER COMPANY, of St. Louis, Mo., exhibited the Burroughs adding machine, under charge of W. E. Weatherly; this exhibit, of course, being especially interesting to accountants, many of whom are now using these machines. It is used where any addition of a large number of items is to be made, especially on trial balance sheets and in checking up conductors' returns. C. N. Duffy, auditor of the Chicago City Railway, has four of these machines in his office, and commended it highly in his remarks before the Accountants' Association.

GEORGE W. WILLEBRANDS & BRO., of Detroit, exhibited a model of the Diamond spring frog crossing, which they are preparing to manufacture. The device is similar to the ordinary spring-frog crossing, but is provided with an additional lug for the wheel to travel over on a smooth surface. The crossing will be made with an interlocker, permitting an entire train to travel over the crossing without the spring frog returning to its former position. George W. Willebrands was in charge.

THE BELLAMY VESTLETTE MANUFACTURING COMPANY, of Cleveland, represented by O. N. McClintock, displayed the Bellamy vestlette for conductors. The device was described in the souvenir number of this paper.

THE C. C. WORMER MACHINERY COMPANY, of Detroit, had a stand where P. H. Biggs passed out the company's literature. This concern claims to carry the most complete line of machine tools in the central West.

THE NATIONAL LOCK WASHER COMPANY, Newark, N. J., had an exhibit of lock washers, sash locks, sash balances and curtain fixtures. R. L. Thomas and W. C. Dodd were in charge.

THE AMERICAN MACHINERY COMPANY, Grand Rapids, Mich., displayed, in operation, the Oliver wood trimmer, the Oliver hand joiner, Oliver saw bench, Oliver band saw and Oliver wood lathe. The company manufactures wood working and pattern shop equipment of all kinds. J. W. Oliver, J. H. Armstrong and C. R. Wright explained the features of the machines.

THE AMERICAN RAILWAY SUPPLY COMPANY, 24 Park Place, New York, had a large frame, supported by brass rods, and filled with its various kinds of cap and breast badges and buttons for conductors and motormen. These goods are furnished advertised around the convention hall, both by its exhibit and by Mr. Mason himself.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, distributed souvenirs through F. G. Bolles, advertising manager.

LORAIN STEEL COMPANY was represented by P. M. Boyd, secretary and treasurer; Mayor H. C. Evans, New York agent; A. S. Littlefield and D. J. Evans, of Chicago; W. W. Kingston, of Atlanta, Ga.; R. Clitz, Lorain, Ohio; S. P. S. Ellis, Pittsburgh; E. B. Entwisle, chief engineer, Johnstown, Pa.; G. H. Parmelee, Johnstown, Pa.; H. F. A. Kleinschmidt, superin-

EXHIBITS OF THE R. D. NUTTALL COMPANY, THE OHIO BRASS COMPANY, THE AMERICAN BRAKE SHOE & FOUNDRY COMPANY AND THE NEW HAVEN CAR REGISTER COMPANY

in exclusive designs in brass, copper, german silver, fiber and aluminum. The display was neat and effective. Walter Chur, general manager, was in charge.

THE GARTON-DANIELS COMPANY, of Keokuk, Ia., the well-known lighting arrester maker, which has been working for several years on the perfection of the Knox "Automotoneer" for limiting the rate at which a motorman can advance his controller handle, exhibited at this convention a device which it is now believed will meet all the requirements. It is simpler and more substantial than the forms presented at any of the four preceding conventions. J. V. E. Titus, secretary of the company, who was in attendance, gave out to those desiring it a new catalogue, not only describing the construction of the device but presenting the technical arguments in favor of its use.

THE HELOIS-UPTON COMPANY, of Chicago, had its storage battery interests looked after by Frank H. Clark.

W. R. GARTON, of the W. R. Garton Company, Chicago, was among the convention supply men.

THE GARRIGUS MECHANICAL BOILER CLEANER, of which W. R. Mason, of Chicago, is Western representative, was tendent track welding department. The exhibit was lost in a wreck, but everybody was cordially received by the company officials. Large space had been reserved, and a very interesting display of special track work would have been made, embodying some new features.

ELLIOTT BROS.' ELECTRIC COMPANY, of Cleveland, Ohio, electric railway supply dealers and repairers, were represented by W. H. Elliott, manager.

THE MICHIGAN ELECTRIC COMPANY, of Detroit, was, of course, in evidence, though making no exhibit under that name. President Joseph E. Lockwood was prominent in the management of the local affairs in the convention, and should be numbered among the representatives of the Electric Storage Battery Company and the Stanley Electric Manufacturing Company, for both of which companies the Michigan Electric Company is Michigan agent.

THE JEWETT CAR COMPANY, Newark, Ohio, displayed on the trackage one of its latest and finest models of the car builders' art. The car was one of a regular lot built for the Columbus, Delaware & Marion Railway, a new Ohio road. It is 50 ft.

over all, 40 ft. body, 8 ft. 8 ins. wide, and has seating capacity for 58 passengers. Toilet room and water cooler are located between the compartments. Finish is solid mahogany, inlaid with rosewood and holly, and ceiling is apple green. When in operation the car will be fitted with four G. E. No. 73 motors, with type M.-control. Christensen air brakes, Peckham No. 32 M. C. B. trucks, Hale & Kilburn walkover plush seats with head roll, and Consolidated electric heaters. For the exhibit the car was shipped sans seats and was fitted up as a parlor car, with fine rugs and wicker chairs. Displayed in the car were several frames filled with photographs of the company's plant and numerous types of cars which it has turned out. A. H. Sisson, manager and treasurer; Niel Paulson, superintendent; W. C. Gardner, secretary, and B. E. Rutherford, salesman, received the thousands of visitors.

THE RAILROAD SUPPLY COMPANY, of Chicago and New York, had its interests well taken care of by George Stanton.

THE AMERICAN STEEL & WIRE COMPANY had its customary prominent exhibit, consisting of reels of wire, cable, wire rope, wire fence and bonds and springs. Wire was shown both bare and insulated. The stand was handsomely decorated with cut flowers and palms. The company was well represented by C. S. Knight, Jr., Chicago; W. C. Bogne, Detroit; J. A. McQuale, Jr., Philadelphia; J. D. Sutherland, Pittsburgh; George Chandler, Dayton; H. F. Pratt, Cleveland, and N. H. Van Sicklen, Chicago.

THE UNITED STATES ELECTRIC RAILWAY SUPPLY COMPANY, Detroit, showed its patent self-oiling trolley base, used in connection with the ordinary Westinghouse trolley stand. The device has been previously described in these columns; sufficient to say it is widely known through its use on many of the most important interurban roads of the country. There was also shown a new trolley wheel and harp. The wheel is provided with a dope packed center and a copper contact spring, which takes the current direct from the flange of the wheel to the harp, preventing the heating of the lubrication by the current passing over the bearing. H. Holland and H. L. Walker were in charge.

THE ALLEN & MORRISON BRAKE-SHOE & MANUFACTURING COMPANY, of Chicago, exhibited a line of its brake-shoes; also a device for reinsulating and retaking wire for field coils, as used by the Detroit United Railway and other roads. The wire runs through one end, where a device strips the burned fabric, and the rewinding device puts on two layers of tape, and completes the work at the other end. It makes available burned field wire, which heretofore has been scrapped. It is claimed that the brake-shoe manufactured by this company combines the life of the hard iron shoe with the friction of the soft gray iron shoe.

THE H. B. CAMP COMPANY, New York and Chicago, had an exhibit in the smoking room, consisting of samples of various kinds of conduits and underground work.

THE CONTINUOUS RAIL-JOINT COMPANY OF AMERICA, Newark, N. J., was disappointed in the division of space, as it could not secure sufficient room to make a thorough exhibit. However, there were displayed a number of its various types of joints which are so well known that they do not need further comment at this time. The company was represented by a large force, in the persons of L. F. Braine, general manager; J. G. Miller, St. Louis; W. H. Chapman, Boston; S. P. McGough, Chicago; B. M. Barr, New York; T. J. Dalton, Troy, N. Y., and Clarence Irwin, St. Louis.

THE DETROIT TROLLEY & MANUFACTURING COMPANY, LTD., Detroit, showed its ball-bearing trolley base which has recently been brought out. The base is fitted with fifty 1-in. steel balls in an accurately ground ball race, and the device weighs about 80 lbs. It is claimed that its use will effect a great saving in the cost of trolley wheels and poles and overhead work through the free and easy movement of the trolley stand and the consequent decrease wear and in liability of the trolley flying off.

THE DEARBORN DRUG & CHEMICAL WORKS, of Chicago, had a tastefully arranged booth decorated in white. Robert F. Carr, vice-president and general manager; W. B. McVicker, second vice-president and Eastern manager, of New York; O. L. Fluegel, Detroit, and Grant Spear, Chicago, explained the advantages of the company's scientific treatment of boiler feed water. On a stand there was a model of the company's boiler compound feeder which is attached to the boiler feed-pump rod and distributes any desired quantity of the compound. There were a number of samples of tube sections showing the effect of the scale, pitting and other boiler tube troubles. There were also exhibited samples of the company's line of lubricating oils. The stand was a Mecca for souvenir hunters; among the free offerings being black diamond stick pins, cigar fans, puzzles and cut-glass bottles of perfume for a chosen few.

EXHIBITS OF THE GOULD STORAGE COMPANY, AMERICAN STEEL & WIRE COMPANY AND H. W. JOHNS-MANVILLE COMPANY

THE OHMER FARE REGISTER COMPANY, Dayton, Ohio, exhibited samples of its well-known Nos. 2 and 3 registers for city and interurban service, and introduced an improved register to be known as the identification key machine. In addition to the ordinary key, each conductor is provided with a special key bearing a number corresponding with his badge. At the end of each run the conductor inserts the ordinary key and then the special number key. This unlocks the machine and prints the badge number on the same line with the general report of cash fares, transfers, etc. Each conductor is responsible for the amounts shown in connection with his badge number. At the barns, the inspector who is provided with a similar set of keys, makes his impression in duplicate after totaling the record for the day. The record and total are sent to the local office, while the duplicate record of the total goes to the president or foreign office. The device precludes any possibility of tampering with the figures in the local office. Those present for this company were, John F. Ohmer, general manager; J. H. Steadman, secretary; William F. Breidenbach, manager contracting and installation department; W. McDonald, Eastern representative; W. Hinman, Pacific coast representative; A. N. Potse and Ed. Seiverts, mechanical department.

THE HEIL RAIL JOINT WELDING COMPANY, of Milwaukee, was represented in the person of J. P. Heil, president, who made his headquarters at the space of C. J. Harrington, general Eastern sales agent.

THE H. W. JOHNS-MANVILLE COMPANY, of New York, made a neat exhibit of its overhead line supplies of all kinds of rail-bonds, electric car heaters, molded mica, Monarch and vulcabeston insulating materials, and the Sachs "Noark" enclosed fuses. This company was well represented by J. W. Perry and J. E. Meek, of New York; S. H. Finney, of Chicago; W. A. Buddecker, of St. Louis; T. F. Becker, of Milwaukee; T.

D. Dickson, of Philadelphia, and E. B. Hatch and W. A. White, of the Johns Pratt Company, Hartford.

THE UNITED STATES CURTAIN COMPANY, of New York and Newark, represented by Alonzo E. Nutter, had on exhibition a new water-proof curtain for either open or closed cars. One feature of this curtain is a button on the outside and inside of the car, which, when pressed, raises the curtain immediately. This button can be operated by either the conductor or passengers.

THE UNITED STATES WOOD PRESERVING COMPANY, of New York, exhibited samples of creo-resinate wood paving blocks, treated by this company's process, which is claimed to be an improvement on the well-known creosoting process. Mr. Alexander Reed was in charge. The company received on Aug. 5 from the Railroad Commissioners of Connecticut, an excellent endorsement for its system of wood block paving by the permission of the commissioners to allow the Hartford Street Railway Company to lay this wooden block between its tracks on Main street.

C. J. HARRINGTON, of New York, had a complete exhibit of the Empire overhead material, which he manufactures himself. Mr. Harrington also carries a full line of other electrical railway supplies of all kinds. He is Eastern agent for the Heil cast-welded rail-joint, and recently closed a contract in Pittsburgh for several thousand 9-in. girder joints. J. P. Heil, president of the Heil Rail-Joint Welding Company, made his headquarters at Mr. Harrington's exhibit, where samples of joints and photographs of work were to be seen. Mr. Harrington called special attention to the "New Yankee" drill grinder, made by the Wilmarth & Marman Company, Grand Rapids, Mich., for which he is agent. This is a valuable acquisition to street railway shop equipment because it will soon repay the investment. It has distinctively valuable features not found in any other machine of the kind, and is entirely new and original. The calipering device employed on other machines, which requires many adjustments to set the drill before grinding, is entirely discarded, and only one adjustment is required to grind any drill within range of the machine. Any clearance can be had by one instantaneous adjustment, and when once set the machine will grind all drills at the same clearance without further adjustment. This makes it a distinct improvement in simplicity and ease of operation. It does not require a skilled mechanic to operate it, as a boy can grind a drill and grind it right with this machine. The enormous saving in time by having drills always fresh and sharp makes investment in a drill grinder a matter worth while in a shop of any size. The drill grinder shown was electrically driven with a 500-volt motor. The manufacturers put out seventeen styles, suited to as many different conditions.

THE GLOBE MACHINERY & STAMPINGS COMPANY, Cleveland, Albert F. Schroeder, secretary-treasurer, showed the well-known Globe electric headlight and an improved trolley harp manufactured for D. A. Petre, of Duluth, Minn. The King Engineering Company, Chicago, showed the King trolley stand in connection with this exhibit.

H. K. DOOLITTLE, Watertown, N. Y., exhibited a model of a window sash for street cars, which can be taken out and replaced without removing a stop or screw or the use of any tools. It attracted considerable attention.

THE POWELL & TURNER TRUCK COMPANY, of Troy, N. Y., had a model truck at the convention, showing a combination wheel and track brake, in charge of E. J. Knauff.

THE STAR BRASS WORKS, Kalamazoo, Mich., showed the famous "Kalamazoo" trolley wheels and harps in a very unique manner, consisting of a large star made up of small trolley wheels in a frame of the larger sized wheels, each lighted with a small electric globe and arranged on a black back ground. On either side was a smaller panel of yellow, upon which was shown the improved harps the company is putting out. The claim is set forth that this company is the "largest exclusive trolley wheel makers in the world," and also that "300 roads, operating 30,000 cars, are using the Kalamazoo trolley wheels." Messrs. C. A. Peck, president; O. P. Johnson, secretary and treasurer, and F. P. Crockett, manager, represented the company.

EDWARD G. THOMAS, of Boston, made an exhibit of his new rail bond, which occupies a place between the rail-ends and is fastened by cap screws and solder. It is an extremely short bond but has ample allowance for contraction and expansion. The peculiar features of this bond were illustrated and described in the Street Railway Journal for Oct. 4.

THE CHRISTENSEN ENGINEERING COMPANY'S EXHIBIT

THE OHIO BRASS COMPANY, of Mansfield, Ohio, as usual occupied a large and prominent space, very tastefully arranged. The space was surrounded by different types of mounted flexible pole brackets, and the rail around the space consisted of sections of 100-lb. T-rail, joined with fish-plates and bonded with this company's "all wire" rail-bonds, in which the heads are formed from the bunch of wire itself. These T-rail rails were mounted on different forms of Ohio Brass Company third-rail insulators, including the new Gonzenbach type used on the Aurora, Elgin & Chicago Railway. Inside the space this company's numerous products, in the way of overhead material and bonds, were displayed on circular stands. The exhibit included the Monarch track cleaner. This company's representatives were F. B. Black, president; C. K. King, secretary; W. M. Garland, manager New York office; O. W. Uthoff, manager St. Louis office; G. A. Harwood, general agent; A. L. Wilkinson, H. C. Schwable, G. A. Mead, electrical engineer; Burt Gellatly, manager Pittsburgh office; E. O. McCormick, Toronto office, and C. N. Manfred, advertising manager. This company gave away an attractive souvenir in the form of a cigar ash tray for gentlemen and ping-pong rackets to ladies.

THE J. G. BRILL COMPANY, of Philadelphia, exhibited both inside and outside the building. The exhibit included a fine collection of this company's solid hydraulically-forged wrought truck frames, for which it has put in expensive special machinery. The

trucks shown were the Brill 21-E, maximum traction and 27-G. A 27-E truck was also shown with motors in the General Electric exhibit. Inside the building sections of convertible, semi-convertible and Narragansett cars were shown. On the track outside the building a semi-convertible car, which is one of an order built for the Calumet Electric Street Railway, of Chicago, was shown. The gentlemen from this company in attendance were Samuel M. Curwen, W. H. Heulings, George M. Haskell, D. B. Dean and J. Elwood Brill.

THE WORCESTER STEEL FOUNDRY COMPANY, of Worcester, Mass., exhibited its steel terminal rail-bond, made by fusing a soft steel terminal directly to the copper bond wires. The steel terminals can be applied to the rail by any of the well-

THE JOHN STEPHENSON COMPANY'S EXHIBIT

known screw or hydraulic compressors, and have the same coefficient of expansion as the rail. W. E. Oakley was in charge of the exhibit.

W. J. SHEPHERD & CO., of Denver, Col., showed an illuminated watch and clock holder for use on the front platform by motormen. W. J. Shepherd was in attendance.

THE STANDARD VITRIFIED CONDUIT COMPANY, manufacturers of vitrified salt-glazed underground conduits and third-rail insulators, made a small exhibit and Vice-President B. S. Barnard was in attendance.

THE ELECTRIC RAILWAY SWITCH COMPANY, 814 Chamber of Commerce, Detroit, Mich., exhibited a model of an electric track switch.

THE JOHN STEPHENSON COMPANY, of Elizabeth, N. J., had a fine sample of interurban car construction on the track space near the convention hall. This car was one of a number being built for the Muncie, Hartford & Fort Wayne Railway. It had two compartments, a smoking and baggage compartment in front, with the main compartment and closet in the rear. The seats in the baggage compartment were arranged to fold up, so as to give either a clear, complete compartment for baggage, or seats along all of both sides, including the space opposite the baggage doors. The finish is a mahogany with curly maple ceilings. The car was built after the designs of E. P. Roberts & Co., electrical engineers, of Cleveland, who are the consulting engineers for the road. E. J. Lawless, of New York; Thomas F. Carey, of Boston, and J. A. Hanna, of Cleveland, represented the John Stephenson Company at the convention.

THE PAIGE IRON WORKS, of Chicago, were, as usual, represented by E. S. Nethercut.

THE KNELL AIR BRAKE COMPANY, of Battle Creek, Mich., had a prominent space in which was located a truck with axle-driven compressor connected to a regular car equipment, consisting of storage reservoir brake cylinder and control valves. The compressor was driven by an electric motor belted to the car axle, upon which the compressor was placed. Joel C. Hopkins, secretary; A. H. Metzelaar, manager; A. L. Wisner, J. R. Bunce and O. Cornell did the honors and distributed souvenirs in the shape of American Beauty roses to the ladies.

THE McGUIRE MANUFACTURING COMPANY, of Chicago, exhibited on the trackage in front of building a rotary snow sweeper, with I-beam steel underframe, which was one of an order of twelve for the Union Railway, of New York. This is a double-end sweeper, weighing, complete with motors, 30,000 lbs. Then, too, there was a McGuire 39-A swivel steel truck and sliding cushion feeder, and the new Columbian car heater. The prominent feature of the exhibit, however, was the immense 4000-gallon steel tank street sprinkler on double trucks. This is one of the largest ever built. The tank is 6½ ft. in diameter by 8½ ft. long. An air compressor, driven by an electric motor, is located on one platform to maintain air pressure in the tank so that water can be thrown more easily and to a greater distance from the sprinkler nozzles. This sprinkler will wet from 50 ft. to 60 ft. each side of the track. An auxiliary air reservoir, 38 ins. x 78 ins., is used for the storage of air when the tank is nearly full. This sprinkler goes to the Newport News & Old Point Railway, Hampton, Va. W. J. Cooke, vice-president, and B. F. Stewart, sales manager, were on the ground, and Mr. Cooke distributed a neat aluminum memorandum tab to his friends.

W. T. VAN DORN, of Chicago, as usual had the only automatic coupler for electric cars on exhibition at the convention. Mr. Van Dorn exhibited two of the heavier types of draw bars made by him. One of these was the elevated type and the other a somewhat lighter coupler used on interurban cars. The exhibit included a number of blue prints, showing the Van Dorn draw bars and attachments, as used by various companies, including the Manhattan and Boston Elevated systems.

THE CHASE-SHAWMUT COMPANY, of Boston, made an exhibit of its flexible rail-bond, which is fastened to the rail by soldering, and has been successfully used in a number of cities. The exhibit was in charge of F. D. Masterson.

THE PITTSBURGH SWITCH & SIGNAL COMPANY had on exhibition a very complete system of automatic block signals for single and double-track roads. This system uses both semaphores and lights. It is constructed on the correct principle that all features shall be on the side of safety. For single-truck roads the signals are arranged to show red in front of an approaching train and green in the rear. Any number of successive trains are passed into a block going in the same direction, and a train counting device prevents the signals at the entrance and end of the block from clearing until all cars have passed out.

THE CROCKER-WHEELER COMPANY, of Ampere, N. J., was represented by Putnam A. Bates, assistant secretary, and C. W. Startsman, of the home office; Managers F. B. Degress, Julian

EXHIBIT OF THE CONSOLIDATED CAR HEATING COMPANY

Roe, W. H. Wissing and W. F. Sullivan, of the New York, Chicago, St. Louis and Cleveland offices, respectively, and W. J. Hartwig, local representative for the Detroit territory. The company issued several handsome circulars descriptive of Crocker-Wheeler apparatus in Detroit and elsewhere.

GILES S. ALLISON, of New York, sole sales agent for the St. Louis Register Company, exhibited the St. Louis self-record-

ing registers. Mr. Allison also distributed circulars illustrating a large variety of excellent second-hand cars he is offering for sale.

THE GENERAL SUPPLY COMPANY, of New York, was represented by A. B. Dolby.

THE CLEVELAND FROG & CROSSING COMPANY, of Cleveland, Ohio, had its interests looked after by General Manager George C. Lucas.

THE ALPHADUCT MANUFACTURING COMPANY, of New York, is a new concern making "alphaduct," a product

EXHIBIT OF THE CONSOLIDATED CAR FENDER COMPANY

somewhat similar to circular loom, but better adapted to rough handling. William Porter, formerly of the Lea Electric Manufacturing Company, had charge of this exhibit.

SMETHURST & ALLEN, electrical engineers and contractors, of Philadelphia, were represented by W. A. Smethurst.

B. J. ARNOLD, president of the Arnold Electric Power Station Company, of Chicago, was among the convention visitors.

GEORGE A. PARMENTER, of Cambridgeport, Mass., manufacturer of the Parmenter fenders and wheel guards, was looking after his interests.

JOHN BLAIR MacAFEE, contractor and railroad builder, of Philadelphia, was present, and was accompanied by William Harrison MacAfee and W. N. Walmsley, chief engineer.

THE JOHNSON WRECKING FROG COMPANY, of Cleveland, Ohio, exhibited some of its frogs for placing derailed cars upon the track on the track space near the exhibition hall. These frogs are adapted for T-rail on interurban roads and girder rail on city streets as well. O. W. Johnson, general manager, looked after this company's interests.

P. D. MILLOY, of Buffalo, the well-known inventor of the Milloy trolley catcher, had a couple of new devices at this convention, the most promising of which is a resilient gear case, made of canvas, with sheet steel protection on top and bottom to hold the canvas in shape. This gear case yields when struck, instead of breaking, and at the same time tends to deaden the noise of the gears. The trolley base, it is claimed, is the lowest base made, requiring but 6½ ins. clear space above a car roof.

THE UNION SWITCH & SIGNAL COMPANY, of Swissvale, Pa., has recently adapted its train staff system to the use of single-track interurban electric roads. This staff system permits the movement of any number of successive trains each way with absolute safety, but allows only one train in a block at a time between any two staff stations. The steam road staff instruments require a man at each instrument when a staff is released. To adapt it to electric roads changes have been made so that a staff can be obtained from either instrument by a man at an instrument if no other staff is out. Five wires are required between staff stations. T. H. Patenall was the company's representative.

THE HUNTER AUTOMATIC FENDER COMPANY and the HUNTER ILLUMINATED CAR SIGN COMPANY, represented by Lytle J. Hunter, president and general manager, had in the annex the front platform of a car equipped with a Hunter fender, of which 3000 have been ordered by the St. Louis roads. This fender consists of two parts, one part carried on the dash, and designed to throw any person standing on the track to one side. The impact of a body against the fender on the dash trips the wheel guard fender so that should the person be knocked down the wheel-fender will be down on the pavement to prevent him going under the wheels. The Hunter car sign carries the names of a large number of routes upon a roll of canvas, and any one of these names can be brought into view on the sign by revolving the roll. Incandescent lamps behind the sign illuminate it at night. These are in use on a great many roads.

THE INTERNATIONAL REGISTER COMPANY, of Chicago, manufacturer of stationary and portable fare registers, made its usual exhibit of different types of registers. Delegates were received at the company's space by A. H. Woodward, president; W. H. Brown, secretary and treasurer; E. T. Runge and F. B. Hall.

J. R. McCARDELL & CO., of Trenton, N. J., manufacturers of the well-known Trenton trolley tower wagon, had a novelty running around the streets in the shape of the new Trenton automobile tower wagon, which was equipped with a powerful and reliable gasolene engine, which was capable of propelling the wagon at a rate of 20 miles or 25 miles per hour. The company has long been in search of a satisfactory motor outfit for its purpose, and thinks that now it has found it. The tower of the wagon includes all the patented features common to the Trenton horse-drawn wagons, but the general construction of the wagon was slightly heavier because of the weight of the motor and higher speeds. M. J. McDonald represented the company and took delegates to ride in the wagon whenever they so desired.

THE JENKINS IMPROVED CAR SANDER was found on exhibition. This is the invention of B. B. Jenkins, of Toronto, and particulars can be obtained of B. Madill & Co., bankers, Toronto, Ont.

D. N. MILLER, 501 Sixth Street, Detroit, Mich., exhibited a new sander, in which the sand is fed by a screw operated by chain and sprocket from a crank on the front platform. The feed is positive, being due to the revolution of the screw, and not dependent on gravity.

THE ST. LOUIS CAR COMPANY had Assistant Superintendent G. J. Smith in attendance renewing his acquaintances among operating master mechanics, formed in his years of experience as one of them. William Sutton, formerly president of the American Car Company, is now identified with the St. Louis Car Company, and was in attendance at the convention. George S. Hastings, of Cleveland, also represented this company among others. Some particulars of the company's sample car which was

INTERIOR OF THE JEWETT CAR, AT DETROIT EXHIBITION

in active service carrying excursionists about Detroit are published elsewhere in this issue.

THE F. BISSELL COMPANY, of Toledo, Ohio, represented by M. S. Walker and C. M. Hamilton, made an exhibit of switchboards and general railway supplies. This company is agent for the Nernst lamp.

THE STROMBERG-CARLSON TELEPHONE & MANUFACTURING COMPANY, of Chicago, occupied a space in the annex with a line of telephones suited to the requirements of street railway service. The Milwaukee Electric Railway & Light Company has over 200 Stromberg-Carlson instruments in use. The switchboard shown had visual lamp-line signals and magneto

signals, and a combination of connecting cord circuits, adapted for interconnecting the various systems. J. J. Nate and A. J. Rousseau were in attendance.

THE CHRISTENSEN ENGINEERING COMPANY, Milwaukee, had a very large and interesting exhibit across one end of the hall, including a straight air brake-school equipment, and an automatic air-brake multiple unit equipment, both of which were in operation; also a Christensen portable motor-driven air compressor in operation by means of a hook connection to a trolley wire. The company also exhibited some of its new electrical machinery, which it is just putting out for the first time, including a 250-kw, three-phase, 2200-volt alternator; a 30-hp 500-volt open style motor, and a 4-hp 500-volt enclosed style motor. The company distributed very attractive booklets of their air brake equipments and electrical machinery. The entrance of the concern into the manufacture of large electrical apparatus is an event which is considered of considerable importance. The Christensen Engineering Company's interests were cared for by the following representatives: F. C. Randall, manager sales department, New York; J. T. Cunningham, Eastern sales agent, New York; J. J. Neff, engineer, New York; J. F. Dixon, Jr., secretary, sales department, New York; J. H. Denton, chief engineer sales department, New York; W. W. Power, Pennsylvania sales agent, Philadelphia; William Gohel, Pennsylvania engineer, Philadelphia; H. N. Ransom, sales agent, Cleveland; J. J. Riley, Cleveland; J. F. Eldred, Jr., sales agent, Chicago; C. P. Tolman, assistant chief engineer, sales department, Chicago; N. A. Christensen, consulting engineer, Milwaukee; Charles D. Knight, mechanical engineer, Milwaukee; W. L. Waters, electrical engineer, Milwaukee; J. C. James, Milwaukee; W. J. Richards, Milwaukee; F. L. Hutchinson, advertising manager, Milwaukee.

EXHIBIT OF THE INTERNATIONAL REGISTER COMPANY

MC GUIRE STREET SPRINKLER, AT DETROIT

THE STANLEY ELECTRIC MANUFACTURING COMPANY, of Pittsfield, Mass., had space in the center of the exhibition hall, including the heaviest and largest piece of machinery in the exhibition hall proper. The machine referred to was one of the standard S. K. C. rotary converters, similar to those in use on the Flint division of the Detroit United Railway, the Oley Valley Railway Company, of Reading, Pa., and the Kansas City & Leavenworth Railway, of Kansas City. Its liberal design at once commands attention, the commutator being 33 ins. in diameter and having three carbon brushes per holder. The shaft is 7 ins. in diameter at the armature, and 5½ ins. at the bearings. The bearings are each 22 ins. long. The exhibit was essentially a complete S. K. C. sub-station equipment, including, besides the rotary, a three-panel switchboard, instruments, circuit breakers and switches. One panel is reserved for the alternating current supplied to the rotary, another for the direct current coming from the rotary, and the third is a double-feeder panel. All direct-current instruments are on the positive side of the circuit, the negative leads from the rotary being mounted upon a separate pedestal arranged for connection to the rail through a special single throw, single-pole quick-break switch. This pedestal also carries the equalizing switch, which is a duplicate of the negative switch. Much of the completeness and success of the Stanley Company's representation at the convention was due to its energetic Michigan representative, Joseph E. Lockwood, president of the Michigan Electric Company, who directed the installation. The Stanley Company was represented also by Dr. F. A. C. Perrine, president of the company; Messrs. Van Deventer, Arnold and Bergenthal, of the Chicago office; S. T. Dodd, engineer of the railway department, and D. B. Rushmore, from Pittsfield, also Mr. Hough from the New York office. Ray D. Lillibridge, in charge of publicity details for the Stanley Company and other large manufacturers, was on the ground throughout the convention. The rotary exhibited was sold to the Indianapolis & Eastern Traction Company, of Indianapolis, Ind.

HEADQUARTERS OF STREET RAILWAY JOURNAL AT THE CONVENTION

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, manufacturers of the Chloride accumulator, had on exhibition several standard types of railway cells, ranging from 2600 amps. at the hour rate, to 240 amps. at the hour rate. Several samples of vehicle types of the Exide battery were also on exhibition. Two standard blue Vermont marble switchboards, of the type commonly erected by the Battery Company, were installed, showing the special apparatus used in connection with railway installations. One of the most interesting features of this exhibit was the special differential type railway booster. Besides this exhibit on the floor of the armory the Battery Company used, as part of their display, the three batteries on the system of the Detroit United Railway. The first of these batteries consists of 276 G-67 cells installed opposite the main power house of the system. This battery has been in daily operation for the past two years, and by absorbing fluctuations on the system greatly reduces the daily engine hours. Its capacity is 2500 amp.-hours at the hour rate, which capacity is fully utilized once every day on the peak of the load. The second battery, consisting of 250 G-53 cells,

was located about two miles from the power house, at the corner of Hancock Avenue and Third Street. Its capacity is 2200 amp.-hours at the hour rate. It is operated in connection with a standard differential type booster. It is used on the peak of the load once or twice a day, as conditions demand, to maintain the proper voltage within a radius of a mile from the battery house. Before this installation was made a variation in voltage of over 100 volts occurred, the pressure on the peak dropping as low as 375 volts. After installing this battery a voltage variation of from 480 to 500 was the maximum. The third battery on this system was located about eleven miles from the power house, on the Wyandotte division at Ecourse. It consists of 276 type F-13 cells of a capacity of 240 amp.-hours at the hour rate. This battery is used as a regulating line battery in connection with a booster operated at the power house end of the line, a feeder running direct to the battery and the line being fed by feeders from this point. Before the installation of the battery the pressure of this division varied between 200 volts and 750 volts. The pressure of this division is now maintained between the limits of 550 volts and 600 volts, enabling them to better maintain schedules as well as materially reducing the maintenance cost of the electric equipment of the cars. During the convention the Electric Storage Battery Company was represented by Charles Blizard, manager sales department; J. Lester Woodbridge, engineer sales department; E. Vail Stebbins, manager Cleveland office; G. H. Atkin, manager Chicago sales office; R. H. Klauder, manager St. Louis sales office; R. B. Daggett, manager San Francisco sales office, and J. E. Lockwood, president of the Michigan Electric Company, the Detroit agent. The Electric Storage Battery Company has up to the present time installed 220 Chloride accumulator plants on railway systems. A booklet describing the plants of the Detroit United Railway batteries and several other installations was distributed by the Battery Company during the convention.

THE WILSON TROLLEY CATCHER COMPANY, of Boston, Mass., exhibited the Wilson trolley catcher in the hall, but by far the best and most impressive exhibit of this company was on many of the cars of the Detroit United Railway system.

THE SIMPLEX ELECTRIC HEATING COMPANY, of Cambridgeport, Mass., made an exhibit of heaters in the space of the Ludlow Supply Company.

THE PENNSYLVANIA STEEL COMPANY made no heavy exhibits, but showed models of an adjustable split switch with angle-bar reinforcements, the Challenge switch, the Long safety switch stand, the New Century switch stand, the anvil-faced frog and the spring frog. Blue prints of complicated special work done by this company, were shown, and also pictures of the works at Steelton, Pa., the Niagara Bridge and the Goktiek Viaduct, Burma, India. The company was well represented by eight gentlemen, as follows: W. C. Kuntz, Philadelphia; C. S. Clark, Boston; J. G. Miller, St. Louis; C. E. Irwin, St. Louis; Clifford J. Ellis, Chicago; R. E. Belknap, Chicago; H. K. Parsons, Chicago; C. A. Alden, Steelton, Pa. The company's representatives distributed to delegates a steel tape of good quality, useful to street railway mechanical engineers.

EXHIBITS OF CREAGHEAD ENGINEERING COMPANY, STERLING-MEAKER COMPANY AND UNITED STATES CURTAIN COMPANY, C. J. HARRINGTON AND THE TAYLOR ELECTRIC TRUCK COMPANY

THE FRANK RIDLON COMPANY, of Boston, as usual, was represented by C. N. Wood, vice-president and general manager, who was assisted by N. L. Wood. Its exhibits were the Kilbourn track sander, the Ridlon track drill and the Weld babbitting device, which finishes babbitt bearings in one operation without turning out.

THE PNEUMATIC RAILWAY EQUIPMENT COMPANY, of Cleveland, had something new in car equipment in the shape of a pneumatic trolley catcher, worked by compressed air from the air brake reservoir. An air cylinder and piston are

mounted on the trolley base. When the trolley leaves the wire and the current supply is interrupted an electropneumatic valve is opened, which lets air into the cylinder on the trolley base and pulls down the trolley. The electropneumatic valve is in front of the motorman in the vestibule and can be operated by hand in case the motorman wishes to pull the trolley down when the conductor is occupied with other duties. The device is called the air electro-trolley control. The motorman can throw the valve out of action when passing over section insulators or in car houses. The Nichols-Lintern pneumatic sander, so popular on interurban lines, was also shown. George R. Tomb, mechanical engineer, and Robert C. Beebe, vice-president, explained the devices to delegates.

THE STANDARD UNDERGROUND CABLE COMPANY made its usual exhibit of samples, showing various cables in use for street railway work. The important announcement was made that this company is just completing a new copper rod and bare wire mill alongside its present factory at Perth Amboy, N. J., and will be prepared about the last of this year to make not only the bare wire for its own use in making insulated wire, but will be in the market with bare and weatherproof wire in addition to its cables. J. R. Wiley, manager Western sales department, Chicago; H. P. Kimball, of New York; A. A. Anderson and F. S. Viele, of Pittsburgh, were present.

THE BALL BEARING COMPANY, of Baltimore, Md., had the Norwood ball-bearing trolley base on display.

ROSSITER, MACGOVERN & CO., of New York, represented by Frank MacGovern and J. Warren Archer, had headquarters at one of the Cadilac parlors.

THE Q. & C. COMPANY, of Chicago, was represented by A. L. Kalas, and furnished the Stanwood steel steps on the car exhibited by the John Stephenson Company, built for the Muncie, Hartford & Fort Wayne Railway

CHARLES F. JOHNSON, of Buffalo, who carries such a large stock of second-hand electric railway material, was an attendant at the convention.

THE AMERICAN BRAKE-SHOE & FOUNDRY COMPANY, of New York and Chicago, exhibited the Diamond S. Congdon and other types of shoes made by its various branches, and was calling special attention this year to the steel back shoe, in which the cast iron can be cracked transversely without danger of the shoe falling apart. F. W. Sargent, chief engineer; J. S. Thompson, assistant chief engineer; Arthur Gemunde, W. W. Gardner and H. S. Bradfield formed this company's representation.

THE CONSOLIDATED CAR HEATING COMPANY, of Albany, N. Y., represented by Cornell S. Hawley, general agent, New York, showed the types of heaters used on the Manhattan Elevated, of which it has delivered 21,000, and the Boston Elevated with a three-point switch for use on elevated cars. In addition to the regular cross-seat heaters a chair-car heater was shown, which are attached to the truss plank in the same relative position as the hot water pipes on steam coaches, and extend the full length of the car. Among the high-speed interurban roads that have adopted this form of heater are the Aurora, Elgin & Chicago, the Canton Akron Railway, the Grand Rapids, Grand Haven & Muskegon, and the Chicago & Joliet Electric Railway, the Detroit, Ypsilanti, Ann Arbor & Jackson Railway.

GEORGE C. EWING, Board of Trade Building, Boston, formerly president of the Morris Electric Company, was in attendance. He is now handling railway material and supplies and the Nernst lamp in Boston territory.

THE GOLD CAR HEATING & LIGHTING COMPANY, of New York, had a neat display of all types of heaters and a bank of heaters arranged under a longitudinal seat, with cushions re-

EXHIBITS OF THE OHMER FARE REGISTER COMPANY, THE MORRIS ELECTRIC COMPANY, THE CRANE COMPANY, THE REVERSIBLE ELECTRIC CAR SIGN COMPANY AND W. J. SHEPHERD & CO.

moved for inspection. A heater switch controlled all these heaters, regulating the degree of heat to a nicety. E. E. Gold, president, and J. E. Ward attended the convention.

THE COLUMBIA MACHINE WORKS, of Brooklyn, was represented by J. G. Buehler, W. R. Kerschner and Colonel Mack.

THE WEBER RAILWAY JOINT MANUFACTURING COMPANY, New York, exhibited all its types of rail joints, which are so well known and extensively used all over the country. James C. Barr came from the New York office, and Fred. A. Poor, W. T. Smetten and H. C. Holloway from Chicago.

THE MURPHY VARNISH COMPANY, of Chicago, distributed dice-box souvenirs through its representative, William P. Mellon.

THE ARCHBOLD-BRADY COMPANY, Syracuse, N. Y., made no exhibit but was represented by W. K. Archbold and Paul T. Brady.

THE KNOX ENGINEERING COMPANY, of Chicago, recently formed, had both President G. W. Knox and Secretary R. M. Heskett in attendance. This company now has a fine engineering business and has a long list of desirable clients among electric railway companies.

THE PROCESS COPPER & BRASS COMPANY, of Jersey City, N. J., manufacturers of pure copper trolley wheels, had its interests looked after by F. H. Seavey, of the Star Refining Company, Boston, sales agent.

THE CREAGHEAD ENGINEERING COMPANY, Cincinnati, Ohio, represented by T. J. Creaghead, president; A. E. Payne and Claude Johnson, of the Cincinnati office, displayed a line of overhead material, making a specialty of flexible brackets and Bourbon strain insulators. Many photographs of views on roads recently built by this company were also shown. Mr. Creaghead was handicapped in his exhibit by the late arrival of his material, but, nevertheless, made a good showing.

THE STERLING VARNISH COMPANY, of Pittsburgh, was represented by Alvin S. King.

THE HARRISON SAFETY BOILER WORKS, of Philadelphia, Pa., was looked after by Frederick H. Mason, of Detroit.

A GROUP OF ATTRACTIVE EXHIBITS

THE WHEEL TRUING BRAKE-SHOE COMPANY, Detroit, Mich., Dr. J. M. Griffin, exhibited wheel truing brake-shoe and commutator truer. This company bought the parquet at the Temple Theater for Thursday evening and its souvenir was a theater ticket to this entertainment. Some two hundred of the delegates and their friends passed a very enjoyable evening as a result of Mr. Griffin's hospitality.

JOHN F. BLAIR, sales agent, Detroit, Mich. Mr. Blair and F. R. Marks, of the Buckeye Boiler Skimmer Company, Cleveland, Ohio, gave a practical demonstration of the Buckeye Skimmer. They also showed the Jefferson union and flange.

SEVERAL IMPORTANT EXHIBITS

THE NATIONAL BATTERY COMPANY, of Buffalo, N. Y., was represented at the convention by Joseph P. Devin. Mr. Devin reports that the National Battery Company is now in shape to handle installations of any size for electric railway and lighting purposes.

THE KEYSTONE CAR WHEEL COMPANY, of Pittsburgh, was represented by President Chas. V. Slocum.

DALLETT & CO., of Philadelphia, were represented by Frank D. [illegible] president of the company, and N. H. Mason, general representative. They distributed at the convention a series of circulars describing a number of open and closed cars that they have for sale; also a circular describing a number of G. E. motors that they now have on hand.

F. S. DRAKE, the well-known electrical contractor of Philadelphia, attended the convention.

CHARLES S. ACKLEY, who was in charge of the exhibit of the Sterling-Meaker Company, mentioned elsewhere, had also a neat exhibit of metal signs, manufactured by the Terry-Ackley Company, of New York. These signs are entirely of brass, in which the lettering and designs are etched by a new chemical process and afterward plated, oxidized, or otherwise colored, as desired. The business of the company is the making of general business signs, name plates, clock faces and novelties in metal. The effects brought out in the works are pleasing and artistic, and the signs are said to be much more durable than ordinary enamel signs, since the lettering and the color matter are etched into metal itself. The Terry-Ackley Company, of which Mr. Ackley is president, has already secured a large number of orders for this work. The company's business offices and manufacturing plant are located at 571 Hudson Street, New York.

DUMEE, SON & CO., of Philadelphia, distributed some very attractive circulars at the convention. They would like to open correspondence with parties desiring to buy franchises and rights of way for electric railways, also paying roads that are now in operation.

THE PENNSYLVANIA ELECTRICAL & RAILWAY SUPPLY COMPANY, of Pittsburgh, was represented by Samuel F. Hammond.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, of Philadelphia, was represented by William M. Scott, general manager, who was accompanied by Mrs. Scott.

WILLIAM WHARTON, JR., & COMPANY, of Philadelphia, in a tastefully arranged exhibit showed a number of examples of special track work for street railways, especially their manganese steel hard-center work, which has proven such a great success in the more than six years that it has been in use under the heaviest traffic in the country. A worn-out frog of girder rail construction with manganese steel center, attracted great attention, and it conclusively proves that the manganese steel centers which the Wharton company uses actually do out-last the adjoining rails. Some of the samples of new work exhibited showed the details of the construction and the peculiar manner of fastening the centers, which is so secure that even under the heaviest traffic the centers remain perfectly tight and never become loose. At the same time, the method of fastening is such that the centers could be renewed should necessity arise, but the Wharton Company states that in all their experience this has been limited to only a very few centers which developed some hidden defect, and that it is not necessary to renew manganese steel centers on account of wear. This is apparently proven by the worn sample above referred to. The Nichols protected heel switch exhibited, while it had been shown before in its general features, embodied a number of improvements, one, in particular, being a new method of tightening up the bearing of the tongue pin, and a new simple fastening device for the manganese steel cap which protects the heel of the tongue, and by which this cap can easily be removed should it become necessary to take out the tongue on account of some accident to it. This type of tongue switch has proven a marked success. The construction absolutely prevents the tongue from throwing between wheels or between trucks of cars, and the heel of the tongue does not knock down, as has been found the trouble with most ordinary tongue switches. The standard tongue switch of the Wharton Company, also shown, had already, to a great extent, overcome the two troubles mentioned, but the protected heel switch, although more expensive, is regarded well worth the difference, on account of the greater efficiency in regard to these two points. The manganese steel construction for standard T-rail work, of which samples were included in the exhibit, represents a comparatively new departure, and has been greatly improved by the Wharton Company within the last few years. The special pieces in this track construction are made of solid manganese steel castings. The abutting rails are joined up to these pieces by means of fish-plates and wings extending from the manganese steel casting, making an exceptionally solid joint. This class of work is extensively used where permanency, rather than saving of first cost, is aimed at. Although no samples were shown, the Wharton Company report extensive use of its manganese steel on steam railroad tracks and elevated roads with most phenomenal results, the manganese steel frogs on the Pennsylvania Railroad having out-lasted as many as ten ordinary frogs, and being still in use. They also have recently furnished rails cast out of manganese steel in curves for the Boston Elevated road, which promise to exceed all expectations in regard to their wearing qualities. The representatives at convention were Victor Angerer, vice-president; W. Rodman Wharton, John C. Robinson, New England agent, and Arthur S. Partridge, of St. Louis.

THE PECKHAM MANUFACTURING COMPANY had, as usual, a very attractive exhibit, and although unable to secure space within the convention hall, secured a most desirable position directly adjoining the main entrance to the Light Guard Armory, so that every one who entered the building passed the exhibit. The company showed an attractive line of trucks, but probably the greatest interest was taken in the new Peckham No. 32 M. C. B. truck, equipped with triple elliptic spring bolster. The truck shown was one of twenty now being built for the Columbus, Delaware & Marion Railway, of Columbus, Ohio, although trucks of the same type are used on the Indianapolis, Lebanon & Frankfort Railway and on the Toledo & Indiana Railway. The side frames are of the bridge truss construction with a very strong and deep truss, which is spring-supported on the equalizing bars, and also from the journal boxes to prevent teetering. The truck has a long spring base, which is secured by locating spiral springs on each side of and supported from the journal boxes, thus preventing the tilting of the top frames. The transoms are bulb angles 10 ins. deep, which extend full size with the side truss frames, to which they are very rigidly secured. Gussets of sheet steel connect the transoms to the side frames and hold the frame rigid and square. The bolsters are all steel and of "bridge shape" top and bottom and the end sections of the bolsters are supported by triple elliptic springs. Straps secured to the transoms and extending to the bolster prevent its being lifted out. The journal boxes are M. C. B. standard pattern with M. C. B. journals. The truck as exhibited was designed to be equipped with 75-hp motors and weighs about 9000 lbs. Mr. Peckham also showed one of his extra strong, short wheel base No. 14 B3 trucks, as constructed for the Cincinnati Traction Company and also for the Indianapolis Street Railway Company. This truck was designed expressly to reduce the height of the car body and do away with one step by allowing the wheels to radiate between the sills of the car and by its short-wheel base to enable the truck to take a 25-ft. radius curve with minimum power. The ends of the truck are of the "low down" construction, so as to allow the truck to radiate under the steps of open cars. One hundred of these trucks are now being built for the Cincinnati Traction Company, and the company has sold 400 of them to the Massachusetts Electric Companies, of Boston. Mr. Peckham also expected to exhibit the Aurora special truck built for the Aurora, Elgin & Chicago Railway described in the Street Railway Journal for Oct. 4, but the truck was delayed in transit. In addition, the company had under the exhibit car of the Jewett Car Company built for the Columbus, Delaware & Marion Railway, a pair of its high-speed No. 32 trucks, as described above, and also under the car equipped by the Kuhlman Car Company a pair of high-speed No. 15 trucks. The Peckham Company was represented by Edgar Peckham, J. A. Hanna and F. A. Richards. After the close of the convention, Mr. Peckham left for a trip through the West. In addition to the trucks on regular exhibition, the Peckham Company was well represented in Detroit, as they sold many equipments in that city. Among the companies using the Peckham 14A XX truck are the Detroit United Railway, the Detroit, Romeo, Rochester & Lake Orion Railway and the Detroit, Lake Orion & Flint Railway.

HUNTER FENDER EXHIBIT

MESSRS. TOWNSEND, REED & CO., of Chicago and Indianapolis, were represented by W. H. Gray and W. M. Moran.

THE MORDEN FROG & CROSSING WORKS, of Chicago, were represented by M. F. Moore.

THE KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY was well represented by F. E. Kinsman.

THE MacPHERSON SAFETY SWITCH & FROG COMPANY, of Niagara Falls, had a working model of its appliances on the main floor of the Cadillac Hotel.

THE BEMIS CAR TRUCK COMPANY, of New York, had as representatives at the convention Geo. M. Hoadley and Thos. F. Carey.

THE ROCHESTER CAR WHEEL WORKS had no exhibit, but Edward H. Chapin and F. D. Russell attended the convention in the interests of the company and had as a souvenir an attractive matchbox.

THE NEW YORK SWITCH & CROSSING COMPANY, of Hoboken, N. J., was represented by M. W. Conway. The com-

pany made no exhibit, but a visit to its plant at Hoboken would show a fine variety of switches, crossings and special work under construction for electric railway companies.

THE FORT WAYNE FOUNDRY & MACHINE COMPANY was present in the person of A. A. Hilton, manager. Mr. Hilton renewed many of his acquaintances with street railway men, made during his six years' connection with the St. Louis Car Wheel Company as general sales agent.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, of Cincinnati, made no exhibit; but its excellent line of tubular poles, brackets, line material, etc., was ably spoken for by J. B. Crankshaw, electrical engineer.

J. G. WHITE & CO. were represented by C. G. Young, who recently returned from Philippines; H. S. Collette, who represented the San Juan Light & Power Company of Puerto Rico; S. G. Averell and E. L. West.

THE WACLARK WIRE COMPANY, of New York, was represented by H. F. Sanville, its Philadelphia representative. The Waclark Wire Company is now making a specialty of trolley and feed wire of every description, including long-distance transmission wire.

THE ELECTRICAL ENGINEERING & DEVELOPMENT COMPANY, of New York, was represented by H. S. Cooper.

MR. W. R. KERSCHNER, of Allentown, Pa., was present in the interests of the Columbia Machine Works & Malleable Iron Company, of Brooklyn. It is needless to add that the company in question profited greatly by Mr. Kerschner's attendance at the convention.

MESSRS. WENDELL & MacDUFFIE, of New York, were represented by Jacob Wendell and J. B. Embick. Much regret was expressed that Mr. MacDuffie was unable to be present also.

THE MULFORD & PETRY COMPANY, of Detroit, New York, Chicago, etc., was represented by A. F. Petry, vice-president. Murford & Petry advertisements are so familiar to the officers of electric railway companies and to the patrons of their cars that no exhibit was required.

THE AMERICAN CAR & FOUNDRY COMPANY was represented by Scott H. Blewett, general agent.

THE NATIONAL CONDUIT & CABLE COMPANY was represented by W. S. Eckard and J. D. Honan, of the New York office, F. S. V. Fraf, of the Boston office, L. D. Beylard, Philadelphia, and Harry F. Tate, of the Chicago office.

THE ST. LOUIS CAR COMPANY was not represented in the exhibition hall, but it had a most effective exhibition in the large car which made regular trips from Detroit to Farmington, out Grand River, a distance of 19 miles. An invitation was extended to the delegates to make this trip, and many of them took advantage of this opportunity. W. A. Boland, who is completing the interurban line between Detroit and Jackson, upon which cars of this type are to be operated, accompanied the party together with representatives of the General Electric Company and the St. Louis Car Company. The car is 58 ft. long, and contains a smoking compartment, which is entirely isolated from the rest of the coach, so that it is not necessary to pass through it to leave the car at the end where it is located. It has seating accommodations for 75 passengers. There is a vestibule in front and rear, the front being divided and one part fitted up as an observation section. The woodwork is mahogany throughout, and the seats of cane with reversible backs. The fittings and furnishings are in keeping with the type of the car and the service for which it is built. The car is equipped with four General Electric 125-hp motors, geared to run 65 miles an hour. Good time was made in the trips at Detroit, but no attempt was made to develop the speed limit. Several trips were made each day through the courtesy of the Detroit United Railway Company. Mr. Boland expects to have his own road running from Jackson to Battle Creek and from Jackson to Ann Arbor by the first of the year, and running the entire distance from Jackson to Detroit by spring.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY, of Chicago, one of the leading manufacturers of high grade telephones and switchboards, made one of the most extensive telephone exhibits ever offered at a street railway convention. Telephones of special interest to street railway men were shown. There was a standard common battery switchboard with many different types of instruments connected thereto. R. H. Manson, of the engineering department, and F. L. Martin, advertising manager, looked after the exhibit. This company is now catering to the street railway field in the same excellent manner that it has handled large exchange work.

THE McROY CLAY WORKS, Brazil, Ind., was represented by E. F. Kirkpatrick, western manager, of Chicago.

R. W. CONANT, of Cambridge, Mass., exhibited his portable bond tester and also an instrument for determining whether motor field coils have become short circuited. The latter is an induction instrument in which a pulsating current is sent simultaneously through a perfect field coil and the one to be tested. When the induction is unequal the circuits are out of balance, and a telephone receiver is used to note the fact. The bond tester is similar to previous forms, save that it is now arranged for one man to manipulate the contacts on the rail as well as the instrument. This works on the Wheatstone bridge principle with the telephone receiver and vibrator in place of galvanometer.

THE SIMONDS MANUFACTURING COMPANY, of Pittsburgh, so well known as manufacturer of the Simonds gears and pinions, was represented by H. F. Sanville.

L. C. CHASE & COMPANY, of Boston, was represented by Frank B. Hopewell, manager of the company's leather department, with headquarters at Boston. Messrs. Chase & Company have been making a specialty for years of plush seating for railroad cars, and have excellent facilities for handling electric railway orders for the same material, as well as for Chase leather.

GENERAL ELECTRIC COMPANY'S EXHIBIT

THE STRONG, CARLISLE & HAMMOND CO., of Cleveland, was represented by F. H. Lovejoy, manager of the Squires' feed-water controller department.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, was represented by H. J. Doyle, manager railway department.

THE JOHN A. ROEBLING'S SONS COMPANY, of New York, and Trenton, N. J., had a large representation present, among whom was noticed H. L. Shippey, treasurer; M. R. Cockey and G. W. Swan, of the New York office, and George C. Bailey and Mr. Conover, of Chicago; W. P. Boreman, Cleveland and W. L. Doyle and N. G. Tingley, Trenton.

THE WESTERN ELECTRIC COMPANY had as representative at the convention, R. H. Harper, of its railway department at Philadelphia.

In his speech at Steubenville, a few days ago, Senator Hanna challenged Mayor Tom L. Johnson to a debate on the tariff, the subject to be discussed from a strictly economic standpoint and with no reference to monopolies. Senator Hanna's challenge was telegraphed to Mayor Johnson at Wooster, and it is said that the latter immediately replied that he would accept the challenge and would debate the subject in any way or at any time Senator Hanna might name.

General Electric Apparatus at Detroit Convention

The General Electric Company's exhibit was located in the corner of the annex and occupied 2000 sq. ft. of space. The principal feature was an installation of the type "M" control now in use on the Manhattan Elevated Railway in New York City. This exhibit was mounted on a frame which permitted free examination of the parts during its operation and shows the rise in voltage which, of course, corresponds to the increase in speed of the motors. To indicate this rise in voltage a number of incandescent lamps are used, grouped in the form of the company's monogram, which start at a dull red and gradually come up to full candlepower. Other General Electric apparatus for electric railway service exhibited consisted of a line of railway motors of various sizes, including the 125-hp GE-66 motor which has been adopted by the Manhattan Railway Company. A Brill 27-E truck was shown with two GE-57 motors mounted upon it and equipped with the General Electric new type of shoe for use on the protected third-rail system. This latter was exhibited for the first time. There was also exhibited in operation, General Electric air compressors of standard types with automatic governors. These were in operation connected to a standard reservoir.

A CORNER IN THE GENERAL ELECTRIC COMPANY'S EXHIBIT

A type-H electrically controlled oil break switch with a capacity of 300 amps. at 12,000 volts made a very interesting operating exhibit, the switch being substantially installed as in actual service. Direct and alternating current rotary converter switchboard panels of standard types are also shown. Among the small supplies exhibited may be mentioned a 6000-amp. carbon break circuit breaker for railway use beside smaller sizes of the same type. An attractive display stand for rail-bonds, incandescent lamp sockets and other small devices was also shown. The entire exhibit was arranged for convenience of examination by visitors and the attractive reception space at the center of the exhibit made a pleasant resting place for the delegates. A feature of considerable interest which formed a part of the General Electric Company's exhibit at this convention was a 50-ft. interurban car lent by the Jackson and Suburban Traction Company and used by the company in demonstrating the system for operating such cars. This car was equipped with the type "M" control and 4 GE-66 (125 hp) motors. It was located on the Detroit United Railway Company's tracks at a point near the convention hall and was used by the delegates and their friends for rides around the city. The General Electric Company was represented among others by the following: W. B. Potter, J. R. Lovejoy, J. G. Barry, C. C. Pierce, J. J. Mahoney, T. P. Bailey, J. B. Pevear, G. D. Rosenthal, J. H. Livsley, F. H. Gale, L. R. Pomeroy and E. H. Mullin.

"Corporation Counsel Rives proposes to make efforts to collect back taxes from street car companies. He figures that $17,000,000 is due. Hints are made that unless the companies show a disposition to pay, he may recommend that some of their franchises be revoked; also that license tags be required on cars." This is the "startling" announcement that was made a few days ago in a New York paper. Just how it was arrived at that $17,000,000 is due the city is not made clear.

Convention Notes and Entertainments

The reception at Hotel Cadillac Wednesday evening, tendered by the local committee to the delegates and visitors, proved a most enjoyable affair. Several hundred members and ladies assembled in the spacious parlors of the hotel and enjoyed the music, dancing and refreshments, provided by the committee.

The courtesy extended the visiting delegates by the board of managers of the Detroit Club in offering the facilities of the club during the sessions of the association were heartily appreciated. A considerable number of the visitors embraced the opportunity thus afforded, and found the club surroundings exceedingly attractive.

Col. Hecker, of Detroit, entertained the executive committe and a small number of invited guests on Thursday, giving them a delightful sail on Lake St. Clair and terminating at the Country Club. Those who were fortunate enough to participate in this excursion reported a delightful time on the palatial yacht belonging to Col. Hecker.

A reception was given the ladies from 10 a. m. until 4 p. m. Wednesday in the Cadillac parlors. It was an informal affair, and proved to be a most delightful incident. The visitors were received by a ladies' committee. The rooms had been decorated with roses and palms, and refreshments were served. The reception was much appreciated by the visiting ladies, as it afforded an opportunity to become acquainted with each other before the excursions which followed during the convention.

On Friday the visiting ladies were tendered a trolley ride to Mount Clemens. The start was made from the Cadillac Hotel about 10 o'clock in the morning in a line of special cars. Mount Clemens was soon reached via the Rapid Railway, and a short stop was made at that point so that the visitors could inspect some of the sanitariums which have made this little resort famous. Cars were then taken by way of the Shore Line to the Country Club, which was reached about 1 o'clock. Here the ladies of the local committee had provided a sumptuous luncheon.

The tables were profusely decorated with flowers, and a most attractive repast was served. The club is delightfully situated on the banks of the river, a view of which was afforded the guests as they sat at luncheon, and afterward from the broad verandas which surround the club house. A number of the delegates who participated in the Friday morning sessions in Detroit, joined the party at the club, where most of the visitors stayed until it was time to return to the city for the banquet.

The Crocker-Wheeler Company, of Ampere, N. J., organized on Thursday afternoon a most interesting trolley trip to the Rochester power house on the Flint division of the United Railway Company of Detroit. Two well-filled cars were despatched under the direction of Putnam A. Bates and F. B. DeGress, of the Crocker-Wheeler Company, and a delightful ride of some 30 miles was taken into the pretty rural region lying back of Detroit, illustrating how the trolley has banished isolation for the farmer and brought all the comforts and conveniences of the city within his reach. Not only were passenger cars flying in every direction up and down rural lanes, but at frequent switches were freight and express cars laden with goods or with farm produce, from fresh milk to the last bushel of husked corn. The Rochester plant, 26 miles out, recently illustrated in these pages, might well be called a Crocker-Wheeler railway power house. It contains a fine 400-kw Crocker-Wheeler generator driven by a Ball & Wood compound condensing engine and two 200-kw Crocker-Wheeler units similarly driven. Circuits radiate widely from this plant, and the sterling stability of the apparatus is evidenced by the continuous overloading to which it has been subjected for months in meeting the demand for current. During the trip cigars and dainty descriptive bulletins were distributed, while at the power house sandwiches, coffee and punch refreshed those who had been enjoying the spin through the crisp autumnal air.

The labor agitators are at it again in New York, they having recently circulated among the employees of the Interurban Street Railway Company and the Brooklyn Rapid Transit Company circulars calling for the organization of a union among the employees of these companies. Of course, the agitators, preaching their doctrine of discontent, will find some who are willing to do their bidding, but the street railway men of New York are too sensible a lot to be fooled by these tricksters. The agitators seem to have forgotten their lesson of 1899.

Westinghouse Interests at Detroit

All the Westinghouse interests that are connected with electric railway development were represented in the exhibition hall at Detroit during the convention.

The apparatus exhibited by the Westinghouse Electric & Manufacturing Company included a 1500-kw rotary converter, of the same design as those ordered by the Rapid Transit Subway Construction Company of New York, and is, except for some details of the frame, practically the same as the 1500-kw rotary converters furnished to the Manhattan Railway Company, the largest of their kind ever constructed. They embody several improvements, one of which is the "grid damper" on the pole pieces. This device serves to prevent fluctuations of the total magnetic flux, and at the same time shifting of the field across the pole pieces. The armature is cross connected in the same way as are all Westinghouse multiple connected direct-current machines. The cross connections are back of the commutator. The brush holders are of the sliding shunt type and leave the commutator easily accessible. These machines run at 25 cycles, 250 r. p. m. and are arranged to be started with direct current. Their efficiency is about 97 per cent. It is a significant fact that 69 of these machines have been built or are on order, the first one having been put out about a year ago.

Multiple control apparatus for two cars with two No. 131 controllers and four No. 50-C motors, were arranged on trucks for operation. These trucks are of the Master Car Builders' standard equalizing-bar type and were built by the Baldwin Locomotive Works, of Philadelphia, Pa. The Westinghouse multiple control system involves the use of compressed air for moving the controlling apparatus, electro-magnetic valves governing the admission of air to the several cylinders and low voltage circuits for controlling the action of the magnet valves. The complete controlling equipment for each motor-car consists of one controller with operating head, two motormen's multiple control switches, one railway type circuit-breaker, one set of connectors, a small storage battery and an auxiliary air reservoir. The controller is of the series-parallel type and is similar in design to the ordinary form of hand controller which has been in successful use for many years. A multiple control switch is placed at one or both ends of each motor-car and by means of the one at the front of the leading car the motorman directs the action of the controllers on all the motor-cars in the train.

Three railway motors were shown. The 50C motor was of the type used on the Union Traction Company's lines in Indiana in two-motor equipments; the No. 76 by the Rapid Railway of Detroit and the Pacific Electric Railway of Los Angeles, Cal., in 4-motor equipments, and by the Toledo, Fremont & Norwalk, of Ohio, in 2-motor equipments, while the No. 81 was similar to those used by the Brooklyn Rapid Transit Company, 1700 motors having been sold to that company. These are all large motors adapted for suburban, interurban and elevated railway service.

VIEWS IN THE EXHIBITS OF THE WESTINGHOUSE COMPANIES

Type-N transformers which embody many new features introduced by the Westinghouse Company into American practice, were shown, together with type-C induction motors and a starting device used with this motor which may consist either of a simple switch or a switch in connection with an auto-transformer, occupied a conspicuous position. Among the detail apparatus was the cell-type diverter, a form of resistance used in starting street car motors; a canopy switch for street railway equipments, made of metal and slate, with all exposed parts dead; an automatic car circuit-breaker, which serves the combined purpose of fuse block and canopy switch; an automatic circuit-breaker for direct and alternating current circuits, the essential parts of which are the laminated copper brush, the swinging arm, the contact blocks and the carbon shunts at the top; the iron fuse block for street cars, completely enclosed by an iron casing, except where the vent extends through the bottom; a direct-current illuminated dial volt-

meter and ammeter, made of translucent material, so that it can be illuminated from the rear, thus rendering it easily read from a distance; and the low equivalent lightning arrester, used on high voltage alternating-current circuits.

The Westinghouse Electric & Manufacturing Company's representatives included F. H. Taylor, L. A. Osborne, Arthur Hartwell, W. H. Whiteside, Geo. B. Dusinberre, D. D. Pendleton, H. B. Shute, N. W. Storer, S. W. Kier, H. P. Davis, P. N. Lincoln, C. Renshaw, H. N. Cheny, M. Baxter, C. E. Skinner, A. Whitley, J. M. Duncan, Pittsburgh, T. P. Gaylord, C. W. Regester, Irvin Dryer, Chicago; C. B. Humphrey, Cincinnati, R. E. Drake, B. T. Brady, Syracuse; C. W. Underwood, W. E. Parker, Buffalo; F. B. H. Paine, J. L. Crouse, New York, N. Y.; J. R. Gordon, Atlanta, Ga., R. S. Brown, Boston, Mass.; N. S. Braden, Cleveland, Ohio; C. F. Medbury, W. B. Wriaks, Detroit.

Westinghouse, Church, Kerr & Company's staff at the convention included E. H. Sniffen, C. M. Vail, New York, H. H. Kerr, Chicago, W. Franklin, H. J. Raynor, Detroit, S. A. Jenkins, Boston.

The Nernst Lamp Company was represented by A. E. Fleming, G. J. Stanley, Pittsburg; George C. Ewing, Boston; Walter Floyd, New York.

The Standard Traction Brake Company had a large representation comprising J. R. Ellicott, C. R. Ellicott, F. V. Green, A. J. Brislin, New York; G. A. Hager, C. C. Farmer, Chicago; P. J. Myler, Hamilton, Ont., A. B. Brown, Buffalo, S. D. Hutchins, Columbus; W. Cummins, Cincinnati, I. B. Clarke, E. H. Dewson, F. C. Newell, Pittsburgh.

A Parlor and Sleeping Car

One of the most conspicuous exhibits at the Detroit Convention, as well as one which attracted wide attention, was a private car built for use on the Mandelbaum system of electric railways by the G. C. Kuhlman Car Company, of Collinwood, Ohio. This car, which is illustrated herewith, was located on the track just in front of the entrance to the exhibit hall, and attracted many visitors, not only on account of its novel features but also of its

EXHIBIT OF THE G. C. KUHLMAN COMPANY

handsome appearance within and without. Private cars for the use of presidents and prominent directors are common in steam railroad service, but cars of this kind for electric railways are certainly novel. The car was fitted with two drawing room compartments, one at each end of the car, a complete sleeping compartment with stationary bed, bath tub, etc., an observation compartment in the front of the car, and an observation platform of the regulation type in the rear. The car measured 46 ft. 6 ins.

INTERIOR VIEWS OF THE KUHLMAN CARS

over all, and 8 ft. 6 ins. over the side sills. Owing to this width the car was set 2 ins. off of the center of the trucks, away from the devil strip, to allow ample room for passing cars in cities where the tracks are close together. The windows were 54 ins. wide, of ground French plate, and were draped with silk curtains and fitted with silk shades. The interior finish of the car was mahogany throughout, with carved panels curved underneath the window sills. The interior decoration of the car was of the empire style with ceiling finished in pea green with carved gilt mouldings. The curtains, furnishings and upholstery of the car were designed to match with this general effect. The deck lights were of

cathedral glass. The car was lighted with thirty electric lamps, one row being over the windows and the rest being in the electroliers. The fixtures shown at Detroit were temporary, but the car will be finished with electroliers of all gold finish, made in empire style with globes and shades silver edged.

At the center of the car was a private bed room and bath, with a three-quarter mahogany bed, washstand, toilet and bath tub. The water tank for the latter holds 225 gallons. The lamps in the bed room were on a separate circuit from those in the car proper.

The seats used in the drawing room compartments were of cane, with leather and plush cushions. The carpet was the best Wilton velvet, and was selected to harmonize with the color scheme of the interior. The front end of the car was glazed with curved sash, and had a separate motorman's compartment to the right, with observation room at the left, from which the entire track in front of the car can be inspected. The rear drawing room will be fitted with a fine mahogany buffet with leaded glass doors and an ice chest. As the car was sent to Detroit before it had been finally completed, the buffet was not on exhibition, but views of it were shown by the representatives of the Kuhlman Company present. The observation platform in the rear was 4 ft. x 7 ft. 6 ins. wide, and was fitted with the standard observation railing with grilled iron work and brass mountings. The hood was supported by heavy brass posts, and the sides of the car were fitted with large, heavy brass grab handles. The corners of the car are to be provided with embossed bent plate glass. The car was painted throughout with Sherwin-Williams paint and varnished with varnish of the same manufacturers. The car was mounted temporarily on Peckham trucks and was equipped with Christensen air brakes with motor compressor and air whistle.

A Well-Managed Exhibition

It would be out of place to publish a report of the exhibits at the Detroit convention without mentioning the constant conscientious attention given to the exhibitors' needs previous to the opening of the convention by the Detroit United Railway people. That there should be a few delays in railroad shipments of exhibit material, and disappointments in the way of not securing all the space asked for, was inevitable, but it is hard to conceive how the local street railway men could have done more to aid exhibitors in getting their exhibits in place than was done at Detroit. John H. Fry, assistant general passenger agent of the Detroit United Railway, who had charge of exhibit matters, won the hearts of exhibitors early in the game by his considerate treatment of everyone, and his earnest efforts to accommodate in some way those who, for various reasons, did not secure the space desired. But the great point about the whole matter of getting the exhibits in place was that the gentlemen of the Detroit United Railway who looked after these matters were always on hand, and always ready to help out any exhibitor, either in the way of locating exhibits lost in the Detroit freight houses, or facilitating their movement towards the convention hall. Besides Mr. Fry, mention should be made of the work of John Kerwin, superintendent of tracks of the Detroit United Railway, who had in charge the erection of the temporary building, no small task in itself, and the receiving of heavy exhibits. It was by virtue of Mr. Kerwin's portable track and the prompt work of his crews that the large number of heavy exhibits were found on the track space at the opening of the convention, and to him was due the credit of having the temporary building around the armory ready for occupancy within so short a time after the close of a previous convention, which prevented its earlier erection. Mr. Kerwin was always to be found around the convention hall during the few days previous to the convention, as were also F. J. Burdick, superintendent of overhead lines, who had every available kind of electrical current on tap in the hall to meet the desires of any exhibitor, and Albert Eastman, traveling express agent of the Detroit United Railway, who had a marvelous way of getting lost freight and express boxes out of the clutches of his friends in the steam railway freight depots. It seemed to be the universal sentiment among the supply men who had anything to do with placing exhibits that the constant, faithful personal attention given to the matter by officers of the Detroit United Railway was very much appreciated and left little to be desired.

The Worcester Consolidated Street Railway Company, Worcester, Mass., has given the city of Worcester an opportunity to buy 2000 tons of Welsh anthracite coal at $6 per ton at Boston, and an option on a cargo of 7000 tons at the same price. The company had the opportunity to buy two cargoes of 7000 tons each, but 5000 tons is sufficient to meet its needs. The first cargo is to reach Boston Oct. 20. The city has a committee appointed to procure fuel for those otherwise unable to get it, and the offer was made to this committee.

"Ceco" Electrical Machinery

The Christensen Engineering Company, of Milwaukee, has just placed upon the market a complete new line, including direct-current motors and generators, alternators and transformers, to be known as "Ceco" electrical machinery.

The company is now prepared to build machines up to 1500-kw capacity, suitable for general power, railway or lighting service. Type C. E., ranging in capacity from 2 hp to 50 hp, is illustrated herewith. These motors are made in three styles, open, semi-enclosed and enclosed. The standard styles are belted, but any motor can be geared or direct-connected to the driven machine or shaft. The frame or magnet yoke to which the poles are secured is cylindrical in shape. It is composed of a single steel casting. The bearing brackets are secured to the frame by bolts. The terminals are mounted on top of the frame where they are not liable to be accidentally touched, but where they are readily accessible in case it is desired to change the connections in order to reverse the direction of the motor. The two bearings are supported by two end brackets, which are identical and interchangeable so that the motor is symmetrical and pleasing in appearance. The semi-enclosed style is the same as the open, with the addition of four perforated malleable iron cover plates. The plates fit into the four open spaces between the arms of the end brackets, and can be quickly and easily removed or replaced. The enclosed style is the same as the semi-enclosed except that the cover plates are solid instead of perforated. Either style of cover will fit into the open style motor, consequently the same motor may be used as open, semi-enclosed or enclosed.

The field poles are built of laminated sheet steel, thereby avoiding eddy current losses. The larger machines have four poles, and the smaller sizes are built with two only, thus permitting the use of a commutator that can be easily insulated. The poles are bolted to the yoke so that a rigid construction is obtained, and the pole is easily removable without disturbing the armature.

The field winding is composed of machine-formed coils accurately wound by automatic machinery. Any field coil can be readily and quickly removed without disturbing the armature by simply withdrawing the pole. The armature core is built up of punched discs of soft sheet steel slotted around the periphery to receive the armature winding. These discs are reannealed and insulated after being punched before assembling.

The shape of the punching is such that when assembled on the steel shaft openings are provided for ventilation parallel to the shaft. Additional ventilation is secured by the use of radial air ducts.

The armature coils are all machine wound. Those for the smaller motors are of wire, while those for the larger sizes are composed of copper bars. The coils are all carefully insulated, then dipped into a bath of special insulating compound, and finally placed in a drying oven until they are thoroughly baked. Surface bands are used to retain the coils in the slots on the smaller sizes, while the same result is secured in larger sizes by the use of retaining wedges placed in specially provided notches near the top of each slot.

The commutator is built up of copper segments insulated from each other by sheets of the highest grade of mica, of hardness corresponding to that of the copper, so that a smooth and even wearing surface is presented to the brushes. Pure-hard drawn lake copper is used. The segments are of generous length and depth, insuring cool running and allowing ample margin for wear. The commutator is easily removable from the armature shaft, tapped holes being provided in the face of the commutator sleeve for that purpose. As the commutator is usually the cause of more trouble than all other parts of a motor combined, unusual care has been given to the design and construction of this important element of "Ceco" motors.

Carbon brushes are used, and the brush holders are of the Christensen Company's coil spring reaction type. The studs to which the holders are secured are mounted upon a yoke, which is fastened to the inner side of the bearing bracket. Each brush can be readily adjusted and any brush can be quickly and easily removed while the motor is running.

The brush contact area is in all cases ample for the current to be commutated, the current density being very low and at the same time consistent with economical design. Wear of the commutator is provided for by radial adjustment of the brush-holder studs. After the brushes are properly set no shifting is required, and the motor operates without noise and without sparking.

The bearing surfaces are generous in area. Self aligning babbitted bearings with self-oiling ring arrangements are provided.

The motors are mounted on a cast iron sub-base, which is composed of a single casting, thus insuring perfect alignment. Belt tension is accomplished by moving the motor upon the sub-base in the usual manner.

The ventilation of the armature and commutator is such that these motors will operate at their rated loads without the temperature of the armatures rising more than 30 degs. C. The rise in temperature of the field coils under these conditions will not exceed 40 degs. C., and of the commutator 45 degs. C. These machines will operate from no load to full load with the brushes in a fixed position without sparking. They will also operate for two hours with 25 per cent overload and for two or three minutes with 50 per cent overload without injurious heating or sparking.

TYPE C. E. ENCLOSED "CECO" MOTOR

These motors will operate in any position in which the shaft is horizontal. This is accomplished by shifting the bearing brackets on the frame so that the oil chambers remain in the proper position, whether the motor is secured to the floor, the ceiling or the side wall.

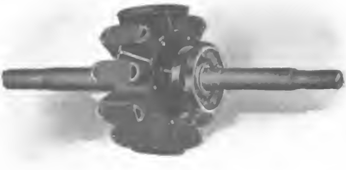
A rigid system has been established for the inspection of the parts of each machine while under construction. When completed each machine is given a severe running and high insulation test. Then the frame is rubbed with a good filler and painted. All bright parts are polished.

All the "Ceco" alternators, whether belted, engine-type or direct-couple, are of the revolving field type, thus leaving the armature stationary and easily accessible. By this form of construction the difficulties of properly insulating the armature coils which have caused much trouble in rotating armatures are eliminated.

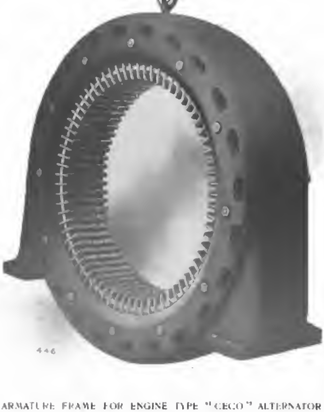
The frame consists of cast iron housings, into which rings of laminated steel with inwardly projecting teeth are assembled, thereby forming slots for receiving the armature windings. The armature is designed with six slots per pole, so that it may be wound or rewound for single, two or three-phase, as required. The armature frames for the belt-driven alternators are cast in one piece, while the frames for the direct-driven machines are divided horizontally. Instead of the usual practice of having several coils for the same machine, all the armature coils for each "Ceco" alternator are of the same size and shape, so that they are interchangeable. The coils are specially insulated, so that they will stand, without injury, the highest temperature that will ever be reached in service.

5 HP TYPE C. C. ARMATURE

The poles are built up of laminated steel upon a cast iron spider, which is mounted upon a forged steel shaft. In the large sizes the laminated poles are assembled upon a steel ring which is carried on the shaft by means of the cast iron spider. The individual poles are in all cases easily removable with their coils, without dismantling the machine. The field coils are composed of rectangular copper strap bent on edge. The collector rings are made of cast iron, and carbon brushes are used, thus reducing to a minimum the tension required, as well as the wear of the parts. Standard frequencies are 60 cycles and 25 cycles per second. With the exception of the smaller sizes "Ceco" alternators can be wound for any voltage up to 15,000. The temperature rise when running continuously with full load at any power factor will not exceed 35 degs. C. in the armature, or 40 degs. C. in the fields. At 25 per cent current overload the corresponding temperatures will not exceed 40 degs. C. and 50 degs. C. The machines are all designed so that they will carry satisfactorily a 50 per cent current overload for two hours at any power factor without injurious heating.



REVOLVING FIELD FOR "CECO" ALTERNATOR



ARMATURE FRAME FOR ENGINE TYPE "CECO" ALTERNATOR

The Christensen Engineering Company has comparatively new works, as they were completed but two years ago, and no expense was spared in providing every facility for the rapid, accurate and economical manufacture of its product. The foundation for a

250-ft. extension to the main machine shop, which is 180 ft. in width, has just been completed. There are three stories, and this extension will provide 88,000 additional square feet of floor space.

Litigation Ended at Nashville

By an agreement entered into a few days ago, litigation between the City of Nashville and the Nashville Street Railway Company which has been pending in the courts for some time, has been settled. The city secured the recognition of the right to purchase the street car system at any time after twenty years; also a guarantee that the company will expend not less than $1,000,000 in the improvement of the system; also the donation of a park at a cost of $125,000 and the payment to the city of 2 per cent upon the company's gross income to be used by the park commission for the improvement and maintenance of the city's parks. After the company's gross earnings aggregate $1,000,000 then the 2 per cent assessment will be increased to 3 per cent and continue perpetual.

Street Railway Patents

UNITED STATES PATENTS ISSUED OCT. 7, 1902

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

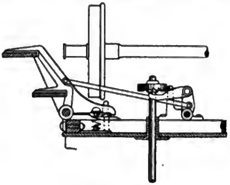
710,422. Automatic Safety Device for Cars; W. H. Caley, Denver, Col. App. filed Feb. 10, 1902. A safety device for preventing accidents to the entering and departing passengers by preventing the starting of the car while any passenger is stepping upon the step and may therefore be partly on the car and partly on the ground.

710,432. Automatic Switch Mechanism for Street Railways, J. D. Cottrell, Providence, R. I. App. filed May 13, 1902. The motorman throws down a projection which engages with mechanism in the track for moving the switch.

710,469. Trolley; J. F. Kerr, Paterson, N. J. App. filed Aug. 8, 1901. A vertical stud is mounted to oscillate at the upper end of the pole and carries a crank upon which the trolley wheel is mounted, affording it sidewise motion.

710,470. Mechanism for Operating Street Railway Switches; W. H. Kirkley, Cranston, R. I. App. filed Jan. 18, 1902. Push rods which can be pressed downward by the motorman to engage and throw the switch mechanism.

710,489. Railway Car Sander; D. N. Miller, Hamilton, Can. App. filed April 10, 1902. A conveyor which feeds out the sand can be rotated, when necessary, manually by the motorman.



PATENT NO. 710,422

710,516. Ice Cleaner for Trolley Wires; F. N. Root, Kalamazoo, Mich. App. filed Jan. 23, 1902. Ice-cutting wheels are mounted adjacent to the trolley wheel.

710,532. Rail-Bond; C. Sprague, Boston, Mass. App. filed Feb. 24, 1902. A laminated bond, the ends of which are made solid by dipping in solder and embracing with a strap of copper.

710,535. Hand Strap for Railway Cars; M. Straus, Denver, Col. App. filed Jan. 21, 1902. The main loop has a number of smaller loops secured to each side.

710,536. Hand Strap for Street Cars; M. Straus, Denver, Col. App. filed Feb. 25, 1902. Several loops pivoted to a single support and having elastic sections.

710,609. Car Side Bearing; W. A. Pungs, Detroit, Mich. App. filed Oct. 22, 1901. The upper bearing plate has a rocking connection with its support.

710,645. Side Bearing for Railway Cars; C. H. Williams, Jr., Chicago, Ill. App. filed May 26, 1902. The rollers are set in openings in an endless flexible belt.

710,673. Roller Side Bearing for Cars; F. K. Fassett, St. Louis, Mo. App. filed Feb. 18, 1902. The rollers are on an endless chain and have their axles confined in endless grooves of the frame.

710,691. Magnetic Traction Wheel; B. B. Hill, St. Petersburg, Russia. App. filed Jan. 28, 1902. The wheel is provided with a hollow movable rim and a magnetizing coil in the rim.

710,709. Car Wheel Flange Lubricator; G. W. Newton, Hubbard, Ohio. App. filed May 23, 1902. A roller charged with lubricating material is arranged to be thrust against the flange of the wheel when necessary.

710,794. Rail-Bond; E. P. Morris, East Orange, N. J. App. filed July 9, 1901. The ends of a flexible bond are passed into and through openings in the head pieces.

ENGINEERING SOCIETY

THE ENGINEERS' CLUB OF PHILADELPHIA.—A regular meeting of the club will be held on Saturday, Oct. 18, at which Mr. Washington Devereux will present a paper entitled: Some Electrical Fire Hazards.

Mr. Carl Hering will make a few remarks, postponed from the last meeting, on "The Latest and Best Value of the Mechanical Equivalent of Heat," and on "Recent Progress in Single Phase Traction."

PERSONAL MENTION

MR. H. S. NEWTON has resigned as general manager of the Beaver Valley Traction Company, of Beaver Falls, Pa., and Mr. S. W. Thomson, of New Castle, Pa., has been elected as his successor.

MR. JAMES P. GILBERT, who has been the general superintendent of the New York & Ohio Company, of Warren, Ohio, has resigned his position and will become general manager of the Standard Electrical Manufeturing Company, of Niles, Ohio, manufacturers of the Standard incandescent lamp.

MR. J. E. TOWNSEND, who was manager of the Lima Railway & Light Company, of Lima, Ohio, for six years, and who has been connected with electric railway interests in Ohio for the past year, has been appointed operating manager of the Kokomo Railway & Light Company, of Kokomo, Ind.

MR. H. E. SAWYER, who has been foreman of construction on the Columbus, London & Springfield Railway, and the Dayton, Springfield & Urbana Railway, of Springfield, Ohio, has been made superintendent of the latter road. He succeeds Mr. C. E. Simonson, who becomes traffic and passenger agent of the company. Mr. William Parker, agent of the company at Dayton, has been made freight agent and auditor.

MR. F. REED WEISNECKER, for many years engineer of roadway for the Cincinnati Traction Company, of Cincinnati, Ohio, has resigned from the company to accept a similar position with another company. A few days ago he was called into the offices of Vice-President Foraker, where the employees of the general offices presented him with a handsome silver snuff box. Mr. Weisnecker has been connected with the company since 1875.

MR. JOHN H. PASCOE, Republican nominee for the Pennsylvania State Senate, who died last week at his home in Allentown, after a comparatively brief illness, aged 51 years, was a member of the firm of Pascoe & Crilly, builders of electric railways. Among the roads this firm constructed are the Hellertown, Philadelphia & Lehigh Valley Street Railway, the Mauch Chunk & Lehighton Street Railway; the Slatington, Whitehall & Egypt Railway and the Perkiomen Valley Railway.

MR. CHARLES H. COX, who has been superintendent of the Middleboro, Wareham & Buzzard's Bay Street Railway Company, of Middleboro, Mass., since its construction, has been appointed general manager of the company. Mr. Cox was connected with the street railways of Boston for 26 years, entering the employ of the Metropolitan Railway of that city when a mere boy. He entered the employ of the Worcester Construction Company after leaving the employ of the Boston company. He resigned from the Worcester Construction Company to become connected with the Easton, Palmer & Bethlehem Street Railway, of Bethlehem, Pa., and resigned from this company to become connected with the Dayton & Xenia Traction Company, of Dayton, Ohio. It was from this company that he resigned to become connected with the Middleboro, Wareham & Buzzard's Bay Street Railway Company. Mr. L. H. Parker, of Newtonville, has been appointed to succeed Mr. Cox as superintendent.

FINANCIAL INTELLIGENCE

THE MARKETS

WALL STREET, Oct. 15, 1902.

The Money Market

Money conditions at New York have continued no less stringent during the past week than they were in the fortnight before. Call money has loaned for the most part around 12 per cent, with occasional advances as high as 18 per cent. Time money at 6 per cent, with a commission added on, is on a basis practically of 7 per cent for the longer dates, and even higher than this in many cases where the loans are made for periods of two and three months. Trust companies and out-of-town banks which were the principal lenders during September, have been the most urgent during the last week or two in recalling their credits from the market. The result is that in spite of very heavy liquidation in the stock market, it has been impossible for the Clearing House institutions to reduce their own accommodations, and the official statement of last Saturday electrified the speculative community by showing an increase of over $2,300,000 in the loan column. It is apparent, however, that despite the recent failure of the speculative liquidation to produce an immediate increase in bank surplus reserve, the money situation is steadily on the mend. The two particular respects in which conditions have changed for the better are the weakening of the foreign exchange market and the reversal of the Treasury operations from a source of loss to a source of gain for the local banks. Demand sterling, although down nearly a cent in the pound from its recent high point, is not off enough to make gold imports probable. But the reaction has served to relieve apprehension over the abnormal condition of ten days ago, when exchange was advancing in the face of an acute stringency in our money market. The change in the Treasury from creditor to debtor in the daily operations in the market, is chiefly the result of diversion of internal revenues into the national bank holdings of government moneys. Since the outset of the month nearly the whole of the receipts from internal revenue have been intercepted in this way, and doubtless the process will continue so long as the supply of government bonds necessary for security holds out. The chances are, altogether, that we have seen the low point of the season in the New York surplus reserve. Increase from now on will be slow because the demands from the West and South for crop-moving money, will not cease for another month at least. But the prospect seems fairly good for a gradual strengthening of bank resources and a gradual relaxation of money rates.

The Stock Market

The liquidation on the Stock Exchange, which everybody concedes was needed to clear both the speculative and money situations, reached its extremity at the outset of the current week. Prices for the leading stocks on Monday morning showed declines ranging from 15 to 25 points from their highest of September and August. In view of this very extensive reaction, it would be hard to believe that the speculative excesses of the spring and summer in the market have not been pretty thoroughly corrected. So far as the decline was forced by the exigencies of the banking position, the worst is undoubtedly over. With the relief afforded by the wholesale liquidation of speculative accounts, and with the additions to the local cash supply, already noted, through the Treasury operations, the banks should be able to go through the remainder of the autumn without having to squeeze any further their speculative clients. The money question seems for the moment to be subordinate to the question whether or not we are to see an immediate end of the great coal strike. Undoubtedly a large number of people have been impelled to throw over their securities during the last fortnight, who would not have done so if the money stringency had been the only trouble in the situation. They were influenced by fear of the very grave consequences were the coal famine to continue during the winter months, and again by the fear of something even worse were the spirit of socialism and anarchism, which have appeared in the coal strike, encouraged to go on and to spread into other industries. The best judgment, at this writing, is that the striking coal miners cannot do otherwise than accept the concessions offered by the operators who have proposed that President Roosevelt choose a committee to arbitrate all alleged grievances at the mines. On this assumption the stock market on Monday afternoon and Tuesday rallied sharply from its extreme depression of Monday morning, and as money seemed to be working easier, many people were inclined to the view that the turn for the better had come. There will be more or less uncertainty, however, until the miners' answer is made and until relaxation in the money market becomes a more settled fact. Stock prices are not likely, therefore, to go up all at once. But it is no doubt true that they have seen about their lowest for the season.

Among the local tractions, Manhattan has again been better bought than the others, and has responded more swiftly whenever the general market has rallied. Brooklyn Rapid Transit has been the heaviest of the group. The poor showing made in the recent annual report has caused a good deal of liquidation, and has deprived the stock of outside support.

Philadelphia

The Philadelphia traction shares have again resisted the general downward tendency more successfully than the average run of securities elsewhere. This is particularly true of American Railways, which has remained steadily at 52 and above during the past week, and of Philadelphia Rapid Transit, which, after reaching practically its high record of 18 on Thursday last dropped off later only to 17. The action of the latter stock simply goes to affirm the previous idea that there has been very slight distribution of the shares in the hands of the public. Philadelphia Traction held well around 98, but Union Traction yielded to 46¾ on Monday, and was in fact the weakest of the group. Fairmount Park Transportation, on sales of only 300 shares, broke to 24, an extreme decline of 10 points from its highest price. Other sales for the week included Philadelphia City Passenger (25 shares) at 210, and United Traction of Pittsburgh preferred at 51. In bonds Electric People's Traction 4s between 98 and 98½, Newark Passenger 5s at 116½, People's Passenger 4s at 105, Union Traction of Indiana 5s at 100, American Railways 5s at 108½, and United Railways 4s at 87.

Chicago

The movement of the Chicago traction issues has been governed during the week entirely by general market conditions. Excellent traffic advices continue to be received from the various lines, the Northwestern Elevated, for instance, showing an increase of 20 per cent in earnings of the first week in October, as compared with a year ago. But good earnings have not availed to hold up security prices in face of the general speculative depression. Some of the prices reached this week are the lowest of the present year, notably Northwestern common at 34, and the preferred at 82. City Railway dropped 6 points to 210, and West Chicago sold down from 93 to 91¾, and Lake Street from 10⅝ to 9¾. On the other hand no Union Traction came out during the break, and Metropolitan common and preferred both held well at 41 and 89¼, respectively. It is said that the bulk of the Metropolitan's heavy earnings now being recorded are derived from the original line, and that less revenue is coming in from the Aurora-Wheaton extension than was at first reported.

Other Traction Securities

The prevailing unsettlement of market conditions has made itself felt in Boston more in restricting trading than in liquidation, at least so far as the local traction stocks are concerned. Boston Elevated sold down to 153, Massachusetts Electric common to 33¾, and the preferred to 95, but all of them recovered most of the loss later on. Light dealings were the only characteristic of their market. The week in Baltimore has been an extremely dull one, with weakness in the active traction specialties. United Railways incomes sold down to 66⅞ on Monday, and the stock to 13, which are the low prices of the season. Nashville Railway shares were off a fraction at 6, and the 5 per cent certificates a half point, at 75. United Railways 4s sold at 95 and 94⅞. Atlanta Street Railway 5s at 106, and Lexington Street Railway stock (34 shares) at 50. This was all the business done. United Railways of San Francisco securities were dealt in for the first time on the New York Stock Exchange. Both common and preferred started off strongly at an advance to 22¾ for the former, and 62¼ for the latter. But the gains were lost during the subsequent reaction in the general market. Twin City Rapid Transit reached its low point of the season during Monday's general break, touching 114½, but it rallied to 116 at Tuesday's close. New York curb transactions for the week include American Light & Traction, at 41½ and 42, Camden & Trenton (50 shares) at 4¼, New Orleans common from 15½ to 16½, the preferred at 53. St. Louis Transit (500 shares) between 28⅝ and 29. Washington Railway & Electric preferred at 52, Brooklyn Rapid Transit new 5s at 87⅝ and 87¾. San Francisco subscription privileges at 48, United Railways of St. Louis 4s at 86, Washington Railway & Electric 4s at 83, and New Orleans 4½s at 83.

Traction stocks on the Cleveland Stock Exchange were stag-

nant last week. Sales numbered only 1081 shares for the entire week. Nearly the entire board showed slight declines from the week previous. Western Ohio declined from 30½ to 28⅞ on sales of 425 shares. The fact that this stock was hit so hard by the uncertainty of the market shows up the anomalies of the situation. The earnings of the property are showing up very well, each month showing an increase. In addition to this a considerable amount of new mileage will soon be placed in operation. The road is a fine earner and it would seem that these securities have less reason to drop at this time than at any time this year. Lake Shore Electric common declined from 19 to 18½ on small sales. Aurora, Elgin & Chicago common sold from 39½ down to 37. Sales were small. Elgin, Aurora & Southern also sold down, the range being between 58 and 59. Small lots of Miami & Erie Canal sold between 27½ and 28, Northern Ohio Traction common held at 67 and 67½, the preferred selling at 96½ and 97. Both small lots. Monday a small lot of Syracuse Rapid Transit common sold at 30½ and a small block of Miami & Erie Canal at 25.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Oct. 7	Closing Bid Oct. 14
American Railways Company	52½	52
Aurora, Elgin & Chicago	38	(a) 39½
Boston Elevated	154	154
Brooklyn R. T.	61½	62
Chicago City	214	210
Chicago Union Tr. (common)	17	17
Chicago Union Tr. (preferred)	50	50
Cleveland Electric	88	86
Columbus (common)	60	56
Columbus (preferred)	108	106
Consolidated Traction of N. J.	69½	69
Consolidated Traction of N. J. 5s	110⅝	110¾
Detroit United	84¾	85
Electric People's Traction (Philadelphia) 4s	98⅝	98½
Elgin, Aurora & Southern	54	—
Indianapolis Street Railway 4s	87	87
Lake Shore Electric	16⅝	(a) 18½
Lake Street Elevated	10	9½
Manhattan Railway	132⅝	133½
Massachusetts Elec. Cos. (common)	34⅛	35
Massachusetts Elec. Cos. (preferred)	95½	(a) 95
Metropolitan Elevated, Chicago (common)	40½	40
Metropolitan Elevated, Chicago	88½	88½
Metropolitan Street	136½	137⅞
New Orleans Railways (common)	16	15⅝
New Orleans Railways (preferred)	54	53
North American	122	121
Northern Ohio Traction (common)	66	64
Northern Ohio Traction (preferred)	96⅝	95
North Jersey	33⅝	33¼
Northwestern Elevated, Chicago (common)	36	34
Philadelphia Rapid Transit	17⅛	16⅞
Philadelphia Traction	98	98½
St. Louis Transit (common)	29½	28
South Side Elevated (Chicago)	110	108
Syracuse Rapid Transit	30	30½
Syracuse Rapid Transit (preferred)	76	76
Third Avenue	—	127
Toledo Railway & Light	(a) 33⅝	32¼
Twin City Minneapolis (common)	116½	115½
United Railways, St. Louis (preferred)	—	—
United Railways, St. Louis 4s	—	86
Union Traction (Philadelphia)	47⅝	46⅞
Western Ohio Railway	28	(a) 33½

(a) Asked.

Iron and Steel

The principal information of the week in the iron market is furnished by the "Iron Age" in its usual monthly compilation of blast furnace statistics. It shows the total output of these furnaces to have been only 60,000 tons less in September than in August, although a heavy decrease might have been expected in view of the increasingly bad effects of the coal strike upon the fuel supply. Nevertheless, the domestic out-turn of both pig iron and steel billets is considerably below the demand, and importations of the foreign product continue freely. This is especially true in foundry iron, the foundrymen being almost entirely dependent upon the foreign markets. The "Iron Age" reports that sales have been made of 100,000 tons of Bessemer pig, for delivery in the first quarter and first half of next year, at $20.50 to $21.00 at the furnace. Quotations are unchanged but nominal, as follows: Bessemer pig, $21.75; steel billets, $31.50 to $32.00; steel rails, $28.00.

Metals

Quotations for the leading metals are as follows: Copper, 11.65 cents; tin, 24.05 cents; lead, 4⅛ cents; spelter, 5½ cents.

AUGUSTA, GA.—The Augusta Railway & Electric Company, the North Augusta Electric & Improvement Company, the Augusta & Aiken Railway Company, the North Augusta Land Company and the North Augusta Hotel Company, all of which were brought under one management through the recent purchase by the Railway & Light Company of America of the Augusta Railway & Electric Company, will be merged into the Augusta Railway & Light Company.

SACO, MAINE.—The Saco Valley Electric Railway Company has filed for record a mortgage deed for $300,000 in favor of the Federal Trust Company, of Boston. This is to cover an issue of bonds to that amount, of $1000 each for 20 years, bearing interest, payable in gold, at 5 per cent.

BOSTON, MASS.—The Boston Stock Exchange has listed $1,800,000 five per cent. non-cumulative preferred stock and $5,000,000 common stock of the Georgia Railway & Electric Company.

WORCESTER, MASS.—The Railroad Commissioners have granted approval of an issue of $80,000 additional stock by the Hampshire & Worcester Street Railway Company to pay floating indebtedness and provide for extensions and equipment.

PITTSFIELD, MASS.—The Railroad Commissioners have approved an issue of $250,000 original stock by the Berkshire Street Railway Company for part payment of the cost of construction and equipment of the road.

ST. LOUIS, MO.—The statement of the gross earnings of the St. Louis Transit Company for the month of September shows a gain of $61,435 over the same month last year. The total earnings for the month were $561,921, as against $500,486 in September, 1901. This brings the total earnings for the present year to $4,169,346, a gain of $435,106 over the same period in 1901. The earning capacity of all the roads in the system is increasing, and the effect of numerous improvements made since the first of the year is being felt.

EXETER, N. H.—The interest of Wallace D. Lovell in the New Hampshire Traction Company, which controls the Exeter, Hampton & Amesbury Street Railway, the Haverhill & Plaistow Street Railway, and the Haverhill, Plaistow & Newton Street Railway, is reported to have been sold to Howard Abel, president of the company. The system comprises about 127 miles of line, with $1,000,000 of stock and $6,000,000 of bonds. Mr. Abel, it will be remembered, was an officer of several Chicago properties when the Yerkes interests were operating there, and later was interested with Mr. Yerkes in his London underground ventures.

NEWARK, N. J.—It is now said that the syndicate that has been arranging for the absorption of the North Jersey Street Railway Company, Jersey City, Hoboken & Paterson Street Railway Company, Orange & Passaic Valley Traction Company, and the Elizabeth, Plainfield & Central Jersey Traction Company has secured options on over 60 per cent. of the stock of these companies, and that despite rumors to the contrary, the deal will be consummated within a few weeks.

ALBANY, N. Y.—Justice D. Cady Herrick, on motion of Sheehan & Collin, attorneys for the Colonial Trust Company, of New York, has appointed George T. Blakeslee, of Kinderhook, receiver for the Albany & Hudson Railway & Power Company. The appointment of the receiver, as has been previously mentioned in the STREET RAILWAY JOURNAL, is the first step in a plan for its complete reorganization of the company. The officers of the company are: A. C. Salisbury, president; M. E. Stark, vice-president; G. C. Blakeslee, general manager.

NEW YORK, N. Y.—The governing committee of the New York Stock Exchange has admitted to dealings on the regular list $15,000,000 United Railroads of San Francisco preferred stock and $10,000,000 common stock.

ALBANY, N. Y.—The United Traction Company has declared the regular quarterly dividend of 1¼ per cent., payable Nov. 1.

CINCINNATI, OHIO.—The property of the Mill Creek Valley Traction Company and the Hamilton, Glendale & Cincinnati Traction Company has been turned over to the Cincinnati Interurban Company, a company formed by the Cincinnati Traction Company interests to lease the properties in question. The terms of the lease have previously been outlined in the STREET RAILWAY JOURNAL.

CINCINNATI, OHIO.—The Cincinnati, Newport & Covington Light & Traction Company have declared a quarterly dividend of 1 per cent. on preferred stock. A member of the board of directors is quoted as saying that the next quarterly dividend will probably be 1 1-4 per cent.

PHILADELPHIA, PA.—Press reports say that it is reported that the United Railways & Electric Company has decided to issue first mortgage bonds on the extension of its system now being built from Dundalk to Sparrows Point.

MERCER, PA.—The directors of the East End Street Railway Company have voted to increase the capital stock of the company to $500,000. The company was recently granted a franchise here.

TITUSVILLE, PA.—The directors of the Titusville Electric Traction Company have voted to increase the capital stock of the company from $100,000 to $300,000.

DALLAS, TEX.—The Dallas Electric Corporation, recently organized, which controls through ownership of stocks and bonds the Metropolitan Electric Street Railway, the Dallas Consolidated Electric Street Railway, the Dallas Electric Company and the Dallas Electric Light & Power Company, will be capitalized as follows: Bonds, 5 per cent. 20-year gold, secured by mortgage deed to the City Trust Company, as trustee, $4,000,000; preferred stock 5 per cent. non-cumulative, $1,500,000; common stock, $3,000,000. There will be issued at this time $2,750,000, bonds; $1,350,000, preferred stock; $3,000,000, common stock.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has declared the regular quarterly dividend of 1¼ on the preferred, payable Nov. 1.

TORONTO, ONT.—The stockholders of the Toronto Railway have ratified the plan to increase the capital stock of the company from $6,000,000 to $7,000,000 to provide funds for improvements.

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The Street Railway Accountants' Convention

The convention of the Street Railway Accountants' Association of America at Detroit was largely attended, and the interest taken in the meetings was fully equal to that which has marked previous conventions of the association. The business of the convention was practically confined to the discussion of two papers and two reports, but these, especially the latter two, were upon very important topics and led to active debate. The association was fortunate in having in attendance at the meeting a representative from Washington of the United States Census Bureau, W. M. Stuart, as well as T. Commerford Martin, expert special agent of the census, also one of the accountants of the New York State Railroad Commission. The presence of these gentlemen not only indicated the interest which the national and State boards take in the proceedings of the association, but also the willingness of these bodies to work in harmony with the accounting department of the railway companies of the countries as represented by the Accountants' Association.

The Accountants and the Census Inquiry

It will be conceded that nothing could well exceed in importance a statistical report on the growth and magnitude of the street railway industry conducted by the United States government; and to us there is significance in the fact that this inquiry is the first conducted by the permanent Census Office. Few people realize that the capitalization of electrical development in this country is already one-third that of the steam railroads, and of the electrical development street railways comprise more than one-half. When Congress directed the Census Office to begin its work specifically in the field represented by this journal, it doubtless had in mind the swift revolution that is going on in urban methods of transportation, in rural facilities for travel, and in the closer knitting together of the whole people, due to the advances seen since the first street railway census was taken in 1890. We venture to believe that the result of this inquiry will be to impress upon the American public the greatness of the benefaction which has been conferred by the trolley car, to stimulate the further investment of capital in the art, to accelerate the pace of improvements, and to intensify the natural pride which street railway men already feel in their industry. Fortunately at the outset of this inquiry the Census Office authorities were alive to the necessity of adopting a proper form of accounting, and even more fortunate were they to enjoy the active assistance and co-operation of such men as Messrs. Duffy and Calderwood. There is a tendency in inquiries of this kind to burden companies with a lot of unnecessary matter, of interest doubtless to many statisticians and sociologists, but extremely difficult to extricate from regular and systematic methods of bookkeeping. The Census Office, while formulating a clean cut and excellent plan, has shown itself amenable to suggestions as to lopping off items of minor importance, and the schedule as now prepared by the office is one of the best attempts ever made in the direction of taking account of a great industry. It is based essentially on the system of the Accountants' Association, and thus accomplishes at one sweep in enforcing uniformity, results which it would have taken years and years of missionary work on the part of the association to attain. There cannot be a statistical inquiry of this nature without a plan universally applicable, and yet the very adoption of such a plan brings all the systems whose figures are to be compiled up to a common standard and a common ratio. At the present time there are about a dozen States where annual reports are required to be made, and while each of these may exhibit variations, it is plain that the work of the national government must have a marked tendency to eliminate from them, in turn, features of eccentricity. To the members of the Accountants' Association this prompt recognition of their work by the head of the Census Office, Governor Merriam, and by his staff entrusted with the work, must be eminently gratifying.

The Papers and Reports at the Accountants' Convention

The two papers at the convention were respectively on stationery and the collection and registration of fares. The former, which was presented by Mr. Shurtz, described the result of applying system to a chaotic condition of forms and blanks and reducing the paper stock required to uniform sizes and styles. Mr. Sampson's paper related to interurban operation and indicated that the problem of collection and registration of fares on these long lines is by no means a simple one. Steam railroad practice cannot be adopted from the fact that practically all of the passengers pay their fares on the cars, and as a result the use of duplicate fare receipts prove very cumbersome. The ordinary single register was also tried, both on the zone system and for registering at one time a through fare, but was abandoned in favor of a multiple register, upon which six classes of fares can be recorded. The discussion indicated that at least one company represented at the convention printed its own transfer tickets, this company using about 10,000,000 transfers a month. It might be said in this connection that the Union Traction Company, of Philadelphia, not only prints its own transfer tickets but practically all its own blanks and stationery, annual reports, etc., and has found the practice a very economical one.

The two reports presented at the convention were on standard blanks and accounting for material and supplies and on standard forms of report for electric railways. A few changes in wording were made by the association in the reports as presented, and these changes appear in the reports as they are printed in this issue, so that they represent the form as adopted by the association. Both reports were, however, accepted practically as they were presented, though not without a great deal of debate, particularly in regard to the recommendation to change the standard system of report from that which had been previously adopted. In view of the fact that the first issue of each month of this paper contains our regular department on street railway accounting, it has been considered advisable to postpone the discussion of the revised form of report adopted at Detroit until that issue, when we expect to present several communications on the subject. The report on standard blanks for material and supplies recommended a system which is in practical use on a number of the principal railways of the company and has given very good satisfaction. Several suggestions were made by which the blanks could be reduced slightly in number in case all of the information indicated by them was not considered necessary, and undoubtedly some of the roads, especially some of the smaller roads, will follow this modification.

Excessive Car Service

The necessity of greater economy in operation on city roads with variable traffic is bringing to the front the matter of excessive car service. It will frequently be found that more cars are run at certain hours of the day than are actually necessary to take care of the business offered. This is sometimes done to divert traffic from a competing line, but is done more often to avoid a large proportion of tripper runs on the regular schedules. Wherever there is a pronounced morning and evening rush, with light traffic in the midday and at night, the manager is confronted with the choice of two evils. He must operate unnecessary and unprofitable service during the hours of light traffic or he must (by cutting it out) operate a timetable with a considerable proportion of small pay tripper runs. By doing the one he pleases the public and the employees at the expense of his stockholders, and by doing the other he pleases his stockholders at the expense of the public and the employees. A complicating element of the situation is that the maximum traffic of the evening is usually concentrated into a much shorter space of time than the maximum rush hour morning traffic. The morning concentration may be handled with fifty cars, because the traffic is spread over two hours or more, but the evening concentration may require sixty cars because it covers not more than 45 minutes to 70 minutes, thus requiring ten trippers with one trip each.

Where the excessive midday and night car service may be depended upon to build up a growing community, the money involved may be considered not merely as a contribution to the men and to the public but also as a present expenditure to secure a future gain to the stockholders. It is nothing less than a tribute to the kindly feeling of the manager and the stockholders toward the employees to say that the unnecessary and unprofitable trips are usually run during hours of light traffic, not because of the hope of future gain, but as a humane concession to the employees. It must be borne in mind, however, that the wages of the car crews are not the only items of cost in operating the unnecessary trips. There are the items of wear and tear on cars, electrical equipment, track, overhead line and, what is of still more consequence, the cost of the additional coal burned at the power house. It is an open question worthy of serious consideration whether it would not be cheaper to keep the unprofitable trips off the road and pay the car crews the wages for a fair day's work. If, now, the tripper men thus cut short of work could be given other employment of a useful character in the car house or shop there need be no question of money loss to the company or a gratuity to the men. Some such solution of the tripper question may be feasible in one place but not in another.

Where small single-truck cars are used there is a partial solution of the problem by getting an equipment of large double-truck cars, thus increasing the maximum carrying capacity without running so many additional trippers. The tendency for many years has been in that direction, but in places where the entire equipment is of large cars the tripper problem still exists. As it is hardly possible to make the large cars much larger (without double-decking them) it is plain that the problem of trippers or excessive car service will continue to vex railway managers for some time to come.

The Wrecking Equipment

Every well equipped electric railway is supposed to provide for the quick handling of all kinds of obstructions by having for each important line or division one or more wrecking cars. They may not often be needed, but when they are required they are wanted badly, and should be ready to start out like a fire engine, on a moment's notice, night or day. But are they? There are some roads that are not up to date in the equipment of their wrecking cars, and certainly not keeping up with their neighbors in the matter of getting the crew together and the car started quickly. A delay of fifteen minutes to a half hour, night or day, when an important line is tied up, and when minutes are running into dollars and cents, or when injured persons are suffering, would seem to be worth looking into. Naturally the first aim of every manager or superintendent is to prevent accidents, and then provision should be made, when they do occur, to clear the road as quickly as possible and care for the injured, if that has not already been done before the wrecker arrives.

To be of the maximum use the wrecking car must be equipped for every possible emergency. This idea is not original but it is sensible. There are many things that may obstruct the track, and it is usually embarrassing to find, after the wrecker reaches the scene of the trouble, that the very appliances needed to remove the obstruction have been left behind or were never a part of the equipment. The wrecking car equipment is often utterly inadequate, and will be found to consist of several fish-plates and flat draw-bars, a quantity of blocking, two or three chains or wire ropes, two or three jacks and a few necessary tools, such as wrenches, shovels, picks, etc.

It is pretty well understood that accidents have a habit of occurring almost anywhere, and frequently where not even the smallest mechanical assistance can be had for love or money. It may be nothing more than a heavy truck loaded with iron, stone or timber that has broken an axle and dropped across the track

at some lonely spot in the suburbs; it may be a collision between a car and such a truck, it may be a collision between two cars, it may be a simple but annoying derailment, or it may be a land or a rock slide or a washout.

Every well-equipped wrecking car should have appliances for removing heavy obstructions, for replacing derailed cars, for tieing up and holding in position broken axles, gears or truck frames or motors that have dropped. There should be plenty of axes, sledges, jacks, saws, wrenches, bolts, spikes, shovels, crowbars, chains, ropes, lanterns, torches, light clusters with overhead trolley connection, rubber gloves, insulating pliers and all kinds of line repairers' tools, including a plentiful supply of tackle and falls. There should be all kinds of blocks, and plenty of them for blocking is sometimes exceedingly difficult to get. Every wrecking car should carry on the outside a ladder, a couple of extra trolley poles, and at least two wide, heavy, push poles, to be used for placing against the forward bumper, and pushing wagons or other obstructions from the track. Last, but not least, every wrecking car should carry a case containing all necessary articles for rendering first aid to the injured, and some one of the crew should understand how to use the articles. The crew should be trained so that they will assemble on signal and get started within one minute to three minutes, either in the day or night time. If there is ever an occasion when time is money it is when a heavy passenger line is blocked, and there are perhaps dozens of cars and hundreds of passengers waiting and the number multiplying every minute. Under such conditions the wrecking car becomes an important part of the equipment.

Steam Roads and Electric Competition

The probability that steam railroad men may be called upon at any time to adapt electric traction to the conduct of their suburban passenger traffic and to the working of their light branch lines makes it important that they follow closely the course of the development of electric operation. The electric motor is destined to find one of its widest applications in work of this kind. For elevated and for underground roads it is destined to drive the steam locomotive out of business. Unless the steam roads serving populous suburban communities are forehanded in maintaining a more frequent and cheaper suburban service they will probably encourage electric competition, in which the experience at St. Paul and Minneapolis may be repeated. It will be remembered that several years ago the passenger traffic between these two cities was handled entirely by two steam railroads. Each road gave an hourly service, making the actual interval thirty minutes, and the running time from terminal to terminal was about twenty-five minutes. The single fare was 30 cents, the round-trip fare 50 cents, and the commuter's rate 15 cents each way, the distance being about 10 miles. The electric road, when it commenced operation, made the fare 10 cents each way, and ran cars over the distance in about fifty minutes, on a headway of six to ten minutes. The electric cars ran through the streets of both cities, and gave transfers to connecting lines. Considering the time lost by going to and from the depots of the steam roads as against the convenience of taking a through electric car at any corner on the principal streets of the business district, it would appear that there was not much, if any, time gained by using the steam road service. The result, which was foreshadowed, very soon occurred. The electric road took the bulk of the business and the steam roads reduced their train service.

* * * * * * *

The building of interurban roads to connect the small towns with one another and with the large centers of population has just begun. These roads are to be developed into carriers of bulky freight, farm and dairy products, light express matter, baggage and United States mail as well as of passenger traffic. Their ultimate function is to become the feeders, the collectors and distributors of traffic for the trunk line steam railroads, in addition to their legitimate function of handling the strictly local business. The question of the relation that is to grow up between the electric and the steam roads is a most interesting one, and it is bound to engage the attention of all classes of railroad men in the near future.

* * * * * * *

The demand for electric interurban roads as mediums of local communication is becoming almost universal. In former times the pioneers in the new portions of the country found no highways of travel or commerce except the trail or bridle path. One of the first evidences of civilization was the construction of wagon roads. The commercial and social conditions of a community then, as now, depended upon the extent and quality of its highways of communication. A pious old farmer, looking at things philosophically, once remarked that it was a striking illustration of the wisdom of divine Providence that the one place where He had usually created the best roads was through prosperous and highly civilized communities, where they were most badly needed. We may laugh at the old farmer's philosophy, but since the dawn of history it has been true that cheaper and improved means of inter-communication between communities determined their social and commercial welfare. When the means of inter-communication are poor the pleasures of life and the duties of citizenship and society are imperfectly done, then the prompt and steady movements of the products of the soil and of manufactures are retarded. The interurban electric roads are destined to make possible as great an advance in the commercial and social prosperity of the communities they serve as did the first wagon roads that replaced the trail and the bridle path.

* * * * * * *

Without going deeply into the matter at this time it may be suggestive to call attention to the fact that with a few hours of rain or snow the country highways often become quite impassable. This may occur at a time when the farmer or the country merchant wishes to travel or to market his products or to draw his supplies from the city or the station of the steam railroad. Such conditions have been known to continue for many days, sometimes for weeks, resulting in a perceptible interruption in the steady flow of traffic even on the steam roads. Such fluctuations of traffic are annoying and expensive not only to the communities themselves but to the railroads. Cars are detained beyond a reasonable time in loading and unloading. Locomotives and terminal facilities are comparatively idle awaiting the uncertainties of the weather. The markets are often deprived of that for which there may be a strong demand. With the advent of the interurban electric road into the freight business this condition will be changed, and traffic will flow in an uninterrupted stream because no ordinary storm can stop it. The steam railroads will find that instead of being overcrowded one-half of the year, with little to do the other half, the movement will be more continuous from the farms to the markets and vice versa. It is not improbable that the time will soon come when the electric and the steam roads will make physical connections at many common points, and that the electric roads may accept and haul the freight cars of the steam roads into the suburban and interurban districts.

* * * * * * *

The question which interests the steam railroad officials more deeply than any other in connection with electric traction is the possibility of operating many of their branch lines where traffic is light by electricity, also of operating their frequent suburban short-haul train service by electric power. It is no secret that the New York Central and the Pennsylvania Railroads have already developed their plans for operating some portion of their through train service and all of their suburban train service in and out of New York city by electricity. The trains of both of these roads will reach the heart of the city underground through tunnels. Electric operation through the tunnels is not a question of economy but a question of necessity. These developments, being the first attempted upon a large scale by any of the steam roads, will be watched with much concern. They will furnish an example from which other roads can work out their own problems on a strictly economical basis.

Union Interurban Passenger Station at Toledo.

In a number of cities where there are several interurban roads plans are being made, or have been perfected, for a combined union passenger and freight station from which all interurban cars will radiate. In two or three instances these stations are to be fine structures, comparing favorably with steam union stations. Examples of this kind have been presented from time to time in these pages, and the details of less pretentious undertakings have also been published. There has been no recognized standard for this work; in fact, there has been a wide difference of opinion as to the best plan for handling this class of business.

UNION STATION FOR INTERURBAN ROADS ENTERING TOLEDO

In Toledo the interurban companies decided, after canvassing the situation, to separate rather than combine the two facilities; to locate the union passenger station in the retail shopping district and the freight station in the jobbing and manufacturing section. It was believed that the combining of the two would work inconvenience for both classes of patrons, as passengers do not like the delays, noise, dust and confusion consequent upon the loading and unloading of freight. Moreover, it was hardly possible to find a location which would be convenient for both.

Both the passenger and freight stations in Toledo are in a sense makeshifts, neither having been designed for the work which they now satisfactorily perform, and this fact makes them especially interesting, as indicating that it is not absolutely necessary to go to the expense of building special stations at this stage. The union freight station was described in the STREET RAILWAY JOURNAL of Oct. 4, and the method of handling business adopted by the roads using this depot was carefully considered.

The union passenger station, which is equally interesting, was established at its present location, near the corner of Superior Street and Adams Street, not long ago, through the concerted efforts of enterprising merchants in that district, who, hearing that a station was about to be selected, leased the large store room in the newly-completed Smith & Baker Building, and offered it rent free for a short period to the interurban companies. The results obtained have demonstrated the wisdom of this move on the part of the merchants, since several thousand passengers arrive and depart from the station every day, and naturally many of them make their purchases at the nearest stores. All interurban cars now traverse the loop made by Superior, Jefferson, Summit and Cherry Streets. Each car stops in front of the interurban station long enough to load and unload passengers. It is the duty of each conductor upon arriving at the station to announce his car and the towns on his road.

All the interurban lines of which Toledo is the center use this union passenger station. These include the Lake Shore Electric Railway, Toledo & Western Railway, Toledo & Monroe Railway, Toledo & Maumee Valley Railway, and the Toledo & Bowling Green Railway. Some idea of the magnitude of the operations of these roads may be gained from the fact that when the last link in the Lake Shore Electric Railway is completed this winter, direct communication may be had by trolley between Cleveland and Detroit or Adrian, Mich., and that a fast service is contemplated over the entire system. The importance of this system for Toledo will be readily appreciated, as all the interurban lines touch many small towns and bring these places into convenient time-distance for shopping.

The station at Toledo is a large room with seats for a couple of hundred people. A view of the waiting room is presented herewith, together with an exterior view. It is open night and day, and is in charge of a manager, who has two assistants. Tickets, both single trip and round trip, are sold over all the roads. All expenses are divided equally among the five roads using the station, settlements being made each month. A counter at one side of the room is leased to a newsdealer, who also dispenses soda water and other soft drinks. An additional source of income, as well as one which is of great convenience to patrons, is the check room, where packages may be left or delivered. On payment of 5 cents the passenger is furnished a check for a box, and in making purchases throughout the city he may have goods sent to this box, to be called for when he leaves the city. The station is in the best part of the retail district, convenient to the leading hotels, and on the whole it is proving eminently satisfactory to the merchants and the public as well as the railway companies.

WAITING ROOM OF INTERURBAN UNION PASSENGER STATION AT TOLEDO

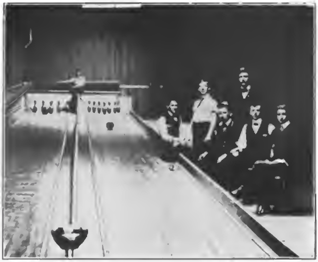
The Brockport (N. Y.), Niagara & Rochester Railway Company, Brockport, N. Y., was incorporated Oct. 22, with a capital of $500,000, to construct an electric road 44 miles long from Rochester to Medina. The new concern has a capital of $500,000. The directors are Frederick Beck, Brockport; W. S. Shields, Waterville; S. J. Spencer, Buffalo.

Rochester Railway Employees' Club Rooms

The problem of providing suitable assembly rooms for the employees of electric railways and securing attractions which will command the attention of the men while they are not on duty, has received a great deal of attention throughout the country and has been worked out satisfactorily along different lines in several cities. In New York, Chicago and other large cities where the number of men has warranted the management in forming benefit organizations, the insurance feature has proved an important factor, but in the smaller cities this has not been practicable, and the companies have relied upon the educational and social advantages to attract employees.

In Rochester, N. Y., the local company has found the co-operation of the Young Men's Christian Association of great value, and the management has encouraged the formation of a street railway branch, much after the plan of the railroad branches, which are to be found throughout the country. Thus far the work among the street railway men has been highly gratifying to the company and the men as well as the association, and each month has shown a growing interest in the new undertaking.

MEETING ROOMS ABOVE CAR SHEDS



VIEW OF THE BOWLING ALLEY

CORNER IN THE GAME ROOM

During the summer the company fitted up rooms for the men in the car house on State Street. This building is of historic interest, as it was for many years the headquarters of the Rochester City & Brighton Railroad Company. It has been entirely overhauled, and the part assigned the men for their assembly rooms is fitted up and furnished very comfortably. An exterior view of the building is presented herewith, together with pictures of the bowling alley and a corner of the game room. In the latter there are two pool tables, a ping-pong table and ten small tables for chess and checkers. There is also a reading room, which is well lighted and provided with suitable reading matter, bath rooms, finished in marble and provided with three hot and cold showers, and the secretary's office. The bowling alley is one of the most popular features of the establishment, and it is expected that interest in this sport will increase during the winter, when match games between the crack rollers will be played. Already the men have shown marked appreciation of the efforts made by the company to provide a comfortable place and congenial recreation for them, and this will be more noticeable, it is believed, during the long winter evenings.

The rooms are under the direct supervision of a secretary, representing the Young Men's Christian Association, and he looks out for the details, thus relieving the management of this responsibility and insuring proper attention to these matters. William C. Montignani, who occupies this position, has had considerable experience in similar work, having been identified with the railroad branch of the Young Men's Christian Association at Montreal. The scope of the work is to be broadened. Classes in electricity are to be formed, as well as in other studies which the men have expressed a desire to take up. Entertainments are to be given from time to time and other forms of amusement added. To do this successfully the management decided that a board of managers should be appointed, to consist of three members of the board of directors of the Young Men's Christian Association and four employees of the road. The latter are selected by the men themselves and the three directors of the association by the board of directors. This action brings the men in co-operation with the city association and gives them a part in the management of the affairs of their rooms.

Very soon one afternoon a week will be set aside for the wives and friends of the employees, at which time the ladies will make full use of the rooms. Another idea suggested is that of forming a bowling club and playing matches with other clubs in the city. It is proposed to arrange for the installation in the rooms of a day and all-night light lunch department. The opening of a barber shop in the rooms is another feature that has been suggested.

The charges for all games and amusements have been made as low as possible, no profit being made on anything in connection with the institution, and the receipts are all used to support the rooms. The company not only donated the rooms and fitted them up, but it makes up the deficit, if there should be any at the end of the year. The secretary's monthly reports show a steady advance in attendance, and with the coming of winter, it is believed, there will be even greater interest manifested among the men in the enterprise.

PAPERS READ AT ACCOUNTANTS' CONVENTION

Collection and Registration of Fares

BY WILLIAM C. SAMPSON,
Treasurer, Union Traction Company of Indiana, Anderson, Ind.

Our company has been in search of a satisfactory system for the collection and registration of fares upon interurban cars from the time we began to operate lines requiring a variety of denominations of cash fares.

We have passed through a series of experiments, laying aside various methods as a new one presented itself which seemed better than the old plan then in use.

The first plan in vogue was to collect by sections, requiring each passenger to pay a 5-cent fare for each section traveled over, each fare being rung up separately. This plan was used upon

*	7643	8657	2621	6932	0151	1590		SEP 13
‖	7643	8657	2621	6932	0151	1590		SEP 13
‖	7618	8645	2614	6929	0145	1488		SEP 13
*	7618	8645	2614	6929	0145	1588		SEP 13
	25	12	7	3	6	2		

Train 2 Condr O. S. Johnson 161
Motor 252 and 642—a. m. 9/13

EXHIBIT "A" (TAKEN OUT BY INSPECTOR AT INDIANAPOLIS)

the line running from Anderson to Marion, a distance of 34 miles, and the fare was 35 cents; this required each through passenger to pay his fare seven times; and had the same plan been used upon the Muncie-Indianapolis line, each through passenger would have had to pay thirteen times. This plan for our system proved impracticable and was soon discarded.

The next system put into practice was the torn ticket, one portion going to the passenger and the other to the auditor. The form of ticket used was one with all stations printed across the top of the ticket and also down the left-hand margin, and the tearing was regulated by a metal square which would leave the amount paid by the passenger upon each portion of the ticket in the angle of the square. This system was operated without registration. The tickets were consecutively numbered, and conductors were required to account for all tickets charged against them. The principal difficulty with this system was the inaccuracy of the conductors in tearing the tickets, and in a great many cases it was impossible to determine the correct amount to credit the conductor. This system was also very slow of audit, and was soon discarded.

The next system used was the collection of the fare from each passenger through to his destination and registering it upon a portable register, ringing once for each nickel collected. This system was in use until March 1, of this year, at which time we adopted the Ohmer car register, which registers six classes of fares. While this register does not entirely fill the bill, it has come nearer giving the desired result than any other system we have tried. As already stated, this register takes care of six classes of fares, four of which

Union Traction Co.
of Indiana.

Date 190

Train No ...... *Division* ....
Conductor .... *No* ....

DUPLEX TICKETS ISSUED.

No. off ....
" *on* ....
" *off* ....
" *on* ....
Total ( ) ....

PASSES HONORED.

Identification slips, ...
Limited employes, ...
Single trip, ...
Advertising, ...
Total, ...

EXHIBIT "B" (6 INS. X 3¼ INS.)

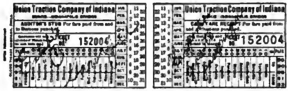


EXHIBIT "C" (2 INS. X 6 INS.)

UNION TRACTION COMPANY OF INDIANA.

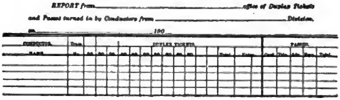


EXHIBIT "E" (7½ INS. X 12 INS.)

UNION TRACTION CO. OF IND.
CONDUCTOR'S REPORT.

.... Ind. *Date* .... 190...
Hour .... *M* *Car No.* .... *Reg. No.* ....
.... " .... " ....
Line .... " .... " ....

FARES RETURNED.

Cash from Passengers . . $..........
" " *Baggage* . . ..
Total Cash . . $..........

Used by Conductors on City lines

6 for 25 cents . . . .
Soldiers' Home . . . .
Scholars . . . .
Reg. Employe's . . . .
Ltd. " " . . . .
Spec. Coupon . . . .
Coupon Pass . . . .
Advertising . . . .
Transfers . . . .

TRANSFERS ISSUED.

Trans. No. .... *On* .... *Off* ....
Trans. No. .... *On* .... *Off* ....

PORTABLE REGISTER STATEMENT.

Reg. No. .... *On* .... *Off* .... *Passengers* ....
" .... *On* .... *Off* .... " ....
Total Registration . . ..

.... *Badge No.* ....
Conductor.

EXHIBIT "D" (5 INS. X 6½ INS.)

UNION TRACTION CO. OF INDIANA.

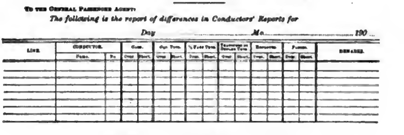


EXHIBIT "H" (8½ INS. X 11½ INS.)

UNION TRACTION COMPANY OF INDIANA.

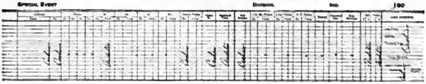


EXHIBIT "F" (12 INS. X 19 INS.)

we use for 5 cents, 10 cents, 15 cents and 20 cents, respectively; the fifth, together with the use of a duplex cash fare receipt, we take care of all cash fares above 20 cents; and the sixth for passes. We are able by this system to arrive at the number of passengers carried as well as the amount collected.

The Ohmer register you no doubt have all seen on exhibition at this and previous conventions, and have had its workings explained to you. I will, therefore, only attempt to give you the methods used by the Union Traction Company of Indiana in accounting for the fares collected.

We operate our interurban lines on the steam railroad system, and give each train a number, a train being run from one terminal to another, and when the car returns it becomes another train taking a different number. In all we operate 156 interurban passenger trains per day.

We have cashiers located at each terminal, who verify the count of the conductors' cash, and make up a report of the duplex cash fare receipts from each train, these tickets being turned in from each train separately by the conductor in small envelopes provided for that purpose.

The register statements are also taken from each train, but are not seen by the conductor or by the cashier, but are forwarded to the auditor's office by the inspector, who removes them from the register.

In order to illustrate the workings of our system of collection and reporting of fares, we will take the work of the conductor starting from Muncie at 4.15 a. m. This conductor would operate train No. 2, leaving Muncie at 4:15 a. m., arriving at Indianapolis at 6:40 a. m.; train No. 7, leaving Indianapolis at 7:15 a. m., arriving at Muncie at 9:50 a. m.; train No. 16, leaving Muncie at 10:15 and arriving at Indianapolis at 12:40 p. m.; and train No. 23, leaving Indianapolis at 1:15 p. m., and arriving at Muncie at 3:50 p. m. This completes his day's work. Before the car is turned over to the conductor at Muncie at 4:15 a. m., the inspector takes an impression of the register, setting the dial on the left-hand side at the star, and immediately upon receiving the car the conductor also takes an impression of the register, setting the dial at 1. These two impressions should be the same. Upon arrival at Indianapolis the conductor again takes an impression, using No. 1, and the inspector also takes an impression, using the star. The inspector then removes the register statement, writes upon it the train number, conductor's name and number, car number, arriving time and date, and keeps the statement in his possession until the statements are obtained from all trains arriving at Indianapolis on that day when they are forwarded to the auditor's office at Anderson. The inspector at Muncie does the same, and thus you will see that the local offices at each end of the division only see one-half of the work of each conductor, making it impossible for the cashier or conductor to figure up the amount registered for the day's work.

The register statements representing the work of this conductor are marked Exhibit "A" in the file of forms submitted with this article. The conductor upon his arrival at Indianapolis places in the envelope marked Exhibit "B" the auditor's stub of all duplex cash fare receipts (a sample of which is marked Exhibit "C") which have been issued on that train run, and which are registered as cash tickets; also all pass tickets, which are registered as tickets. This envelope he does not deposit until he returns to Muncie, as this is the point where he will finally turn in his cash collections for his day's work. This operation is repeated at the end of each train run, and upon completion of his day's work he then turns in his cash collections in envelope marked Exhibit "D." This envelope is deposited in a safe at the terminal, and the entire day's receipts at that terminal are removed by the local cashier on the following morning.

The local cashier makes three reports for the auditor's office, only one of which is complete, the other two being completed and balanced in the auditor's office. They are as follows:

1st. Report of Duplex Tickets and Passes. (Marked Exhibit "E.")

2d. Report of Daily Earnings Interurban Lines. (Marked Exhibit "F")

3d. Report of Daily Earnings City Lines. (Marked Exhibit "G.")

UNION TRACTION COMPANY OF INDIANA.
REPORT OF DAILY EARNINGS—CITY LINES

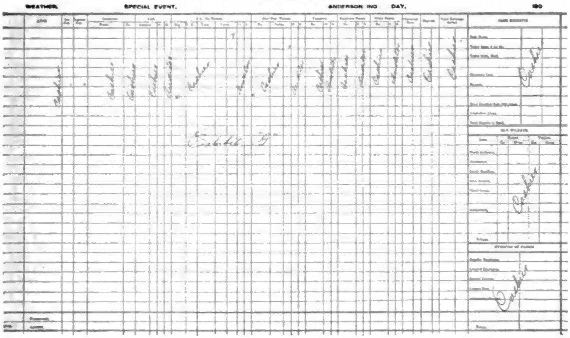


EXHIBIT "G" (SIZE SHEET, 12 INS. X 19 INS.)

The columns used by the cashier and auditor, respectively, are marked upon the blanks submitted. In making up report No. 1, the cashier assembles all envelopes containing duplex and pass tickets turned in by each conductor and in the order of trains operated; or in other words, using the same illustration as was used in explaining the methods of collection, be would arrange the envelopes from trains numbered 2, 7, 16 and 23; first open envelope from train 2, sees that numbers on the duplex tickets run consecutively, then arrange by denominations of fares, and enter number of each denomination upon the blank marked "E," carrying out in the total column the total number of tickets from that train and calculating the total value represented by the tickets; after this operation is performed for each train this conductor has operated, he then makes a total of the number and value of duplex tickets for the day's work of this conductor and transfers these to the proper column on blank "F." The same is done with the pass tickets.

On blank "F" the conductors' names are entered in the order in which they have started from the terminal, and the entire cash receipts of each conductor counted and entered opposite his name in the proper column. There are also columns provided for city tickets, but these are only occasionally used, as, with two exceptions, our city tickets are not accepted on interurban cars. In the cases where our city tickets are accepted on interurban cars, they are registered as a 5-cent fare. When the total receipts from interurban lines are obtained, the amount is transferred to

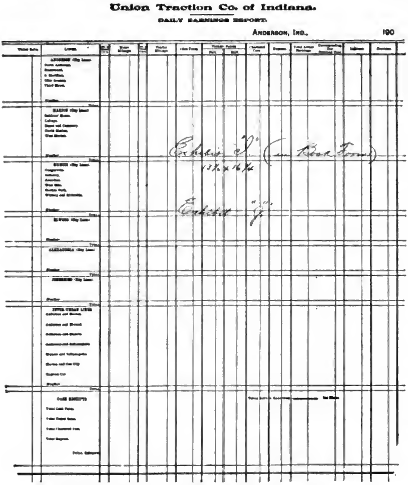
blank "G," and added to the receipts from city lines, which gives the amount to be deposited in bank for the day's business from that office. This deposit is made by the local cashier and a duplicate deposit ticket signed by an officer of the bank forwarded with the reports to the auditor's office.

As before stated, the register statements are forwarded by the inspectors direct to the auditor's office, and while the cashiers are counting the money and making up as much of the daily reports as can be done by them, a clerk in the auditor's office is calculating the value of the day's collections from these register statements, and when the reports arrive from the local cashiers, this clerk takes them and enters the registered value and records the amount over a short. He also verifies the calculations of the local cashier and certifies to the correctness of the deposit tickets.

When the reports are all completed and checked, this clerk makes a report to the passenger department on blank marked Exhibit "H" of the differences in conductors' reports.

The reports are then turned over to another clerk, who makes up the permanent record in a book (a sample sheet of which is marked Exhibit "I") and renders a report to the general manager on blank marked Exhibit "J" and to the directors on blank marked Exhibit "K." The daily earnings from each line are kept tabulated in books prepared for that purpose, so that at the end of the month such portions of the totals as go to make up the monthly report are ready for use.

In addition to the records mentioned, an account is kept with each train on blank marked Exhibit "L." This is made up from the register statements, and the reports of duplex and pass tickets as given on blank "E," which record also



EXHIBITS "I" AND "J" (IN BOOK FORM, 13½ INS. X 16¼ INS.)

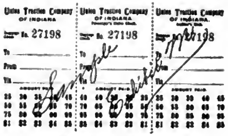


EXHIBIT "M" (3 INS. X 5¾ INS.)

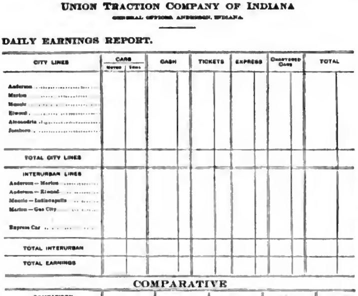


EXHIBIT "K" (8½ INS. X 10¾ INS.)

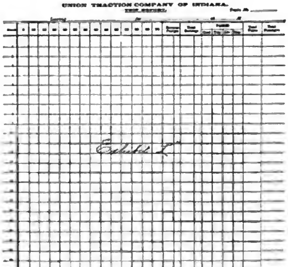


EXHIBIT "L" (9½ INS. X 12 INS.)

contains the number of passengers carried on interurban lines.

The system explained up to this point has been treated as it pertains to interurban lines, with only occasional reference to city lines.

The city cars of this company have also been equipped with the Ohmer register and arranged for the registrations of six classes of fares, to wit: 5-cent, 4 1-6 ticket, half-fare ticket, passes, employees and transfers. As is the case with interurban cars, an impression of the register is taken by the inspector before turning the car over to the conductor, who also takes his impression when he takes the car. The register then compiles without an additional impression being taken until the conductor in charge is relieved, at which time he takes an impression, and the conductor relieving him also takes an impression, using a different number, and so on until the car is turned into the barn, when the final impression is taken by the inspector in charge, and the entire sheet with all impressions for the day's work of that car is removed by the inspector and forwarded to the auditor's office.

The conductors on city lines make up their reports once each day, immediately upon finishing their day's work and deposit same in a safe at the company's office. The report required to be filled out is printed on the back of the envelope in which they deposit their collections (a sample of which is marked Exhibit "D"). This is the only report required from them, the register does the rest.

The method of handling the receipts and reports from city lines by the cashier and auditor is practically the same as that of handling the interurban business, and I think they will be made entirely clear by an examination of the blanks used for that purpose.

I have omitted up to this time any reference to the collection and reporting for such package and baggage business as is handled on our passenger cars. This branch of the business is taken care of by the conductor in charge of the car, except at such prominent points at which the company has an agent.

We use for this business a triplicate check printed upon an ordinary shipping tag (a sample of which is marked Exhibit "M") one portion being attached to the trunk or parcel, the duplicate given to the passenger, and the triplicate turned in to the cashier with the money. There is no registration made for these checks, as we do not wish to confuse them with our passenger business.

These checks are issued by the passenger department and charged to the local superintendent at each station by consecutive numbers, who again charges them to the various conductors by consecutive number, and the auditing department checks up the use of the checks—all three portions being returned through various channels.

In concluding, I wish to say that the systems used by our company have been developed to meet the necessities of our local conditions, and the results obtained are reasonable satisfactory.

Report of the Committee on Standard Blanks and Accounting for Material and Supplies

At the New York meeting of this association, held Oct. 9 to 11, 1901, it was voted that the committee which had presented a report on the above subject be continued until this meeting, when they should again report and together with their report present the forms intended for use.

The committee commenced its labor by having sent to each of the members a circular asking an expression of opinion on the several divisions of last year's report, with the idea of letting the members say what they wanted and preparing a report which should be acceptable to the majority. Four members were kind enough to favor us with their ideas, and we, in preparing this report, have tried to comply with their wishes, that the system should be less complex than the one presented last year. From the discussion at the New York convention, and from what we have learned since, we are of the opinion that most of the larger roads have in operation systems with which they are perfectly satisfied, and that they would not adopt any other system even though it should have the approval of our association, but that some of the smaller roads are not so well provided. In preparing this report, therefore, we have tried to obtain a good accounting with the minimum of labor. With this end in view we recommend that practically all the clerical work, so far as pricing and charging out are concerned, be done in the accounting department, letting the storekeeper deal with quantities in and out only.

We will divide the report under the same general heads as last year, viz.:

A. PURCHASE.
B. RECEIPT.
C. DISBURSEMENT.
D. ACCOUNTING.

which we will sub-divide as follows:

A.
PURCHASE

(1) Requisition for Purchase.

The first requirement is a proper requisition for the purchase of material and supplies for stock or for immediate use. It should be made in duplicate, the original for the purchasing department, the duplicate to be retained by the department making the requisition. It should state for what purpose the material is needed, that is, whether for stock or for some specific work. If for stock, should state the quantity on hand as well as quantity needed and a description of the material required. The original should be sent direct to the properly authorized official, who should make such corrections as to quantity to be ordered, as he desires, and after approval, send to the purchasing agent. (Form 1.)

(2) Order from Purchasing Department and Assignment of Lot Numbers by Accounting Department. (See Form 2.)

This should be made in triplicate, but the original only is reproduced. The duplicate instead of having the receipt attached should have a column at the side in which the accountant can enter the lot numbers. The original for the party or company's shop from whom the goods are ordered, the duplicate for party to whom goods are to be consigned, and the triplicate to be retained in the purchasing department. These orders should be consecutively numbered, should bear the requisition number and contain full shipping directions. The original should also show the conditions of purchase, which can be made to fit the specific requirements of each company and should be signed in the name of the company by a properly authorized person. When the purchasing agent has drawn the order he should send the duplicate to the accountant, who will enter same on his lot number record (Form 3), enter the proper numbers in spaces provided for same on the duplicate, fill out as far as number and description of material are concerned, the cards (Forms 4 and 5) and the sheet (Form 6). He should then forward the duplicate and Forms 4 and 5 to the department for whom goods were ordered, retaining Form 6 in his own department. If the order is on the company's shop, the original should also be sent to the accountant, who should enter the number assigned same on it, to enable the shop department to make its charges against this number. All labor and material used by the shop in filling these orders should be charged to some designated account and a report made of same on Form 7, when work is completed, to the accountant, who should extend prices of material and make a total of the cost and advise the purchasing agent, at the same time crediting the account which had been charged temporarily with the labor and debiting stores account or the proper expense account if made for immediate use. The purchasing agent should advise the accountant of all payments to be made by the company that should be deducted from the face of the bill as well as those payments which add to the cost.

(3) Record of Bills Approved by Purchasing Department. (Form 8.)

This department should be required to keep a record of all bills approved by it. It should be in such form that a total of all bills approved will be shown, and can be made in sheets so that one can be sent to the accountant and a copy kept, or in book form, which can be sent to the accountant as soon as the entries for the month are closed. The accounting department should check the charges to material and supplies on the voucher record by this record.

B.
RECEIPTS

(1) Recording and Reporting.

Upon receipt of a consignment of material at stores, the receiving clerk should check same by the duplicate order (Form 2). When goods are received at a branch store room where it is not convenient to have these on file, the person in charge should be provided with suitable blanks on which to enter the materials received and report to the storekeeper. Consignors should, so far as possible, be required to make a bill for each order and send same to the purchasing department as soon as filled. If, however, a part of the order remains unfilled at the end of the month, a bill should be sent for such material as they have delivered, in order that the accountant may have the necessary data to complete his record. The storekeeper should make a report each day to the accountant on Form 9, sending the original and retaining the duplicate as his record of material received. Upon receipt of the bills by the purchasing department they should be checked by

ORIGINAL.

________RAILWAY CO. No.____

Purchasing Agent: Please furnish the following for the ________ Department within ____ days.

On Hand, or Due on Present Requisition	Lot No. of Quantity on Hand	Quantity required	Description of Articles	For What Purpose Required	Purch. Agent's Order No.

Approved________ General Manager ________ Head of Department

Date________190__ Date________190__

Stored at________ Lot No.____
Description________ Maximum____
From________ Minimum____
Dates____190 ____190 ____190 ____190
Rec'd Q____ Q____ Q____ Q____

Dates Sent Out	Mem'to No.	Quantity	Dates Sent Out	Mem'to No.	Quantity	Dates Sent Out	Mem'to No.	Quantity

Stored at________ Lot No.____
Description________ Unit Cost____
From________ Bill No.____ Amt____
Freight Charges as per Bill No.____ Amt____
Charges for hauling and handling____ Amt____
Rec'd____ Total____

Dates Sent Out	Mem'to No.	Quantity	Dates Sent Out	Mem'to No.	Quantity	Dates Sent Out	Mem'to No.	Quantity

ORIGINAL.

Note our **Order No.** on your Bill.

Chicago,

PLEASE FURNISH THE

________Railway Company

with the following articles and send bill for each consignment direct to the Purchasing Department, ________ same day shipment is made.

For

Wanted

Department Purchasing Agent.

READ NOTICE ON BACK BEFORE FILLING ORDER.

Immediately upon receipt of Order fill out blank and mail to________Railway Co.,
Purchasing Department, ________

RECEIPT *of your Order No ____ is hereby acknowledged and is accepted subject to all conditions printed on the back.*
Shipment will commence ____ 190__ via ________
and will be completed ________ 190__
Dated ________ 190__

____

Lot No.____
Description of Material

________ Department. Letter____ Lot Nos.____ to____

________RAILWAY CO LOT NUMBER RECORD.

Lot No.	Unit Cost	Distribution of Cost: Labor	Mat'l	Date	Order Nos.	Description of Material	From	Bill or Cost Sheet Nos.	Requisition Nos.	Remarks

________RAILWAY CO. Sheet No.____

REPORT OF BILLS APPROVED BY PURCHASING DEPARTMENT

Bill No.	Date	Bought of	Order No.	Total Amount	Discount: Rate	Amount	Deductions, Freight, etc.	Net Amount	Charge to Stores Acct.	Charges to Other Accounts: Account	Amount	Date Sent to Auditor

Bill No.____ Price O.K.
Deduct____
Charge Ac.____
Deduct from Bill No.____
Form of____
Pay on or before____
____P. A.____190__
Storekeeper's Advice
No.____ Date____
________Clerk

No.____

________RAILWAY CO Cost Sheet No.____

ACCOUNTANT: The following is a detailed statement of the cost of________
________made for________ Department on Purchasing Agent's Order No.____
Charge was made against Account________ Signed________

Date	Hours	Rate per Hour	Amount	Material Used: Lot No.	Quantity	Description	These quantities will be billed to by Accountant: Price	Amount

________RAILWAY CO Sheet No.____

DAILY REPORT OF STOREKEEPER AT________

ACCOUNTANT: The following material was received________190__, and added to stores.

Signed________

Order No.	Lot No.	Quantity	Articles	From

________RAILWAY CO ________ Dep't. Req. No.____

DATE____190__

STOREKEEPER at________

This department needs the following supplies within________ days for use at________

On hand or due on this Req. No.	Additional Quantity to be issued	Description	Charge to Account	Storekeeper's Memoranda

________RAILWAY CO No.____

MANIFEST FOR SUPPLIES ISSUED________190__

From________ Storeroom To________

Requisition No.	Lot No.	Quantity	Description	Charge	Invoice No.

The above material received in good order except as noted, and charges are approved.

Date________190__ ________

________RAILWAY CO ________ Dep't. Req. No.____

DATE____190__

STOREKEEPER at________

MEMORANDA OF MATERIAL ORDERED

For use at________

On hand or due on this Req. No.	Additional Quantity to be ordered	Description	Charge to Account	Date Received	Storekeeper's Receiving No.	Quantity Received

________RAILWAY CO. No.____

MEMORANDA OF MATERIAL RETURNED TO STORES OR TRANSFERRED.

From________ To________

Credit________

Quantity	Description	Value	Lot No.	Credit Account	Amount

the order and certified as to the correctness of prices and terms. They should then be entered on his record (Form 8), giving them the first open bill number, which number should then be placed on the bills to thereafter identify them. They should then be sent to the accountant who will check them by the storekeeper's daily report of material received and note on bills that goods have been received. He should then fill in the balance of data on Form 6 and, if correct in all particulars, put the bill in line for voucher. A rubber stamp containing information as shown on Form 10, may be applied in the purchasing department to facilitate matters. By the adoption of the above plan all confidential prices are confined to departments of the purchasing agent and accountant. This plan, too, does away with the delay incident to the sending of bills to various departments for their approval. It will perhaps be held by some that general managers will object to approval of vouchers for these bills if they do not find thereon a prior approval by the head of the department ordering the same, but the stamp notation on the bill showing that the goods have been received, giving reference to the advice of same, we think will obviate this difficulty.

(2) Stock Ledger.

We believe that the use of Forms 5 and 6 will entirely obviate the necessity of keeping a regular stock ledger. It is intended that these cards shall be indexed after the following plan:

Lamps, incandescent, lot numbers 26 and 364. This would indicate that two consignments of incandescent lamps had been received and designated by lot numbers 26 and 364. A reference to the cards or sheets arranged numerically, would show the quantity still remaining on these numbers. As soon as all of lot number 26 were used up, this number could be checked, which would indicate that the only incandescent lamps on hand were those under lot number 364. A reference to the card at any date would show the storekeeper, by referring to his Form 5, and the accounting department by referring to Form 6, the quantity on hand.

(3) Handling of Second-hand Material and Scrap.

The plan outlined in our report of last year seemed to meet the approval of the members at New York and is therefore repeated in this report as follows:

If this class of material is entered on the stock books at a value when it is stored for future use or sale, it then comes under the care of the storekeeper, and more importance will attach to it than if it were simply dealt with when sold. Another advantage to be gained by this plan is that the expense or other accounts to be credited with scrap, will receive the credit at the same time they receive a charge for the material which replaces the scrap. Any discrepancy which may occur between the price obtained for the scrap and the value placed upon it, would have to be adjusted proportionately between the accounts credited. When obsolete material is scrapped, stock material account should be credited with the scrap value and the difference charged to proper expense account or to a depreciation account, if one has been provided, or to profit and loss direct. See paragraph B, under "Manifesting," for forms to be used.

C.

DISBURSEMENT

(1) DISTRIBUTION AND CHARGE OF MATERIAL

(a) Regular Requisition.

Regular requisitions should cover the needs of a department for a specified period, being made but once a month if practicable. They should be drawn in duplicate, the original to be submitted to the general manager or some other official of equal authority, for approval before being filled, and the duplicate to be retained by the person drawing the requisition. They should be numbered consecutively. (See Forms 11, A and B.)

(b) Emergency Requisition.

The emergency requisition is designed to provide for material for emergency use, which could not be anticipated or covered by the regular requisition, and should be honored by the storekeeper without the same approval as surrounds the regular requisition, with the understanding, however, that a regular requisition will be drawn later, covering such emergency requisition honored. They should be drawn in duplicate, the original to go to the storekeeper, and the duplicate to be retained by the person drawing the requisition. They should be numbered consecutively.

(c) Request for Material and Supplies.

This form provides for the drawing of material by employees of the shop, track, electrical or other departments, after the request has been signed by the foreman in charge of the employee, and the goods should be delivered to the employee upon presentation of the request. The request is honored by the storekeeper with the understanding that the head of the department making same will sign a manifest for the material so delivered, or requisition the request later, if so desired by the storekeeper. This form is put up in blocks, is drawn only in original, not numbered, and operates as a sight draft on the storekeeper.

(Note.—No blanks are provided for the emergency requisition or request ticket, but forms in use on several roads will be found among the forms filed with the secretary).

(2) MANIFESTING

(a) A regular manifest (Form 12) should accompany each shipment of stock from the storerooms. This should be in triplicate, the original and duplicate going with goods, the original to be receipted and returned to storekeeper, the duplicate to be retained by person receiving the goods, and the triplicate to remain in storekeeper's book. It has been suggested that the labor and expense of manifesting can be avoided by having the requisition (Form 11) made with a receipt attached and sending same back with the goods. When receipted they would be returned to the storekeeper who would in turn send them to the accountant. This plan would obviate checking the manifests, all entries being made from the original requisition, which has been duly approved. Consideration of both plans by the members is desired.

(b) A blank to be used for one or all of the following purposes (Form 13):

To transfer material from one storeroom or department to another.

Second-hand material transferred to storehouse.

Scrap material transferred to storehouse.

Material transferred from storage yards to the place where it is to be used.

This form should be in triplicate. The original to go with the goods and be receipted and returned to sender, the duplicate to be sent to accountant, to be given a lot number and entered on his record and then sent to the department (if a store room) to which same were sent, with the necessary cards.

(c) A blank that may be called "suspense." Being a manifest designed to cover the issuance of material which cannot be intelligently charged out when issued, for instance, the delivery by the store room of material for line repairs which is to be used on emergency or tower wagons. This should be made out by the heads of departments and consecutively numbered and be in duplicate, the original to be retained by person responsible for the material issued upon it, until every article is accounted for on a place provided on the blank, and the duplicate to be retained by the person sending out the material. All material which has been issued upon this manifest which is unused on the last day of the month, must be returned to the storekeeper for inspection; the storekeeper will receipt for it and remanifest it. The person to whom the material is issued shall report upon this blank the use to which the material was put, giving all particulars regarding same. No sample form has been provided, but may be seen among forms on file.

REPORTING

No reports, other than the daily reports of material received and sent out or the receipted requisition for same, will be required from the storekeepers. They should be required, however, to send in the receipted manifests covering all shipments sent out to enable the accountant to check their work.

ACCOUNTING

Suitable blanks or books will be required on which to enter the daily reports received from the storekeepers and distribute same among the various expense accounts, but as these forms must of necessity be of large size and would vary considerably to cover the special accounts each road has, the committee has not felt warranted in going to the expense of getting them out and having them reproduced.

In transmitting this report the committee desires to thank those members who have aided them by their suggestions, and also the Library Bureau, who kindly offered their assistance in getting out such of the forms as their system would apply to and did prepare Form 5 for us.

We trust the members will come to the Detroit convention prepared to thoroughly discuss this report so that some conclusion may be reached at this meeting.

Respectfully submitted,

F. E. Smith, Chairman,
Auditor Chicago Union Traction Company, Chicago, Ill.
C. L. S. Tingley,
Secretary American Railways Company, Philadelphia, Pa.
Frank R. Henry,
Auditor St. Louis Transit Company, St. Louis, Mo.

The Stationery Store Room

BY J. R. SHURTZ,
Auditor, South Jersey Gas, Electric & Traction Company, Camden, N. J.

In presenting a paper on "The Stationery Store Room" I shall first endeavor to give you an idea as to the origin of our stationery supplies, which grew to such proportion that it became absolutely necessary to establish a suitable "stationery store room." Three years ago our company consisted of two departments—a gas works and an electric light plant, operating in one city; since that time we have taken in and now operate, under one company, nine gas works, eight electric light plants and a railway of 24 miles. In carrying out the consolidation of these properties I found that each had been run in a very conservative way, receiving, smilingly, whatever business came, without any effort and with practically no care on their part; a total absence of any system of accounting from which monthly reports or details could be gathered; where our policy is to get all that comes our way, reach out for more, and make a big effort to get it. Such little stationery as they had was extremely varied, and was used in many different ways, frequently the most handy; on this account it became necessary to look for a great deal of information from such clerks as we fell heir to from the generosity of the previous owners, as well as making a personal study of a great number of various blanks and forms, which I had gathered from a few of my progressive friends, who had been there before, these, together with such original forms as our experience had prompted us to use, adding here and there a new idea, served as a basis of operation. In the preparation of these blanks my time was of necessity limited. It generally happened that I would receive notice of a plant having been purchased one day and that we were to take it over and operate it the next. Then my troubles would begin, endeavoring to convince the newly acquired old clerks (my heirlooms) that they could do their work differently, and that there were new methods in operating corporations as well as other things.

"Things" I have run up against in the operation of our various departments are numberless as well as varied: Harvesting ice, selling electric fans, connecting gas stoves, with which to roast and cook and at the same time keep peace in the household; endeavoring to see the man who had fallen off a car before he found his doctor (lawyer) to tell him how badly he was hurt; issuing an attachment on the menagerie at the last circus for current consumed in their endeavor to leave the city before banking hours; testing typewriters, who "don't have to work, but will if they like *us*."

You can readily see that to carry out the detail of such a business and the recording of it that we have a thousand and one different blanks, but as the fad is "to combine," and we work on the community of interest plan, I have eliminated a great number of forms and substituted ones giving as much detail, at the same time covering as many departments as practicable. We have established a standard size for a great number of blanks, which is a great advantage in filing. It quite often happened that we would have a number of forms, measuring about the same size, as, for instance, blanks between 8 ins. and 9 ins., and 11 ins. and 12 ins.; these forms can be readily changed, as follows: First, by ascertaining the size sheets that would cut to the best advantage from paper stock, finding it very easy to cut off a quarter or half inch, or if needs be add the same. I also found it an advantage to use as many different light colors in paper as possible. When one order called for the performance of one kind of work I used a paper with as great a distinction in color for the order blank, reversing the work.

I have also found it a great advantage in paying particular attention to having duplicated orders of stationery, cut the exact size of the previous lot, as a tendency of all printers is to add something or make the forms a little different in size or printing. On account of our business being extended over some 50 square miles of territory, containing some twenty-five different cities and towns, you can imagine the quantity of printer's ink we have thrown at us from all quarters of that territory; but, in order to collect accounts in some instances, and, in other cases, to stand well in the editor's eyes, we have not been able to concentrate our purchases and obtain at all times good work for the best prices; being necessary for these reasons and others well understood, to distribute our work a great deal, this in time can and should be corrected, the business going strictly to the lowest reputable bidder.

Our store room is fitted up with shelves 18 ins. deep around the entire walls of the room, and about 14 ins. apart. This allows us to store most of the blanks in a very nice fashion. It is very satisfactory to have the blanks tied up by the printers in as small packages as practicable, and so delivered; this relieves us of the annoyance of opening packages in the store room unnecessarily, which soil very readily, even with the best of care. In addition to the shelving we had to provide a cabinet of 100 drawers, running from 1 to 8 ins. in depth, to take care of small blanks, pencils, pens, erasers, etc., a most convenient contrivance.

Once the orders are issued for the stock of "the stationery store room," goods delivered and placed upon the shelves and in the drawers, as described, the issuing of it is readily controlled. In distributing stationery to the several departments, we make the allotments cover a certain period, guided by the wants of each, so that they will run out at about the same time; it is not well to issue large quantities, as it tends to make the clerks wasteful and careless.

In charging up the expense of books, blanks, etc., we charge all stationery first to the store room account, under which we have separate columns for each department, charging to management the general books, reports covering all departments, and blanks in connection with the work of the railway, to their expense accounts; to the gas department, the ledgers which extend over a period of twelve months, and all blanks pertaining to that line of our business, and so on, through all departments.

We are using a number of loose leaf filing cases, similar to a ledger; a style manufactured by a firm in Holyoke, Mass., and find it very convenient to use the same style in a number of departments, and in as many different ways; one in particular being a file 9 ins. x 9 ins., which permits using the same kind of paper for duplicate and triplicate orders, together with copies of correspondence and numerous other items.

Report of Committee on a Standard Form of Report for Electric Railways

BY W. F. HAM, Chairman,
Comptroller Washington Railway & Electric Company; E. M. White, Cashier Hartford Street Railway Company; C. N. Duffy, Secretary Chicago City Railway Company, Chicago, Ill.

To understand correctly the objects sought to be accomplished by this committee, it is necessary to review briefly the circumstances leading to its appointment. As stated in the constitution of this association one of its objects is to promote the adoption of a uniform system of accounts. At its first meeting held in Cleveland, Ohio, March, 1897, a committee was appointed to submit a report on a standard system of street railway accounting. With the work of that committee, known as the standardization committee, you are all familiar, and it is only necessary to say that the classifications reported by them were adopted by this association as standard and are now in general use throughout the country.

We should, however, speak more particularly of the relations existing between this association and the National Association of Railroad Commissioners. The standardization committee had two objects:

First. To devise a standard system of street railway accounting, covering the classification of construction and equipment accounts, classification of operating expense accounts and forms of monthly and annual reports; and

Second. To promote in every way possible the adoption and use of the above classification and forms.

From the first they realized the desirability of working in harmony with such public officials as exercise supervision over the accounts of street railways, with a view to having the classifications of this association approved by them and used in the reports of street railway companies.

Learning that the National Convention of Railroad Commmissioners had appointed a committee to prepare a standard system of street railway accounts, the standardization committee put itself in touch with them, and after several conferences, the system prepared by the standardization committee and adopted by this association was approved and recommended for use by the National Convention of Railroad Commissioners held at Denver, Col., August, 1899.

You will understand that this approval by the National Convention of Railroad Commissioners did not necessarily mean its adoption and use in any individual State. To accomplish this result required action by the several State boards of railway commissioners. Up to the present, the only States that prescribe our system are New York and Connecticut, so that much remains to be done by this association and its standardization committee to bring into line the other States that exercise supervision over the accounts of street railway companies.

Our position, however, was much strengthened by the action of the Denver convention and we were invited to send representatives to the Convention of Railroad Commissioners held in Milwaukee in May, 1900, and again to their convention held in San Francisco in June, 1901. At the latter convention, a constitution was adopted in which it was provided that the Street Railway Accountants' Association should be made an honorary member of their associa-

tion and should be represented at each convention by three delegates, thereby giving us formal and permanent recognition.

At the San Francisco convention, the following resolution was adopted:

"Resolved, That a special committee of three be appointed by the chair to prepare a form for reports of electric railroad and that said committee be authorized to act in co-operation with a similar committee to be appointed by the president of the Street Railway Accountants' Association of America, and to invite the assistance of any person possessing expert knowledge of the subject, and that they make report of the result of their proceedings to the next annual convention of this body."

In accordance with the resolution a committee was appointed consisting of Hon. Lavant M. Read, of Vermont; Hon. George W. Bishop, of Massachusetts, and Hon. Ashley W. Cole, of New York. The president of this association was informed of the appointment of the committee and was asked to appoint a committee to confer with them in the preparation of a report. Our committee met a majority of the committee of the Association of Railroad Commissioners in New York in January, 1902, but owing to the severe illness of Judge Read, the chairman of their committee, and the short time intervening before the next convention to be held in Charleston, S. C., in February, their committee decided to allow the matter to go over for another year.

Since the Charleston convention, the president of the National Association of Railroad Commissioners, Hon. Benjamin F. Chadbourne, of Maine, communicated with the president of this association, suggesting that our committee submit a report to our association at the present convention, and that this report be the subject of conference between their committee and our committee, the restult of such conference to be reported to their next convention to be held in Portland, Maine, July, 1903.

From the foregoing, you will correctly understand why this committee was appointed and what it hopes to accomplish. As it has been the aim of the standardization committee to secure the adoption of a standard system, so it is the aim of this committee to assist the National Association of Railroad Commissioners in their efforts to secure uniformity in the form of reports by street railway companies to State boards or other bodies exercising supervision over their accounts. It is needless to say that such a result will be of the greatest benefit. To the public, it will be the culmination of our efforts in the direction of standardization of accounts.

The standardization committee confined itself to a classification of construction and equipment accounts, classification of operating expense accounts, and forms of monthly and annual reports.

This committee has gone somewhat further by preparing a comparative balance sheet, with accompanying schedules; a form for description of road and equipment; a form for mileage traffic and miscellaneous statistics; and a form for historical and general information. We have eliminated certain features of the usual report required by railway commissioners, which have been outgrown in the development of the business. We believe the report submitted contains all essential information and gives to the public a complete and intelligible report in a simple and concise form.

This committee suggests no change in the classification of construction and equipment accounts.

In the classification of operating expense accounts, we suggest the following minor changes:

Account No. 19. To read, "Wages of Miscellaneous Car Service Employees." Instead of "Wages of Other Car Service Employees."

Account No. 22a. "Hired Equipment." The insertion of this account to cover rental of cars, electric equipment of cars, and other equipment.

Account No. 29. To read "Stores Expenses," instead of Storeroom Expenses."

Account No. 35. To read "Miscellaneous Legal Expenses," instead of "Other Legal Expenses."

In the form of income account, we suggest changes of more importance.

Gross earnings from operation are separated into two divisions:

First. Car earnings, to include all earning derived from the operation of cars, and

Second. Miscellaneous earnings, to include all earnings resulting from the operation of the property not included in car earnings.

Income from Advertising, rent of land and buildings, and rent of tracks and terminals, previously included under "Income from Other Sources," are now treated as "Miscellaneous Earnings."

A new account, "Income from Rent of Equipment," is also treated as "Miscellaneous Earnings."

Sale of Power, previously classified as "Miscellaneous Income from Other Sources" is now treated as "Miscellaneous Earnings." Under the former classification, the amount shown as "Miscellaneous Income from Other Sources" was the net amount after the cost of the production of the power sold had been deducted. In the present report, the gross amount received from the sale of power is shown as miscellaneous earnings, and the cost of the production of this power is included in operating expenses.

With regard to "Rent of Land and Buildings" exception is made of income from rent of real estate purchased or conducted as an outside investment, and with regard to "Rent of Tracks and Terminals," exception is made of income from leased lines or terminals, the operation of which has been temporarily or permanently abandoned by the lessor.

Your committee has not made the changes in transferring the accounts from "Income from Other Sources" to "Miscellaneous Earnings" without a careful consideration of the advantages and disadvantages of so doing. They realize the undesirability of making changes in the forms adopted by this association as standard and would not recommend changes of consequence were they not fully convinced that the former arrangement was illogical and improper from a correct accounting and common sense standpoint.

The gross earnings from the operation of a railroad property as surely include income from advertising in its cars, rents from tracks, terminals, land, buildings and equipment, and income from sale of power as the earnings from passengers, freight, mail, etc.

The definition of earnings is "money or other compensation to which one has a claim for services rendered." Surely a service is rendered when we allow others to use the space in our cars for advertising privileges, to operate their cars over our tracks, to use our land, buildings, cars or other equipment, to utilize our power for lighting, heating or other purposes. If these things are not earnings, nothing can be classed as earnings. That they are different from the earnings derived from the operation of the cars, we admit, and have for that reason made two divisions of earnings as above stated, namely, car earnings and miscellaneous earnings.

Another reason why these items should be treated as earnings from operation is that the expense of maintenance of track, terminals, buildings and equipment is naturally included in operating expenses, and if excluded, the total cost of operation is not shown. This is also true of receipts from sale of power, where in addition, the actual cost of the production of the power sold cannot be determined with any degree of accuracy.

The reason for excluding from earnings from operation the rents received from property purchased or conducted as an outside investment is manifest, as we are dealing with the operation of a railroad property. Likewise, the reason for excluding from earnings the income from leased lines or terminals, the operation of which has been temporarily or permanently abandoned by the lessor is apparent, as we are dealing with earnings from operation and that which is not operated can certainly yield no earnings from operation.

The title "Miscellaneous Income" has been substituted for "Income from Other Sources."

The title "Income from Securities Owned" has been substituted for "Interest and Dividends on Securities Owned."

The title "Gross Income less Operating Expenses" has been substituted for the title "Gross Income."

Here a word of explanation seems desirable. Your committee feel that the title "Gross Income," as used in our previous report, and now in general use in street railway and steam railway accounting is radically wrong. Turn, if you will, to Webster's dictionary and you will find the word "gross" defined, "Undiminished by deduction, entire;" yet in common use, as applied to street and steam railway accounting, gross income means "Gross Earnings from Operation and other Sources with Operating Expenses Deducted." This is a manifestly improper use of the word "gross," and we have therefore in our present report used the term "Gross Income less Operating Expenses," as being the correct title in place of "Gross Income."

Taxes we have shown in four separate divisions:

1. On real and personal property.
2. On capital stock.
3. On earnings.
4. Miscellaneous.

The title "Rent of Leased Lines and Terminals" has been substituted for "Rentals of Leased Lines."

As the first deduction from net income we have placed "Reserves and Special Charges" which takes the place of "Additions and Betterments" and "Sinking Funds" in the old form.

At the foot of the income statement we have placed a statement of profit and loss adjustments during the year, which are to include all items affecting profit and loss which have not passed through the income account. In this way a complete exhibit is made for the year.

We ask your careful consideration and open criticism of the forms that follow.

FORM OF REPORT FOR ELECTRIC RAILWAYS

To include:

1. Income account for the year, with accompanying schedules.
   - *a.* Gross earnings from operation.
   - *b.* Operating expenses.
   - *c.* Detailed statement of rentals of leased lines and terminals.
2. Comparative general balance sheet, with accompanying schedules.
   - *d.* Construction and equipment.
   - *e.* Construction and equipment, leased lines.
   - *f.* Capital Stock and funded debt.
3. Description of road and equipment.
4. Mileage, traffic and miscellaneous statistics.
5. Historical and general information.

REMARKS

Gross Earnings from Operation—Divided into

First. Car Earnings, to include all earnings derived from the operation of cars.

Second. Miscellaneous Earnings, to include all earnings resulting from the operation of the property, not included in car earnings.

Car Earnings.—Divided into earnings from passengers (whether cash or ticket), chartered cars, freight, mail, express and other car earnings.

As an illustration of a proper charge to the last-named account might be mentioned the fixed compensation received for the transportation of letter carriers in uniform.

Miscellaneous Earnings:

Advertising.—If a company conducts the business of selling or renting advertising space in its cars instead of leasing this privilege to others, the amount shown as "Income from Advertising" should be the net income from this source after deducting all expenses of conducting the business.

Rent of Land and Buildings.—This refers to real estate that is being used for the operation of the property, and should show the gross rent without deduction of any expenses.

Income from rent of real estate, purchased or conducted as an outside investment, in which might properly be included office buildings used in part for railway purposes, should be included in "Miscellaneous Income," after deducting all taxes, insurance, water rents or rates, cost of repairs and other expenses connected with such real estate.

Rent for Tracks and Terminals.—To include all compensation received for the use of tracks, terminals and bridges, the operation of which has not been abandoned by the lessor, on whatever basis such compensation may be determined. It may be a fixed sum per annum or a fluctuating rental based upon the number of car miles run, passengers carried, etc.

The word "terminals" is not meant to refer to depots, car houses or other buildings at the termini of the road.

Income from leased lines or terminals, the operation of which has been temporarily or permanently abandoned by the lessor, should be included in "Miscellaneous Income."

Rent of Equipment.—To include all rent received for cars and other equipment, on whatever basis such rent may be determined.

Sale of Power.—To include all receipts from the sale of power, whether for heating, lighting or motive purposes.

If the company conducts a lighting as well as a railway business, this account should not include receipts from the lighting business, but the net income resulting from the lighting business should be included in "Miscellaneous Income." The same principle applies to any other outside business conducted by the company, including operation of parks, park resorts and similar property.

Other Miscellaneous Earnings.—To include all other miscellaneous earnings not specified above.

Miscellaneous Income:

Interests on Deposits.—To include interest on current or special funds on deposit.

Income from Securities Owned.—To include income from stocks, bonds or other securities owned.

Rent of Leased Lines and Terminals.—To include income from leased lines or terminals, the operation of which has been temporarily or permanently abandoned by the lessor.

Other Miscellaneous Income.—To include all miscellaneous income not specified above.

Income from rent of real estate purchased or conducted as an outside investment, in which may properly be included office buildings used in part for railway purposes, should appear in "Miscellaneous Income" and the amount shown should be the net amount received after deducting all taxes, insurance, water rents or rates, cost of repairs and other expenses connected with such real estate.

Income from the operation of parks, park resorts or similar property should appear in "Miscellaneous Income" and the amount shown should be the net amount received after deducting all expenses connected with such operation.

If the company conducts a lighting, as well as a railway business, the net income resulting from the lighting business should appear under "Miscellaneous Income." The same applies to any other outside business conducted by the company.

Deductions from Income:

Taxes.—To include all taxes on real estate and personal property, track taxes, franchise taxes, taxes upon capital stock, taxes upon gross earnings, car licenses and other vehicle licenses; excepting, however, taxes on property such as real estate purchased or conducted as an outside investment the net income from which is credited to "Miscellaneous Income."

Rent of Leased Lines and Terminals.—To include rent of leased lines or terminals the operation of which has been temporarily or permanently abandoned by the lessor.

INCOME ACCOUNT FOR YEAR ENDING

Gross earnings from operation (per schedule "A") .... $ ....
Operating expenses (per schedule "B") .... $ ....
Net earnings from operation .... $ ....
Miscellaneous Income:
  Interest on deposits .... $ ....
  Income from securities owned .... $ ....
  Rent of leased lines and terminals .... $ ....
  Other miscellaneous income* .... $ ....
  .... $ ....
  .... $ ....
  .... $ ....
Gross income less operating expenses .... $ ....
Deductions from Income:
  Taxes
    On real and personal property .... $ ....
    On capital stock .... $ ....
    On earnings .... $ ....
    Miscellaneous* .... $ ....
  Interest on funded debt .... $ ....
  Interest on real estate mortgages .... $ ....
  Interest on floating debt .... $ ....
  Rent of leased lines and terminals (per Schedule "C") .... $ ....
  Other deductions from income* .... $ ....
  .... $ ....
  .... $ ....
Net income .... $ ....
Deductions from Net Income:
  Reserves and special charges* .... $ ....
  .... $ ....
  Dividends ——% on $ ....
    Preferred stock .... $ ....
  Dividends ——% on $ ....
    Common stock .... $ .... $ .... $ ....
Surplus or deficit for year .... $ ....
Surplus or deficit at beginning of year .... $ ....
Profit or Loss Adjustments During Year:*
  Credits.—
    .... $ ....
    .... $ ....
    .... $ .... $ ....
  Debits.—
    .... $ ....
    .... $ ....
    .... $ .... $ .... $ ....
Surplus or deficit at close of year .... $ ....

*Specifying same.

SCHEDULE "A."—GROSS EARNINGS FROM OPERATION

Car Earnings:
  Passengers .... $ ....
  Chartered cars .... $ ....
  Freight .... $ ....
  Mail .... $ ....
  Express .... $ ....
  Other car earnings .... $ .... $ ....
Miscellaneous Earnings:
  Advertising .... $ ....
  Rent of land and buildings .... $ ....
  Rent of tracks and terminals .... $ ....
  Rent of equipment .... $ ....
  Sale of power .... $ ....
  Other miscellaneous earnings* .... $ ....
  .... $ ....
  .... $ .... $ ....
    Total .... $ ....

*Specifying same.

SCHEDULE "B."—OPERATING EXPENSES

Maintenance.—Way and Structures:
1. Maintenance of track and roadway ....$........
2. Maintenance of electric line ....$........
3. Maintenance of buildings and fixtures.....$........$........

Maintenance.—Equipment:
4. Maintenance of steam plant ....$........
5. Maintenance of electric plant.............$........
6. Maintenance of cars ....$........
7. Maintenance of electric equipment of cars.$........
8. Maintenance of miscellaneous equipment..$........
9. Miscellaneous shop expenses ....$........$........

Transportation.—Operation of Power Plant:
10. Power plant wages ....$........
11. Fuel for power ....$........
12. Water for power ....$........
13. Lubricants and waste for power plant ....$........
14. Miscellaneous supplies and expenses of power plant ....$........
15. Hired power ....$........$........

Transportation.—Operation of Cars:
16. Superintendence of transportation ....$........
17. Wages of conductors ....$........
18. Wages of motormen ....$........
19. Wages of miscellaneous car service employees ....$........
20. Wages of car house employees ....$........
21. Car service supplies ....$........
22. Miscellaneous cars service expenses .....$........
22a. Hired equipment ....$........
23. Cleaning and sanding track ....$........
24. Removal of snow and ice ....$........$........

General:
25. Salaries of general officers ....$........
26. Salaries of clerks ....$........
27. Printing and stationery ....$........
28. Miscellaneous office expenses ....$........
29. Stores expenses ....$........
30. Stable expenses ....$........
31. Advertising and attractions ....$........
32. Miscellaneous general expenses ....$........
33. Damages ....$........
34. Legal expenses in connection with damages ....$........
35. Miscellaneous legal expenses ....$........
36. Rent of land and buildings ....$........
37. Rent of tracks and terminals ....$........
38. Insurance ....$........$........

Total ....$........

SCHEDULE "C"

DETAILED STATEMENT OF RENTALS OF LEASED LINES AND TERMINALS

Name of Lessor	Portion Used for Payment of Interest on Debt of Lessor	Portion Used for Payment of Dividends on Capital Stock of Lessor	Portion not Included in Foregoing Payment of Interest or Dividends *	Total Amount of Rental Paid by Lessee
Total				

*Taxes on leased lines should be included in "taxes" and not included here.

COMPARATIVE GENERAL BALANCE SHEET

(Showing Condition at Close of Business June 30, 1902.)

June 30, 1901		ASSETS	June 30, 1902		Year Ending June 30, 1902	
Item	Total		Item	Total	Increase	Decrease
		Construction and equipment, per Schedule "D".................				
		Construction and equipment, leased lines, per Schedule "E".....				
		Other permanent investments as follows:				
		Stocks and bonds of other companies				
		Current assets as follows:				
		Cash				
		Bills receivable				
		Accounts receivable				
		Material and supplies				
		Prepaid accounts				
		Miscellaneous (specifying same)				
		Sinking and other special funds				
		Deficit, per schedule				

June 30, 1901		LIABILITIES	June 30, 1902		Year Ending June 30, 1902	
Item	Total		Item	Total	Increase	Decrease
		Capital stock, preferred, per Schedule "F"				
		Capital stock, common, per Schedule "F"				
		Funded debt, per Schedule "F"				
		Real estate mortgages				
		Current liabilities as follows:				
		Loans and notes payable				
		Accounts payable				
		Matured interest on funded debt, unpaid				
		Miscellaneous matured interest, unpaid				
		Rentals due and unpaid				
		Dividends unpaid				
		Miscellaneous (specifying same)				
		Accrued liabilities as follows:				
		Taxes accrued and not yet due				
		Interest on funded debt accrued and not yet due				
		Miscellaneous interest accrued and not yet due				
		Rentals accrued and not yet due				
		Miscellaneous (specifying same)				
		Reserves,				
		Surplus, per Schedule.				

SCHEDULE "D"
CONSTRUCTION AND EQUIPMENT

ACCOUNT	Total Cost to June 30, 1901.	Charges During Year	Deductions During Year	Total Cost to June 30, 1902
A. Organization				
B. Engineering and superintendence				
C. Right of way				
D. Track and roadway construction				
E. Electric line construction				
F. Real estate used in operation of road				
G. Buildings and fixtures used in operation of road				
H. Investment real estate				
I. Power plant equipment				
J. Shop tools and machinery				
K. Cars				
L. Electric equipment of cars				
M. Miscellaneous equipment				
N. Interest and discount				
O. Miscellaneous				
Grand total				
Cost of construction and equipment per mile of road owned, $				

SCHEDULE "E"
CONSTRUCTION AND EQUIPMENT, LEASED LINES

ACCOUNT	Balance, June 30, 1901	Charges During Year	Deductions During Year	Total Cost to June 30, 1902	Less Amts. Paid by Lessor Co. During Year	Balance, June 30, 1902
A. Organization						
B. Engineering and superintendence						
C. Right of way						
D. Track and roadway construction						
E. Electric line construction						
F. Real estate used in operation of road						
G. Buildings and fixtures used in operation of road						
H. Investment real estate						
I. Power plant equipment						
J. Shop tools and machinery						
K. Cars						
L. Electric equipment of cars						
M. Miscellaneous equipment						
N. Interest and discount						
O. Miscellaneous						
Grand total						

SCHEDULE "F"
Capital Stock and Funded Debt.
CAPITAL STOCK

Description.	Total Par Value Authorized	Number of Shares Issued	Par Value per Share	Total Par Value Issued	Dividends During Year	
					Rate	Amount.
Preferred						
Common						
Grand total						

Total number of stockholders ....
Total number of stockholders in this State ....
Amount of stock held in this State..............................

FUNDED DEBT

Description.	Date of Issue	Term of Years	Date of Maturity	Amount Authorized	Amount Outstanding	Interest		
						Rate	When Payable	Accrued During Year
Total								

Per mile of single track owned———— miles { Capital stock outstanding, $———
Funded debt outstanding, $———
Total .... $———

DESCRIPTION OF ROAD AND EQUIPMENT
TRACK

	Owned	Leased	Operated Under Trackage Rights	Total Operated
*Length of road (first main track)......				
Length of second main track				
Total length of main track				
Length of sidings and turnouts				
Total computed as single track				

Note.—If motive power is other than electric (cable, steam, air or animal) state mileage of each separately.

CARS, ETC.

	With Electric Equipment.	Without Electric Equipment	Total Number
Closed pasenger cars...			
Open passenger cars...			
Combination closed and open passenger cars.			
Total passenger cars ...			
Freight cars			
Mail cars			
Express cars			
Baggage cars			
Combination cars			
Work cars			
Snow plows...........			
Sweepers			
Miscellaneous			
Total			

Note.—If motive power is other than electric (cable, steam, air or animal) state number of cars of each separately.

*Length to be stated in miles and decimals of a mile carried to three places.

MILEAGE, TRAFFIC AND MISCELLANEOUS STATISTICS

Passenger car mileage ....
Freight, mail and express car mileage ....
Total car mileage ....
Passenger car hours ....
Freight, mail and express car hours ....
Total car hours ....
Fare passengers carried ....
Transfer passengers carried ....
Total passengers carried ....
Average fare, revenue passengers ....
Average fare, all passengers (including transfer passengers)......
Car earnings per car mile ....
Miscellaneous earnings per car mile ....
Gross earnings per car mile ....
Car earnings per car hour ....
Miscellaneous earnings per car hour ....
Gross earnings per car hour ....
Operating expenses per car mile.
Operating expenses and taxes per car mile.
Operating expenses per car hour.
Operating expenses and taxes per car hour
Operating expenses per cent of gross earnings.
Operating expenses and taxes per cent of gross earnings.
Average number of employees, including officials, during year.
Aggregate amount of salaries and wages paid.

SUMMARY OF ACCIDENTS DURING YEAR

	Killed	Injured	Total
Passengers			
Employees			
Others			
Total			

GENERAL INFORMATION

Historical sketch of organization, construction, leasing and consolidation of lines now operated.
Corporate names and address of company.
Names and addresses of officers and directors.
Date of close of fiscal year.
Date of stockholders' annual meeting.

President H. C. Mackay's Address

Our association has established a reputation of which we may feel proud. In its chosen field it has brought order out of chaos by formulating a "Standard Classification of Construction and Operating Accounts" which has met the requirements of the various interests represented from all parts of this great country, and has stood for several years the test of actual practice without the necessity of amendment, demonstrating the careful thought and study which it received.

The association has adopted a "Standard Unit of Comparison" which has furnished the means of making correct comparisons. This unit, the car hour, will continue to be appreciated more and more as its use becomes more general.

The work of our association has been the means of elevating the standard of the science of street railway accounting until it has become recognized as the corner-stone of success. It has brought into more intimate relations the operating and the accounting departments to their mutual advantage.

With the foresight which has characterized the work of this association generally, it has seen the necessity of securing the co-operation of the National Association of Railway Commissioners, as in a number of States the State boards have authority to prescribe the methods of accounting to be used by electric roads. Without their co-operation, it will be readily seen that, at least in these States, the results would have been to nullify the work of our association, and, without going into the details, of which you are aware, we secured by that honorable body the adoption of the classification of construction and operating expenses and forms of report, due credit being given to our association, and acknowledgment made by it of the value of our work. The States of New York and Connecticut have put this in use, and all electric roads in those States now report to their respective commissioners in accordance therewith.

Your attention has heretofore been directed to the efforts that have been made to secure the enactment of legislation that would place electric railways in the same category as steam roads, and I particularly wish to emphasize the fact that too great importance cannot be attached to the policy of continuing our very cordial relations with the association of railway commissioners. This desirability increases in corresponding ratio with the adoption of our system by each additional State.

Our association has been officially represented at the last three conventions of the National Association of Railway Commissioners, as explained by my predecessor, W. F. Ham, in his annual address to this association. We have been honored by being elected as honorary members of the association with privilege of debate on matters of accounting, and accorded a representation of three delegates at all subsequent conventions, thus placing our association on the same footing as the association of American railway accounting officers.

During the last year the president of the National Association of Railway Commissioners further honored us by the appointment of C. N. Duffy as a member of the committee on "Railroad Statistics," to report at the Charleston convention, Feb. 11, 12 and 13, 1902. In view of the foregoing, your president appointed as the rest of our accorded representation, W. F. Ham, of Washington, D. C., and myself.

Our efforts were directed mainly toward securing through individual members the adoption of our classification in States where reports are required, and towards cementing the many friendships heretofore formed, and we are confident that the seed sown will, in the near future, bring forth fruit.

In accordance with a resolution passed at the San Francisco convention of the National Association of Railway Commissioners,

a committee of three was appointed to prepare a standard form of report for electric roads, and to report at the Charleston convention; this committee to confer with a committee of like number to be appointed by our association.

A meeting of this joint committee was held in New York, Jan. 10, 1902, where the matter received consideration, but, owing to the sickness of the chairman of the commissioners' committee and to the limited time before the convention, it was decided that a complete statistical report could not be got out which would reflect credit on the committee, and it was decided to suggest to the convention that the matter go over for another year. I regret that none of the commissioners' committee was present at the convention, no report being submitted, nor action taken in the matter.

Your president is pleased to report, however, that he has received the assurance from B. F. Chadbourne, the president of that association, of his hearty co-operation in this matter and of the reappointment of the same committee, to confer with a like committee from our association, in order to present a report at their next convention, to be held in July, 1903, further assuring me that the report would receive careful consideration by that association. In accordance therewith, W. F. Ham, Elmer M. White and C. N. Duffy were reappointed as the committee who will present to this body the reports of their labor. A meeting of this committee was held at Atlantic City, N. J., May 22, 23 and 24, 1902, when the subject was given the same careful scrutiny that always marks the work of the gentlemen of which this committee is composed, and, doubtless, their efforts will be acceptable to both associations. In this connection, the committee reports that they had the assistance of our Mr. Tingley, of Philadelphia, and Mr. Judson, the accountant of the New York State Board, which is very gratifying, inasmuch as it shows the mutual feeling of interest in this work.

In view of the financial difficulties, receiverships, etc., that have befallen some of the street railway interests during the last few years (which, in my judgment, have occurred by reason of erroneous methods of accounting), it was my first intention to have a paper prepared and presented to this convention on "Correct Accounting Methods for Electric Railways," being a treatise on the broad, underlying principles of accounting, including depreciation, injuries and damages, sinking fund, etc., with the object of instilling into the minds of those who have the guidance or direction of street railway affairs the vital necessity of making adequate provision for depreciation.

To secure an expression of opinion on this subject, a circular letter was mailed to about one hundred of the different street railways of this country, asking whether the subject would be of interest to them. The replies were practically unanimous in favor of it, but one of the replies received stated that, while of great interest, it was, in their opinion, going beyond the jurisdiction of our association to discuss matters of policy, and, as we are but the representatives of the members (the companies being the members), some of us not even being officers of the companies we represent, it might be presumptuous to vote on such questions. Nevertheless, as accountants, we are expected to furnish true accounts and true methods of accounting, which should recognize all the provisions mentioned. In deference to this minority, we have refrained from bringing it before the convention for discussion, but I cannot permit the opportunity to pass without expressing my personal views upon this subject, and without in the slightest depreciating the work of our association, will say that we have devoted a great deal of time to matters pertaining to fine accounting, with scarcely a moment's discussion of one of the very foundation stones of this whole structure.

As an illustration of the manner in which roads have been recapitalized over and over again, by reason of the failure to apply correct accounting methods, it is but necessary to refer to the article read before the last convention by Col T. S. Williams, vice-president of the Brooklyn Rapid Transit Company, whereby the methods of the Third Avenue Railroad Company were explained.

Before true costs and profits can be shown, there must be created out of operating, or, as a deduction from income, a sum sufficient to equalize all depreciation which has occurred during that period.

Only recently, your president was informed by the general manager of a large system that with them there was no such thing as depreciation; that as far as physical property was concerned, it was repaired or renewed as worn out, and the expense charged to operation.

The fallacy of this line of argument is to my mind so apparent that I need only say that, if the same policy were continued to the expiration of the franchise, and the company obliged to cease operations, there would be a depreciation ranging from practically nothing on the portions that had just been renewed, to almost total value on the portions which were to be renewed within the near future had the company continued to operate.

Not only this, but the method of charging heavy reconstruction charges into operation is destructive of all comparisons. This provision for depreciation must not be considered as covering ordinary maintenance or repairs which must be charged to operating expenses, but applies when the property can no longer with economy be repaired, and must be renewed or replaced. As an illustration, we will assume the life of a track to be fifteen years. A company constructs 5 miles the first year and a corresponding mileage each succeeding year for the next fourteen years. Now, at the beginning of the sixteenth year, with a total track mileage of 75 miles, it becomes necessary to replace the 5 miles built the first year in order to retain the original track. This expense, amounting to one-fifteenth of the total track construction, has no place in a property account, as it is simply a renewal of what has been already charged to the property, but must be included in operation unless provision has been made for a depreciation reserve, as before mentioned. Bear in mind that, for charging against income monthly a sum sufficient to cover this depreciation, you are distributing this expense over the period during which the depreciation is going on. It is necessary that provision be made, not only for such depreciation, but reserve funds must be created to preserve the capital intact from loss, which may at any moment be sustained through serious accidents, etc. There are unsettled suits and claims for damages always hanging over every company which has been in operation for any length of time, and this contingent liability should appear on the books and be anticipated by proper charges against operation, thus creating an injuries and damages reserve fund, and a like provision should be made to cover uninsured fire losses.

Sinking funds should be created to retire outstanding bonds at maturity, and to guarantee the return of original investment to the stockholders, this being particularly applicable to all systems operating under limited franchises.

These funds should not be mere bookkeeping accounts, but should consist of interest-bearing securities held in trust for the particular purpose, and not assignable to any other use.

To my mind, one of the strongest arguments that can be used to refute the statements of agitators for municipal ownership is public accounting and statements of true costs and profits, which would have the effect of strengthening our securities.

Individually, if not as an association, we can and should use our influence in this direction, and I consider we would not be performing our duty, were we, realizing the danger, to permit without protest the continuation of erroneous methods simply on the theory that it involved a question of policy, and that the directors were responsible for that. The directors, without doubt, feel that the head of the accounting department will give them the benefit of his experience and show them the ultimate results of any line of policy affected by accounting methods.

True, in case an organization is being conducted with the desire on the part of the directors of making a flattering showing in order to unload their securities at a handsome profit, the accounting officer offering such a suggestion would have only labor for his pains, but I am optimistic enough to believe that these are exceptions; that the great majority are laboring to secure fair returns upon a permanent investment, and are desirous of having only correct accounting methods used.

We have the same able committee on "Standard Blanks and Accounting for Material and Supplies," which is prepared to submit a report of its deliberations, which we trust will bring out a full and complete discussion, and harmonize the many conflicting ideas relative to this very important branch of our work.

I desire to thank the gentlemen who have so readily responded to my request to prepare and present to this body the various papers and matters for their information, and the members of the various committees who have given their time and study, and to our worthy and efficient secretary, to whom we are indebted for the printed copies of these articles having been placed at our disposal in time for careful study before the convention. I trust this policy will hereafter be readily followed, as it permits of much more complete discussion. The necessity of having copy in hands of the secretary not later than Aug. 15 is respectfully urged upon members contributing papers or reports, in order that the minimum expense and labor be incurred. In accordance with the authority granted by the last executive committee, your president has approved for payment vouchers covering the traveling expenses of members of committees, there being no reason why expenses incurred wholly on account and for the association's benefit should be borne by the individuals, in view of the financial condition of our association.

Your attention is respectfully called to the desirability of hereafter incorporating in the annual report of our convention the "Classification of Accounts and Forms of Annual and Monthly Reports." This can be added to and kept up with very little labor and expense, forms for same being locked up and set aside

by the printer for the use of each succeeding report. The advantage of this is that, by referring to the last report, it will be possible to get the complete and corrected classifications, etc., without the necessity of reading through the several reports to ascertain what action was taken upon any given subject. Any amendments or changes would thus be readily seen by a comparison with the previous report. The necessity of a standard classification of construction and operating accounts covering the lighting business is becoming apparent, by reason of the increasing number of electric railway companies that are absorbing lighting systems. The accounts covering the operation and maintenance of a railway power plant apply with equal force to a lighting plant, and with slight modifications, the general expense accounts are likewise applicable, thus leaving only the cost of distribution to be provided for. These few accounts could be added to our present classification.

The lack of "Standard Classification of Lighting Accounts" was very forcibly brought to mind by the receipt of a letter from T. C. Martin, expert special agent of the electrical division for the twelfth United States census, in which he stated that blanks of inquiry were being prepared for statistical information covering the street railway industry of the United States, and that these blanks were to follow very closely the classification of accounts as prescribed by our association, as far as the railway features are concerned, but, inasmuch as the statistics of the lighting industry were likewise being compiled, it was necessary to have similar detailed statements of earnings, expenses, etc., for that department. It is to be regretted that we were not prepared to submit a classification for their guidance, the importance of which is very manifest.

During the last year the secretary has had printed and distributed to all members the verbatim report of the organization meeting, thus completing the history of this association from its inception to the present meeting. I think we will all appreciate the value of this work, which has been got out with the usual good taste displayed by Mr. Brockway.

It is gratifying to be able to report that our finances are in very good shape, and while we continue to lose some of our old members through consolidations, the interest in the association's welfare has brought in new members, more than enough to offset its losses. Persistent and aggressive solicitation by individual members, as well as by the association officials, is necessary to maintain our average increase in membership. Our secretary has sent circulars, and otherwise made especial efforts to reach the street railways of this country who are not on our membership list, and particularly those who are members of the American Street Railway Association.

We trust the reputation we have established of promptly and systematically threshing out the wheat from the chaff, throwing out the obsolete methods and agreeing upon those which will increase the efficiency of our departments, and, at the same time the usefulness of this association, will be maintained. Let me remind you that we each and all owe to the association and to the companies we represent prompt and faithful attendance at all meetings.

Report of Committee on the Standard System of Street Railway Accounting

BY C. N. DUFFY, W. F. HAM, J. F. CALDERWOOD, H. L. WILSON AND W. G. McDOLE

Your committee on a standard system of street railway accounting beg leave to submit the following report:

We recommend that the classification of construction and equipment accounts remain unchanged, unless the convention directs otherwise.

We recommend the following changes in the classification of operating expense accounts:

Account No. 19, to read "Wages of Miscellaneous Car Service Employees," instead of "Wages of Other Car Service Employees."

Account No. 22a, "Hired Equipment." The insertion of this account to cover rental of cars, electric equipment of cars and other equipment.

Account No. 29, to read "Stores Expenses," instead of "Store Room Expenses."

Account No. 35, to read "Miscellaneous Legal Expenses," instead of "Other Legal Expenses."

A suggestion was made to substitute the title "Supplies Expense" in place of "Store Room Expenses," but was not approved. The titles as recommended were adopted.

Report of W. B. Brockway, Secretary and Treasurer

I beg to present the following as the report of this office for the year just ended:

RECORD OF MEMBERSHIP

Organization Members	25	
1897	12	
1898	32	
1899	34	
1900	21	
1901	25	
1902	19	
Total		168

WITHDRAWN

1897	1	
1898	0	
1899	2	
1900 (caused principally by consolidations)	25	
1901 " " "	11	
1902 " " "	7	
Total		46
		122

NEW COMPANIES

People's Tramway Company	Putnam, Conn.
Muscatine Electric Railway	Muscatine, Ia.
Providence & Danielson Railway	Providence, R. I.
Richmond Passenger & Power Company	Richmond, Va.
Jacksonville Street Railway Company	Jacksonville, Fla.
Railways & Light Company of America	Baltimore, Md.
Compania Ltd. de Tranvias Electricio de Mexico	City of Mexico
Citizens' Traction Company	Oil City, Pa.
Natchez Electric Railway, Light & Power Company	Natchez, Miss.
Cincinnati, Dayton & Toledo Traction Company	Hamilton, Ohio
Austin Electric Railway Company	Austin, Texas
Springfield & Eastern Railway	Palmer, Mass.
Albany & Hudson Railway & Power Company	Albany, N. Y.
Rhode Island Company	Providence, R. I.
Portland Railroad	Portland, Me.
Springfield & Xenia Traction Company	Springfield, Ohio
Trans-St. Mary's Traction Company	Sault Ste. Marie, Mich.
Jackson Electric Railway, Light & Power Company	Jackson, Miss.
Newton Street Railway	Newtonville, Mass.

COMPANIES RESIGNED

Toledo, Bowling Green & Fremont Railway Co.	Toledo, Ohio
Wilmington City Railway Company	Wilmington, Del.
United Traction Company	Pittsburgh, Pa.
City Electric Railway	Port Huron, Mich.
Norfolk Railway & Light Company	Norfolk, Va.
Bridgeport Traction Company	Bridgeport, Conn.
Southern Traction Company	Pittsburgh, Pa.

FINANCIAL TRANSACTIONS

Balance on hand, Oct. 1, 1901		$1,583.68
Received, applications	$380.00	
Received, dues for 1902	1,740.00	
Dues for 1901	20.00	
Interest on deposits	24.22	
		$2,164.22
Total		$3,747.90

DISBURSEMENTS

Salary secretary	$500.00	
Committee traveling expenses	374.63	
Printing two reports, etc.	710.95	
Stenographer 1901 convention	110.00	
Expenses 1901 convention	60.37	
Expenses secretary's office	273.07	
Advance expenses Detroit convention	62.50	
Miscellaneous	6.45	
		$2,106.97
Cash on hand:		
Home Savings Bank, Toledo, Ohio	$1,027.08	
Van Norden Trust Company, New York	613.85	
		1,640.93
Total		$3,747.90

In addition to the usual routine work of the year, there has been published and furnished to the members the verbatim report of the meeting held in Cleveland, Ohio, March 23 and 24, 1897, at which this association was organized. As explained in its preface, this was published to supply the demand caused by its not having been printed in a form to correspond with the regular annual report.

During the months of August and September the work of the office has been carried on under great disadvantages, caused by the removal of the secretary from New Orleans to New York.

CORRESPONDENCE

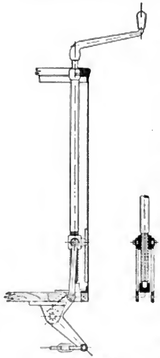
The Screw Brake Lever

NEW YORK, Oct. 12, 1902.

EDITORS STREET RAILWAY JOURNAL:

Gentlemen:—I notice in the paper on "Street Railway Brakes," read at the meeting of the International Tramways Union, in London, by Mr. Peiser, chief engineer of the Hamburg Street Railway Company, that reference is made to the "screw brake." As this brake is not used in this country I would esteem it a favor if you will give me some information about it.

JOHN WILLIAMS.



THE SCREW BRAKE

[Answer].—The screw brake is used on a few of the European cars, and has also been tried in this country. The principal trouble found with the brake has been, we believe, that it is very slow to apply. The brake staff, as shown in the accompanying illustration, is of the usual type, but the lower part of it is provided with a thread and the lower end itself revolves in a socket. A nut runs upon the thread, and by means of two links and a bell-crank lever the revolution of the staff draws up or releases the brake chain. Of course it is possible to arrange the pitch of the thread so as to get practically any amount of leverage on the brake chain, but a thread with a low pitch, which will give a good leverage, will also give a very slow movement to the nut, and this has been found to be the principal trouble in practical operation with the brake.—[EDS.]

Railroad Brake-Shoes

Boston, Sept. 28, 1902.

EDITORS STREET RAILWAY JOURNAL:

The recent street railway accident at Pittsfield commands the attention of the whole country, because the life of the President was endangered. In the discussion of this, and of the many accidents which occur on the electric street railways every year, it is often urged in the press that the means used for stopping the cars in an emergency are insufficient, and power brakes are demanded. In this demand the vital point is overlooked. Power brakes and all other kinds of brakes are mechanical devices to wholly or in part force the brake-shoe against the tread of the revolving wheel to retard and stop them by the friction which results. Obviously the material of which the brake-shoe is made and the sort of contact it has upon the polished chilled thread of the car wheel are of the utmost importance.

Brake-shoes made of chilled iron throughout have been used in the West, but the evidence of several serious disasters goes to show that a chilled brake-shoe on a chilled wheel, with both worn smooth and with the most rigid contact, does not produce the friction which a soft iron shoe produces and therefore does not stop the car so quickly. It may wear longer than a softer shoe, but will not do its work so well. Brake-shoes which are three-quarters or one-half chilled are questionable also.

The Master Car Builders' standard is understood to be a soft gray iron shoe, as distinguished from a hard gray iron shoe, for although the latter may give more mileage, i. e., wear longer under equal conditions, the former has been found to give the better results. There are also special shoes made expressly for the purpose of securing better braking results by means of greater friction on the wheel, requiring less power to set the brakes.

Should not this part of the subject be considered and discussed and should not the railroad commissioners cause a thorough and comprehensive test to be made of all the types of brake-shoes used on the street railways and steam railroads of this State?

W. W. WHITCOMB.

Death of Prof. Sidney H. Short

A cablegram from London, dated Oct. 22, announces the death in that city from appendicitis, of Professor Sidney H. Short, technical director of Dick, Kerr & Co.

Professor Short was one of the pioneers of the electric railway business, and until his departure from this country had been prominently and continuously identified with the development of the electric railways of America. He was born in Columbus, Ohio, in 1857, and was graduated from the Ohio State University in 1880. While in college he invented and patented a long-distance telephone transmitter and an improved arc lamp. After graduation he was appointed professor of physics and chemistry in Denver University, and while in that city built, in 1885, his first electric railway, which was a conduit line. In 1887 he returned to Columbus and built a 2½-mile electric railway in that city. He built another line in St. Louis in 1888, and in 1889 removed to Cleveland, where he organized the Short Electric Railway Company, which soon took a prominent place as a manufacturer of electric railway apparatus. After the absorption of this company by the General Electric Company Mr. Short took a short rest, but was soon invited to engage in his chosen field by the Walker Manufacturing Company, which up to that time had been a large manufacturer of cable machinery. The managers of this company decided to engage in the manufacture of electrical apparatus, and selected Professor Short as its vice-president and electrical engineer. Walker motors and generators were soon placed upon the market and achieved a high reputation for excellence of design and construction. While connected with this company Professor Short paid special attention to the problems of heavy electric railroading, and developed an 80-hp motor for electric railway work, which was adopted on the Brooklyn Elevated Railway, and a 150-hp motor, which was put in service on the Metropolitan West Side Flevated Railway, of Chicago. While connected with the Walker Company Mr. Short also developed a pneumatic system of multiple unit control.

In 1898 the control of the Walker Company was secured by one of the other large manufacturing companies, and early in 1899 Professor Short sailed for London, where he accepted the position of technical director of the English Electric Manufacturing Company, a corporation which had recently been organized by British capitalists associated with Dick, Kerr & Co., to build electrical apparatus of all kinds, but particularly for street railway service.

Under the direction of Professor Short very large works were erected by the English Electric Manufacturing Company at Preston, England, and the work of manufacture was immediately commenced. The success of the enterprise was immediate from the start, and orders were received not only from many of the large tramway companies in Great Britain but also from British colonies in the East and from a number of continental countries. Professor Short's record in England as an electrical inventor and manufacturer was equally as successful as that in America, and at the request of a number of scientific bodies he has presented papers before them on various technical subjects connected with the design of electrical apparatus. In spite of his residence abroad he never gave up his American citizenship, and with his wife made several trips to this country, the last one being on the occasion of the convention of the American Street Railway Association in New York in 1901, where he renewed his acquaintance with many of his former friends.

As an inventor Professor Short's record stands extremely high, and has been marked by a remarkable progressiveness, as he has kept in touch with the latest developments in electric railroading, and has made improvements and inventions in advance of the art. Personally, he was an extremely agreeable companion, and had a very wide circle of friends. Professor Short leaves a wife, three sons and one daughter. His eldest son is now taking the engineering course at Cornell University.

Plan to Arbitrate Hudson Valley Strike Fails

The proposition submitted by Addison B. Colvin, president of the Hudson Valley Railway, and agreed to by the company and the striking motormen and conductors on Oct. 20, has suddenly and unexpectedly failed of its peaceful object. The proposition was that the differences existing between the company and the strikers were to be settled by a board of arbitrators, each side to name an arbitrator, and these two to select a third if necessary to avoid a deadlock. The company appointed B. S. Josselyn, general manager of the company, and the strikers selected James

M. Sheehan, of the Albany division of the Amalgamated Association of Street Railway Employees.

At the first session, held at Glens Falls on Oct. 21, Mr. Josselyn held that the company should have the right to reinstate such of its ex-employees as it deemed proper, but Mr. Sheehan, it is alleged, resented this claim, and instead of requesting the selection of a third member of the board of arbitration, withdrew from the board, and thus violated the agreement that had been signed between the company and the men. The unaccountable action on the part of the representative of the men has excited severe criticism.

Substantially the full schedule of cars is being run on the several divisions in Saratoga, Warren and Washington Counties, and cars are now operated at night on some sections of the road. There is a slight increase in traffic, but many are deterred from using the cars by reason of the intimidating acts and general boycott pursued by strike sympathizers.

Topics of the Week

A peculiar case came before a Massachusetts judge a few days ago, when one of the cars of the Brockton & Plymouth Street Railway was held up in Plymouth by a resident, who was owed $2.50 by the car conductor. The car was held for from five to seven minutes by the defendant's team, which purposely blocked the track until the conductor paid his personal bill. A fine of $10 was imposed by the judge, with the admonition that private bills must not be collected at the public's expense.

The right of way man for an electric railway that is to extend through a rural district took up residence in one of the small towns through which the road is to pass, and in order to "feel the opinion of the community" became a frequenter of the village store. Of course, the electric railway was discussed by the villagers, and frequent arguments as to the benefits to be derived through the construction of the road resulted. But of all who discussed the line one old fellow, a man who sees the tendency of the times, was always found to be the champion of the electric railway. One day, when the discussion began to warm up, the old man declared, after dwelling at great length on the desirability of granting a location, that he would be willing to give $1,000 to have the road run near his place, so sure was he of the advantages that would accrue through its operation. Now, the right-of-way man was within earshot, and, convinced that the time to act had come, he in due time gently broached the subject to the old fellow, seeing in the magnanimity of the latter a door that would open to a flood of grants from others. But now the vision of the old fellow, down from his seat on the sugar barrel in the far corner of the store, was quite different, for he demanded $2,000 for the right to pass his property.

Street Railway Patents

UNITED STATES PATENTS ISSUED OCT. 14, 1902

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

710,941. Street Car Fender; R. A. Boettler, Cleveland, Ohio. App. filed June 21, 1902. A tripping mechanism for changing the elevation of the scoop.

711,022. Trolley for Electric Railways; C. E. Thomas, Springfield, and J. M. Olinger, Vienna Cross Roads, Ohio. App. filed July 21, 1902. The harp is connected with the end of the pole by a latch, so that it can be readily removed therefrom.

711,036. Circuit Closer for Trolley Signals; W. M. Chapman, Newton, Mass. App. filed March 9, 1901. A box-like frame supported above the trolley wire and containing a switch, which is operated by a lever projecting from the box in a position to be struck by the trolley wheel.

711,051. Car-Step; T. Kendrick, Glenwood Springs, Col. App. filed April 21, 1902. Details.

711,084. Car Brake; J. Toner, Pittsburgh, Pa. App. filed March 4, 1902. An emergency brake constructed upon the principal of a chock block.

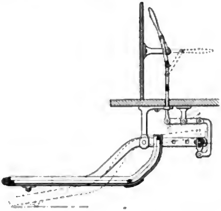
711,107. Electrical Traction System; W. S. Hill, Hyde Park, Mass. App. filed March 31, 1902. The contact-shoe is pressed into engagement with buttons in the roadway by an electric magnet.

711,208. Car Brake; C. M. Haynes, Toledo, Ohio. App. filed Feb. 13, 1902. A brake-shoe presses against the top of a brake disc mounted in movable bearings, and is thus forced into contact with the rail.

711,280. Brake for Street Railway Cars, etc.; H. T. Brown, Wilkinsburg, Pa. App. filed March 28, 1902. A track brake in which the shoe presses against the side of the rail as well as the tread.

711,277. Cement Railroad Tie; W. J. Bell, Newaygo, Mich. App. filed June 21, 1902. A metallic tie embedded in a block of cement.

711,286. Trolley; E. W. Clark, Columbus, Ga. App. filed April 9, 1902. The harp is pivoted to the upper end of the pole and held in place by a latch, which is released when the wheel leaves the wire, allowing the harp to swing downward out of operative position.



PATENT NO. 710,941.

711,292. Electric Railway or Tramway; G. F. Cornwallis-West, London, England. App. filed May 23, 1902. A devitrified glass paving block, having a cavity therein forming a portion of the conduit.

711,320. Switch; A. E. James, Natchez, Miss. App. filed May 16, 1902. The point is held in one of its positions normally by a spring, so that it automatically assumes that position after being moved by the flange of a wheel.

711,428. Trolley Retriever; A. W. Knuton, Galesburg, Ill. App. filed June 4, 1902. A spring drum and pawl and ratchet arrangement for taking up the slack of the cord and pulling down the pole in case it leaves the wire.

PERSONAL MENTION

MR. STUART A. ALLEN has been appointed traffic manager of the Miami & Erie Canal Transportation Company.

MR. ERNST WEINER, manager of Arthur Koppel, of New York, returned last week from an extensive business trip in Europe.

MR. H. L. BAINES has resigned as superintendent of the Mauch Chunk, Lehighton & Slatington Electric Railway Company, of Mauch Chunk, Pa.

MR. EDWARD WAGENHALLS has resigned as general superintendent of the Millcreek Valley Street Railway Company and Hamilton, Glendale & Cincinnati Traction Company, of Cincinnati, Ohio, to become general manager of the New York & Philadelphia Traction Company, of New Brunswick, N. J.

MR. THOMAS FITZGIBBONS has been appointed superintendent of the Bay Cities Consolidated Railway Company, of Bay City, Mich., to succeed Mr. William Luxton, resigned. Mr. Fitzgibbons has been in the employ of the company a number of years, and is well qualified for the position to which he has just been appointed.

DR. LOUIS DUNCAN, director of the department of electrical engineering at the Massachusetts Institute of Technology, gave an informal lecture before the Society of Arts of the Institute in the engineering laboratory, on Clarendon Street, Boston, on the evening of Oct. 9, his subject being the "Long Distance Operation of Electric Railways." Dr. Duncan spoke entertainingly for an hour on various phases of electric railroading which have been brought to his attention recently, notably the Ganz, Arnold and Westinghouse systems. He devoted most of his time to a discussion of the alternating-current road as built in Europe, with an analysis of their principal operating features, advantages and defects.

FINANCIAL INTELLIGENCE

THE MARKETS

WALL STREET, Oct. 22, 1902.

The Money Market

The money market has developed comparative ease during the past week. Call loan rates have ranged between 4 and 6 per cent, with the bulk of the business transacted at about 5 per cent. The premium on time loans has entirely disappeared, and it is no longer difficult to obtain sufficient accommodation for four to six months at 6 per cent. For the shorter dates, however, 6 per cent is still bid, but this is due more to the indisposition of lenders to place contracts for that length of time, rather than to the scarcity of funds. The banks show more inclination to re-enter the market, but at present a large part of the offerings continue to come from trust companies and institutions other than the clearing-house banks. The banks continue to gain cash from the Sub-Treasury, the total gain since Oct. 17 being close on to $13,000,000. This was due largely to the redemption of bonds by the Secretary of the Treasury, and it is expected that the total amount to be released by these transactions will amount to about $23,000,000. In addition to these operations the Treasury Department is anticipating interest on government bonds due on Nov. 1, which will further increase the amount of loanable funds very materially. About the only unfavorable factor in the situation is the increasing strength in the foreign exchange market. Quotations for sterling have risen quite sharply within the past few days, and, according to foreign bankers, rates are now within ¼ per cent of the gold export point, with the tendency still upward. There is, however, considerable difference of opinion as to the prospects of gold exports, and the more conservative are inclined to look upon such transactions as a matter for further consideration. It is argued that should an outflow of gold be inaugurated it would immediately result in a decided hardening of money rates here, which would, in turn, be reflected in a decline in exchange to a point when exports of the yellow metal would be out of the question. The local banks have greatly strengthened their position, the reserve on all accounts showing an increase last week of over $4,080,000. The indications, however, point to a continued firm money market for the balance of the year. Discount rates at the principal European centers continue firm, but the changes from a week ago are not important.

The Stock Market

The liquidation in stocks, which resulted in a severe slump in values on the Stock Exchange, was followed at the close of last week by a resumption of operation by Western speculators for the rise. These operations were accelerated by the final settlement of the coal strike, and by the decision of the Secretary of the Treasury to redeem a round amount of government bonds. The bank statement was unexpectedly good, showing an increase of over $4,000,000 in the reserves. Prices rose on the publication of this statement, but just before the close there was considerable realizing sales in certain issues, which prevented any important advance in other parts of the list. This selling was continued on Monday by people who had bought at the low level, and who evidently thought such a course prudent. For the remainder of the week the market felt the effects of this selling, and the increasing strength in the foreign exchange market, suggesting gold exports, caused some uneasiness. The banks and more conservative interests have felt that it would be unwise to have active speculation at this time, and endeavored to check any unreasonable bull movement. Speculation became dull, and at the close settled down to a purely traders' market.

There was absolutely no news bearing upon the local traction stocks, and the movements in them were unimportant. In Brooklyn Rapid Transit, an inside pool took occasion to mark up the price a trifle, while Manhattan Railway advanced on buying by insiders. There was also talk of a renewal of negotiations with the New York Central people.

Philadelphia

Such moderate trading as there has been in the traction securities in the Philadelphia market during the week has been confined for the most part to Philadelphia Rapid Transit and Union Traction. The former recovered leisurely from 17 to 18, without any particular efforts being noted to bid up the price. Similarly Union Traction, which sold as low as 46¾ a week ago, rallied to 47⅝. Neither of the movements were significant of any special development in the properties, being merely in harmony with the course of the general market. Nothing but odd lots of American Railways and Philadelphia Traction have changed hands, the first-named between 52½ and 53¼, and the latter between 97⅞ and 98¼. Consolidated Traction of New Jersey has been fairly active, at the single price of 69¾. On semi-official intimations that a price of 35 a share had actually been offered for the control of Fairmount Park Transportation, the stock rallied 3 points to 27, but only 100 shares were dealt in. Bond sales for the week comprised Electric—People's Traction 4s at 98¼ and 98½, Union Traction of Indiana 5s at 101, American Railway 5s at 108, Citizen Passenger of Indianapolis 5s at 110½, Indianapolis Railway 4s at 87¼, United Railways 4s at 86½ to 87, and People's Passenger 4s at 105.

Chicago

Transactions in the Chicago tractions have been exceedingly limited, but the tone of the market has been firm during the week. City Railway recovered sharply to 212. Lake Street Elevated, which sold down to 9⅝ the previous week, rose to 10⅜, but later lost part of its gain. Metropolitan continued firm at 40½ and 40¾, and odd lots of the preferred sold between 89 and 90. Northwestern common rose from 34 to 35, but later reacted a fraction. South Side was strong and fairly active at 110. No sales of Union Traction common were reported, and only one sale of the preferred, at 50. It is announced that the Aurora-Wheaton electric line will have its full equipment of fifty cars in operation by Dec. 1, and will then be prepared to furnish an addition of at least 10,000 passengers daily to the Metropolitan Elevated. The increase in Lake Street earnings since the express service was installed is said to be between 10 and 12 per cent. The company is expending $75,000 for improvements, which will provide ample power and heat for the winter months.

Other Traction Securities

Massachusetts Electric responded very quickly to the relief in the general market situation, and there were some indications that the speculative interests in the common stock had resumed active operations again. The quotation was advanced rapidly from 35¾ to 38½, and held most of the gain. The preferred sympathized only slightly, rising from 94¾ to 95. Boston Elevated was stronger, at 156, and sales of the subscription privileges were made freely from 74 to 76½. In Baltimore the week has been a dull one, with a tendency toward recovery. United Railways common rallied from 13¾ to 14¼, the preferred sold 34, the income bonds went up from 67⅜ to 68⅜, and the general 4s sold between 94⅝ and 95. Nashville Railway stock yielded a fraction from 6 to 5⅝, but the 5 per cent certificates held comparatively firm at 75½. Bond sales were less than usual, the only ones reported being Knoxville Traction 5s at 101, and Anacostia & Potomac 5s at 97¼. The week's sales on the New York curb included American Elevated (1200 shares), between 1 and ¾, American Light & Traction at 40½, Camden & Trenton at 4⅜ and 4⅝, New Orleans common from 16 to 17¾, the preferred at 53½, the 4½ per cent bonds from 82 to 84, Brooklyn Rapid Transit new 4s at 87⅝, United Railways of St. Louis 4s at 85⅝, and San Francisco Railways 4s at 91. Last week was one of the quietest on record on the Cleveland Stock Exchange; only about 800 shares of traction stock changed hands. The transactions were all small, coming from small investors who picked up bargains. Prices of nearly all the issues showed slight declines from the week before. Syracuse Rapid Transit sold at 30½, but advanced later to 31¼. Two small lots of Eastern Ohio Traction came out at 28, the lowest on record. Two small lots of Lake Shore Electric sold at 18, and a small lot of Aurora, Elgin & Chicago preferred at 94. Monday the situation improved materially, bids being stronger than in two weeks, on Cincinnati, Dayton & Toledo; Western Ohio, Aurora, Elgin & Chicago and Miami Canal. Aurora, Elgin & Chicago receipts brought 37½ and Lake Shore preferred 57.

Iron and Steel

Interest in the iron market at the moment centers chiefly upon the probable effects of the ending of the coal strike upon the industry. Inasmuch as the furnaces which went out of blast on account of the fuel shortage represented only 2 per cent of the country's entire output, the immediate consequences will not be very great. The main good, if it comes, will be through relieving the present pressure upon the soft coal-carrying railroads, and thus allowing the Western furnaces which are now suffering from inability to get sufficient fuel, to have the supply of coke that they need. Good judges of the situation think that the strike settlement means a check upon the imports of foreign iron, and the gradual raising of domestic production to a level somewhere near

that of domestic consumption. Quotations are nominally unchanged at $21.75 for Bessemer pig, $31.50 for steel billets and $28 for steel rails.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week.

	Closing Bid Oct. 14	Oct. 21
American Railways Company	52	52½
Aurora, Elgin & Chicago	a39½	37
Boston Elevated	154	155⅝
Brooklyn R. T.	62	63
Chicago City	210	212
Chicago Union Tr. (common)	17	18
Chicago Union Tr. (preferred)	59	60
Cleveland Electric	86	86
Columbus (common)	56	56
Columbus (preferred)	106	106
Consolidated Traction of N. J.	69	69½
Consolidated Traction of N. J. 5s	110⅜	110⅜
Detroit United	85	88
Electric People's Traction (Philadelphia) 4s	98½	98¼
Elgin, Aurora & Southern	—	56
Indianapolis Street Railway 4s	87	87
Lake Shore Electric	a18¾	15
Lake Street Elevated	9½	9⅝
Manhattan Railway	133½	134⅝
Massachusetts Elec. Cos. (common)	35	38
Massachusetts Elec. Cos. (preferred)	a96	95
Metropolitan Elevated, Chicago (common)	40	40⅝
Metropolitan Elevated, Chicago	88¼	88½
Metropolitan Street	137¾	139½
New Orleans Railways (common)	15⅝	17
New Orleans Railways (preferred)	53	53½
North American	121	121½
Northern Ohio Traction (common)	64	63¾
Northern Ohio Traction (preferred)	95	92
North Jersey	33¾	33⅞
Northwestern Elevated, Chicago (common)	34	34½
Philadelphia Rapid Transit	16⅞	17⅞
Philadelphia Traction	98¼	98
St. Louis Transit (common)	28	—
South Side Elevated (Chicago)	108	110
Syracuse Rapid Transit	30⅝	a31⅜
Syracuse Rapid Transit (preferred)	76	a78⅞
Third Avenue	127	127
Toledo Railway & Light	32¾	a38
Twin City Minneapolis (common)	115½	120
United Railways, St. Louis (preferred)	—	—
United Railways, St. Louis 4s	86	85⅝
Union Traction (Philadelphia)	46¾	47
Western Ohio Railway	a33½	30

a Asked.

Metals

Quotations for the leading metals are as follows: Copper, 11¾ cents; tin, 25.05 cents; lead, 4⅛ cents, and spelter, 5½ cents.

OAKLAND, CAL.—The gross receipts of the Oakland Transit Company for September, 1902, show an increase of $11,831 over the earnings for September, 1901. For the six months ending Sept. 30, 1902, the gross receipts show an increase of $60,632 over the same period of 1901.

OAKLAND, CAL.—A meeting of the stockholders of the Oakland & San Jose Electric Railroad is to be held Dec. 19 for the purpose of voting on a proposition to issue $3,000,000 bonds. The company was organized by interests identified with the Oakland Transit Company to build an extension of the lines of that company.

NORTHAMPTON, MASS.—The report of the treasurer of the Northampton Street Railway Company, made at the annual meeting of the company, shows the following: Gross receipts, $144,846; gross expenditures, $148,338; deficit, $3,492; passengers carried, 2,846,901; miles of track operated, 26.26; number of employees, 106.

AMHERST, MASS.—The directors of the Amherst & Sunderland Street Railway Company have declared a semi-annual dividend of 2 per cent.

NEW YORK, N. Y.—It is again reported that the Vanderbilt interests are negotiating for control of the Manhattan Elevated Railway.

LINCOLN, NEB.—Minority stockholders say they will apply for the appointment of a receiver for the Lincoln Heat & Power Company, and also demand the Lincoln Traction to produce books in court to show disposition of funds.

WESTFIELD, N. Y.—The Lake Erie Traction Company has obtained consent from the Railroad Commissioners to issue a first mortgage for $400,000 and to increase its capital stock from $126,000 to $500,000. The proceeds from the sale of the additional securities are for the construction and equipment of the road from Westfield, Chautauqua County, to the Pennsylvania State line.

MINEOLA, N. Y.—The Railroad Commissioners have authorized the New York & Long Island Traction Company, the successor of the Mineola, Hempstead & Freeport Traction Company, to increase the amount of its capital stock from $125,000 to $1,000,000, and also to issue a first mortgage for $1,000,000.

NEW YORK, N. Y.—The American Light & Traction Company has declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable Nov. 1.

NEW YORK, N. Y.—Messrs. Haskins & Sells, certified public accountants, have filed with the banking house of Brown Brothers & Company, an analysis of the financial situation of the United Railways Investment Company, of San Francisco, which corporation owns and operates the street railway system of that city. Messrs. Haskins & Sells compiled this table:

	Year Ending Dec. 31, 1901	Six Months Ending June 30, 1902
Gross earnings	$5,125,882.97	*$2,541,996.43
Operating expenses and taxes	3,060,957.71	1,540,587.86
Income from operations	$2,065,925.26	$1,001,408.57
Miscellaneous income	17,230.23	8,579.41
Total net income	$2,083,156.49	$1,009,987.98

*Property completely tied up by strike April 19 to April 26, 1902.

Supplementing the Haskins & Sells exhibit, there is filed a report by Jilson J. Coleman, a street railway expert of standing, who states that his investigation discloses that in January of this year the system was "earning over 29 cents per car mile, and that as 14½ cents per car mile was a high average for expenses of operation, the system could easily operate on a 50 per cent basis." Mr. Coleman adds the estimate that the San Francisco street car system will show an annual increase of earnings of 10 per cent at least, his calculation being that during the current year the system's earnings will reach $5,500,000. And upon the basis of these conclusions by Mr. Coleman and the analysis of Messrs. Haskins & Sells, the following estimate is issued by the Stock Exchange house of Talbot J. Taylor & Company:

	1st Year	2d Year	3d Year
Gross earnings	$5,500,000	$6,050,000	$6,655,000
Expenses of operation and taxes	3,000,000	3,025,000	3,250,000
Income from operation	$2,500,000	$3,025,000	$3,405,000
Fixed charges	1,600,000	1,600,000	1,600,000
	$900,000	$1,425,000	$1,805,000
Five per cent dividend on preferred stock	750,000	750,000	750,000
Surplus	$150,000	$675,000	$1,055,000
Common stock will earn	1⅓%	6¾%	10.55%

BUFFALO, N. Y.—Justice White, in the Special Term of the Supreme Court, has set Nov. 17 as the date of the sale at public auction of the property of the Buffalo, Hamburg & Aurora Railway.

GREENSBORO, N. C.—The Greensboro Electric Company has issued $360,000 of first mortgage 5 per cent gold bonds, dated April 1, 1902, and secured by a mortgage for $400,000, given to the North American Trust Company, as trustee. The bonds are due in thirty years, but are subject to call after five or ten years at 106.

TOLEDO, OHIO.—The Toledo & Indiana Railway has increased its capital stock from $1,000,000 to $2,500,000. The increase is made owing to the enlarged plans of the company.

SPRINGFIELD, OHIO.—It is proposed to increase the capital stock of the Dayton, Springfield & Urbana Railway Company from $750,000 to $1,500,000.

COLUMBUS, OHIO.—The Columbus Railway Company has declared a quarterly dividend of 1¼ per cent on the preferred stock, payable Nov. 1.

COLUMBUS, OHIO.—The Urbana, Bellefontaine & Northern Railway Company, of Springfield, has increased its capital stock $500,000, and has filed a mortgage for $600,000, given to the Continental Trust Company, of New York. The company is building a line from Urbana to Bellefontaine and Kenton.

EASTON, PA.—The Easton & Nazareth Street Railway and the Easton, Tatamy & Bangor Street Railway have consolidated as the Northampton Traction Company.

NASHVILLE, TENN.—By a unanimous vote the committee representing the bondholders of the Nashville Railway Company have decided to accept the offer of 80 per cent tendered by the reorganization committee of the company. This plan of reorganization, which is being financed by Ladenburg, Thalmann & Company, and Isaac Newman & Sons, of New York, contemplates the purchase of the $2,300,000 outstanding bonds at 80 per cent, and the assumption of all debts, contracts and liabilities of the company, except certain counsel fees. Stockholders of the company will be given an opportunity to pass upon the proposition of the reorganization committee. The bondholders' committee is composed of John B. Ramsay, chairman; Frederick M. Colston, William C. Sedden, John N. Steele and R. Lancaster Williams.

SHEBOYGAN, WIS.—It is reported that Eastern capitalists have completed a deal for the purchase of the Sheboygan Light, Power & Railway Company and the Sheboygan, Elkhart Lake Railway & Electric Company.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., Sept. '02	67,492	35,997	31,495	12,907	18,588
	1 " " '01	59,242	31,396	27,846	12,031	15,815
	6 " June '02	318,937	185,362	133,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	16 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,782	*317,475	196,349	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., Sept. '02	132,606	81,990	50,616	23,866	26,750
	6 " " '02	414,635	251,789	162,897	71,598	91,299
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., Aug. '02	23,547	12,324	11,223	......	......
	1 " " '01	21,490	10,886	10,604	......	......
	2 " " '02	46,816	23,522	23,294	......	......
	2 " " '01	43,970	21,688	22,282	......	......
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
	16 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,189	3,915,696	1,862,648	997,206	965,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., Aug. '02	1,226,955	632,087	594,868	......	......
	1 " " '01	1,132,385	684,022	448,364	......	......
	2 " " '02	2,463,355	1,274,192	1,189,163	......	......
	2 " " '01	2,330,942	1,367,635	963,307	......	......
	12 " June '02	12,789,706	*7932214	4,857,490	......	......
	16 " " '01	12,101,198	*7970635	4,130,563	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., June '02	271,345	147,614	123,692	97,048	26,589
	1 " " '01	409,206	192,265	216,941	94,098	122,842
	1 " " '00	218,739	106,174	112,565	65,348	47,217
	3 " " '02	786,280	436,915	349,366	289,068	60,303
	3 " " '01	932,702	465,809	466,894	272,804	194,090
	3 " " '00	631,371	333,927	297,444	221,844	75,601
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., Aug. '02	45,217	31,191	14,026	13,357	669
	1 " " '01	45,474	28,296	17,178	13,697	3,481
	6 " " '02	356,984	200,200	155,784	81,064	74,720
	6 " " '01	246,438	163,145	83,293	82,616	674
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Sept. '02	19,347	6,988	12,359	......	......
	1 " " '01	19,197	6,548	12,649	......	......
	6 " " '02	147,407	59,847	87,560	......	......
	9 " " '01	132,159	56,118	76,041	......	......
CLEVELAND, O. Eastern Ohio Traction Co.	1 m., Sept. '02	21,375	10,808	10,567	6,033	4,538
	1 " " '01	17,761	8,413	9,348	5,129	4,226
Cleveland, Elyria & Western	1 m., Sept. '02	30,464	14,999	15,464	......	......
	1 " " '01	27,430	12,347	15,083	......	......
	9 " " '02	219,968	122,051	97,019	......	......
	9 " " '01	185,992	100,787	85,206	......	......
	16 " Dec. '01	249,260	136,866	112,394	57,023	55,371
	12 " " '00	179,699	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Sept. '02	18,499	10,088	8,404	......	......
	1 " " '01	18,824	9,649	9,174	......	......
	9 " " '02	144,464	76,966	67,499	......	......
	9 " " '01	124,184	63,243	60,941	......	......
	16 " Dec. '01	164,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*69,592	71,520	72,500	† 980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.	1 m., Aug. '02	96,119	*53,295	42,823	22,238	20,585
	1 " " '01	74,525	*45,741	28,784	15,807	12,977
	8 " " '02	596,156	*344,026	252,190	131,230	120,899
	8 " " '01	535,784	*327,615	208,169	125,328	82,841
DENVER, COL. Denver City Tramway Co.	1 m., Apl. '02	124,516	66,553	57,963	32,865	26,119
	1 " " '01	116,357	62,866	53,490	31,304	22,186
	4 " " '02	491,348	261,118	230,230	131,259	88,972
	4 " " '01	435,297	236,915	198,382	126,622	72,750
	12 " Dec. '01	1,507,286	618,321	888,965	383,180	505,785
	12 " " '00	1,302,390	722,458	579,890	374,391	205,548
DETROIT, MICH. Detroit United Ry.	1 m., July '02	295,896	152,948	143,060	......	......
	1 " " '01	302,988	149,812	153,176	......	......
	6 " June '02	1,600,075	*907,044	693,631	395,739	297,892
	6 " " '01	1,384,161	*775,347	608,834	345,119	263,715
	12 " Dec. '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439068	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line	1 m., July '02	44,699	25,687	19,016	......	......
	1 " " '01	43,759	19,471	24,249	......	......
	7 " " '02	229,171	139,580	90,569	......	......
	7 " " '01	213,738	126,170	87,558	......	......
DULUTH, MINN. Duluth-Superior Tr.	1 m., Aug. '02	51,437	26,506	24,932	6,671	15,260
	1 " " '01	41,768	19,890	21,873	*9,204	12,669
	8 " " '02	349,496	183,206	166,342	177,900	88,338
	8 " " '01	296,085	161,610	134,475	73,188	61,287
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., Sept. '02	37,806	20,273	17,533	8,333	9,200
	1 " " '01	34,169	17,089	17,080	8,333	8,747
	6 " " '02	308,241	179,124	129,117	75,000	54,117
	9 " " '01	275,564	153,324	122,240	75,000	47,240
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., Aug. '02	24,340	12,033	12,307	......	......
	1 " " '01	16,849	9,025	7,824	......	......
	6 " June '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O. The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Sept. '02	44,090	23,050	21,040	16,251	4,789
	4 " " '02	184,504	91,206	93,296	65,241	28,055
LONDON, ONT. London St. Ry. Co.	1 m., Aug. '02	16,102	9,699	6,403	2,270	4,132
	1 " " '01	16,260	9,347	6,613	1,595	5,019
	8 " " '02	97,504	62,164	35,340	18,174	17,166
	8 " " '01	91,676	58,064	33,611	15,971	17,641
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Sept. '02	259,501	110,736	148,854	70,591	78,263
	1 " " '01	210,632	93,587	117,045	63,998	53,047
	9 " " '02	2,014,941	946,509	1,068,432	596,811	471,621
	9 " " '01	1,785,247	878,339	906,908	561,402	345,507
	16 " Dec. '01	2,442,342	1,185,534	1,256,808	755,189	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	824,665	266,247
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Aug. '02	323,534	167,969	155,565	60,283	125,281
	1 " " '01	283,589	122,035	161,554	57,850	108,704
	6 " " '02	2,347,426	1,080,709	1,266,716	470,500	796,216
	6 " " '01	2,081,771	945,715	1,086,056	445,398	640,657
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., July '02	198,056	93,996	104,660	16,929	84,780
	1 " " '01	178,180	90,464	87,716	14,142	73,573
	10 " " '02	1,643,837	940,860	702,977	164,228	539,748
	10 " " '01	1,583,206	981,932	601,272	104,409	496,863
NEW YORK CITY. Manhattan Ry. Co.	12 m., June '02	11,291,711	5,518,585	5,773,126	2,699,670	3,073,456
	12 " " '01	10,258,271	5,258,229	5,000,042	2,677,706	2,322,336
Metropolitan St. Ry.	6 m., Dec. '01	3,887,936	1,739,972	2,148,964	1,151,140	992,824
	6 " " '00	3,788,030	1,690,649	2,098,381	1,138,467	947,914
	12 " June '02	16,806,641	7,345,883	8,460,758	4,815,421	3,665,337
	12 " " '01	14,720,767	6,755,131	7,965,636	4,584,069	3,481,567
OLEAN, N. Y. Olean St. Ry. Co.	1 m., July '02	6,569	3,216	3,353	1,771	1,582
	1 " " '01	6,954	2,207	6,747	1,768	1,979
	12 m., June '02	56,065	29,118	26,987	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,085
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co	1 m., July '02	9,387	5,290	4,097	2,083	6,013
	16 " June '02	86,796	*56,392	30,402	23,125	7,277
PHILADELPHIA, PA. Union Traction Co.	12 m., June '02	14,118,159	6,402,338	7,715,820	*6637781	1,078,088
	12 " " '01	13,431,681	5,836,186	7,595,494	*6734328	861,266
American Railways	1 m., Sept. '02	125,159	......	......	......	......
	1 " " '01	91,152	......	......	......	......
	3 " " '02	245,455	......	......	......	......
	3 " " '01	180,911	......	......	......	......
	12 " June '02	1,009,549	......	......	......	......
	12 " " '01	841,298	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., Sept. '02	93,762	46,063	47,699	24,833	22,866
	1 " " '01	82,428	45,854	36,578	24,942	11,632
	9 " " '02	821,852	423,691	398,161	223,361	164,800
	9 " " '01	756,110	449,258	308,858	222,018	86,840
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., Aug. '02	60,580	33,314	27,266	19,085	8,261
	1 " " '01	54,948	30,214	24,729	19,025	5,704
	2 " " '02	123,131	67,670	65,471	38,050	17,421
	2 " " '01	114,376	61,834	52,542	37,996	14,546
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., Sept. '02	127,640	62,001	65,638	38,921	26,717
	1 " " '01	114,667	50,512	64,156	37,813	26,343
	9 " " '02	1,069,059	546,589	522,470	342,709	179,762
	9 " " '01	959,099	460,885	498,214	301,730	196,484
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,182,317	*616,946	565,572	409,061	156,510
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	26,961	22,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,270	133,288	53,987	......	......
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	6 m., June '02	56,635	35,622	21,013	25,000	† 3,986
	6 " " '01	56,986	35,600	22,386	25,000	† 2,666
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co.	1 m., Aug. '02	38,090	*20,450	18,540	......	......
	6 " " '02	276,403	*154,479	121,924	......	......

Street Railway Journal

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THE STREET RAILWAY SYSTEM OF ZURICH

The city of Zurich, which is popularly known as "the city of gardens," occupies a somewhat unique position among the cities of Switzerland from the fact that it is not only a popular tourist resort, but is also the chief city in a large industrial region. The canton of Zurich is in the northeastern part of Switzerland, not far from the border line of Germany. The city itself lies between two chains of mountains, at the foot of the Lake of Zurich, and is intersected by the Limmat River, which rises in the Lake of Zurich and falls into the Aar at Brugg, some distance below the city. Across this river, as well as across the Sihl, which also flows through the city, the municipality has constructed a number of bridges, one of which is shown in the illustration on this page. These, with the handsome quays which line the lake and river fronts, add greatly to the picturesque and substantial appearance of the city. In the immediate neighborhood of Zurich are the large manufacturing towns of Oerlikon and Baden, both prominent for their electrical products; Winterthur, famous for its engines, as well as Egiisau, Wädenschwyl and other cities noted for their manufactories of cotton and silk. The commerce derived from the fact that the city is the capital of the canton containing these industrial centers, its attractive location and therapeutic establishments, as well as its proximity to most of the popular tourist resorts in Switzerland, have made the city a prosperous one, and attract to it annually a large number of visitors.

VIEW OF QUAY ALONG THE LIMMAT RIVER, ZURICH

The layout of the city is an excellent one from a street railway standpoint, as will be seen from the map, Fig. 1. Roughly speaking, the city forms a V around the foot of the Lake of Zurich, the shores of which are comparatively flat for a short distance back from the lake, when they rise abruptly in a series of hills which are surmounted by the better class of residences and the health resorts. Directly in the rear of these hills are ranges of mountains, the summits of several of which have been made accessible by inclined cable railways, while to the south lie the snow-capped peaks of the Alps. The streets along the lake and the river banks, as well as the main streets in the city, are broad, easily accommodating two tracks, and are shaded by fine rows of trees. The industrial quarter of the city is east of the lake shore of the city, on a plain, and contains a number of manufacturing establishments which are world-wide in reputation, including the works of Escher, Wyss & Company, while the Oerlikon works to the northwest of the city can be reached by tramway or steam train, by a short ride.

The street railway system in Zurich is owned by the city, which has been taking over the different tramway lines since 1894, and practically the entire system is now controlled by the municipality. A number of new lines have also been built. The system thus acquired was not at all uniform. Some of the lines were operated by horses and others by electricity, while the gages of the horse and electric lines were different. The first thing to be done

was the adoption of a standard gage, and this was decided upon in 1899 when the meter gage, which was that em-

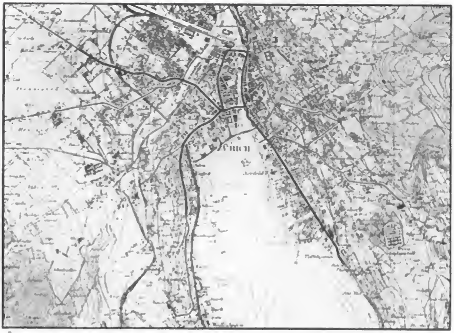


FIG. 1.—MAP OF ZURICH, SHOWING STREET RAILWAY SYSTEM

ployed by the electric lines, was selected for the entire system.

TRACK CONSTRUCTION

The minimum radius of curves in the streets is 18 m (59 ft.), while in the car houses there are some curves with a radius of 15 m (49 ft.). The steepest grade in the system is 2.5 per cent for a distance of 280 m (918 ft.).

With the exception of a few very short distances, such as at crossings with steam railroads, double track is used throughout. The distance between the centers of the two tracks is 2.5 m (8.2 ft.), and as each car is 2 m (6.6 ft.) broad, the distance between two cars, side by side on the two tracks, is 0.5 m (1.6 ft.). Some quite complicated pieces of special work have been installed, as will be seen from the views given of the layouts in Bellevue Place and Parade Place, Figs. 2 and 3.

Especial care was given to obtaining a strong and substantial roadbed construction. As it was impossible to install a uniform system of substruction throughout, a number of different systems were employed, and are clearly shown in Figs. 4 and 5. From these the reader can see at a glance the different types of construction employed, as well as the length of track for which each is in use.

In general, it might be said that there are five systems of sub-construction, viz.:

(1) Concrete sub-construction with wood paving.

(2) Concrete sub-construction with asphalt paving.

(3) Concrete sub-construction with macadam paving.

(4) Broken stone sub-construction with macadam paving.

(5) Tracks laid on the ordinary sub-construction of macadam paving.

Asphalt pavement was used only in the important streets and only where the grades were less than 1.5 per cent. For asphalt-paved streets concrete sub-construction was used, as well as for the streets on which it was thought asphalt will be laid in the future. For other streets where concrete had been used before and was in good condition it was left undisturbed.

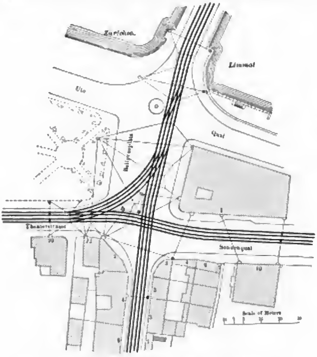


FIG. 2.—SPECIAL WORK AND OVERHEAD WIRING AT BELLEVUEPLATZ

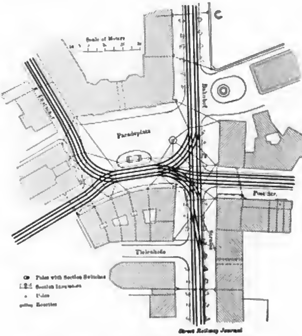
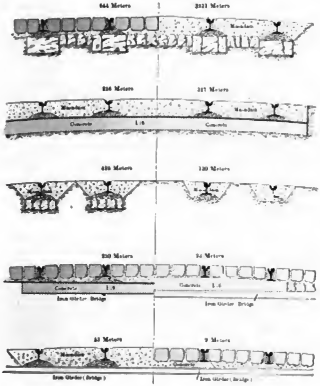


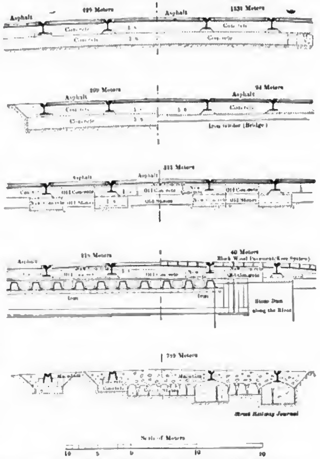
FIG. 3.—SPECIAL WORK AND OVERHEAD WIRING AT PARADEPLATZ

Before the streets were paved, the other municipal departments which were interested in sub-pavement work, such as the gas, water and telephone departments, were requested to make all the necessary repairs and new installa-

tions to their pipes, so that it is hoped that it will be unnecessary to open up the streets for work of this kind for quite a while to come. In order to be able easily to determine points where gas mains are damaged in asphalted streets, little tubes are provided at regular distances of about 50 m (164 ft.) for smelling the gas.

As shown in Fig. 6, arrangements are provided to drain the grooves in the rails. At distances of 100 to 200 m (328 ft. to 656 ft.), according to the grades, slots 120 m





FIGS. 4 AND 5.—CROSS SECTIONS OF DIFFERENT TYPES OF TRACK CONSTRUCTION USED ON ELECTRIC LINES IN ZURICH

(about 5 ins.) in length are cut in the bottom of the groove; the water flowing in the grooves runs down through these slots into a basin where any sand is allowed to settle; the water then flows to the sewer.

The section of rail used is illustrated in Fig. 7. It is a modification of the ordinary Phœnix rail, the changes in which were designed by the engineer of the tramway system, Mr. Schenker, and is called No. 18 C by the Phœnix Company. It is used on the system throughout, with the

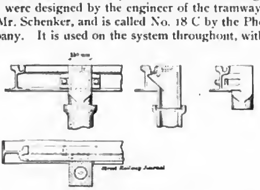


FIG. 6.—DRAIN FOR RAIL GROOVE

exception of about 800 m (half a mile). The weight of the rail is 49.5 kg per meter (99 lbs. per yard), and the weight of track, including fish-plates and accessories, is 116.25 kg per meter (233 lbs. per yard). Thomas steel of a tensile strength of about 7000 kg per square cm (99,000 lbs. per square inch) is employed. The rails have a length of 12 m (39 1/3 ft.). They were laid during the summer at a temperature considerably above the average temperature of the year, and were butted up close.

Before adopting a joint, the selection of the Falk cast-welded joint was very carefully considered. In view of the results obtained with this joint on many roads in the United States, as well as in Lyons, Marseilles and Berlin, its use on the system seemed advisable, especially as it was found to be not more expensive than other good joints. It seems, however, that the engineers of the city in their final deliberations were not quite sure that the use of the joint with Thomas steel rails would be as satisfactory as those which have been obtained with Bessemer steel, and principally for this reason the Falk joint was not employed throughout the system. The present angle-plate joint, however, can easily be discarded for the Falk at any time in the future, if the results on a trial section of 800 m (½ mile) length which has been put in with the latter joint proves satisfactory.

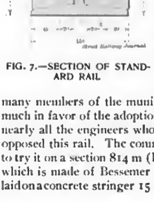


FIG. 7.—SECTION OF STANDARD RAIL

While the modified Phœnix section, as illustrated in Fig. 7, was adopted as standard, many members of the municipal tramway committee were much in favor of the adoption of the Demerbe rail, although nearly all the engineers who were consulted on the subject opposed this rail. The committee finally decided, however, to try it on a section 814 m (half a mile) in length. This rail, which is made of Bessemer steel by a Belgian company, is laid on a concrete stringer 15 cm to 20 cm (6 ins. to 8 ins.) in

thickness. The rail company has guaranteed to keep this line in good order for ten years.

DEPOTS AND CAR HOUSES

The selection of proper sites for the necessary car houses and repair shops of the system was, by no means, an easy

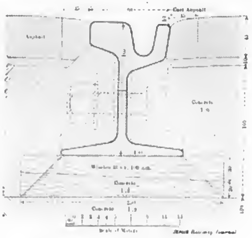


FIG. 8.—SECTION OF RAIL LAID IN ASPHALT

task. The local conditions did not permit the construction of a car house in the center of the city. At the same time the former horse-car house at Seefeld was too limited and the land there available was too contracted to warrant the construction, at that point, of a depot which would fulfil all requirements. It was finally decided to have several car houses and to accommodate not more than fifty cars in one building. As a result, the corporation has erected three car houses, viz., one in Seefeld Strasse, one in Badener Strasse, and one in Mutschellen Strasse, as well as a waiting-room on Paradе Platz.

The property on which the car house in Seefeld Strasse (Figs. 9 and 10) was erected occupies an entire block. The building contains a car house with a small repair shop, the main repair shop and store-rooms. There is also a separate office building, in which is also the residence of the repair-shop manager. The building is particularly interesting from the fact that it is constructed entirely of

LAYING AND TAMPING CONCRETE SUB-CONSTRUCTION

concrete on the Locher system. The total area occupied is 4086 square m (43,982 square ft.). The entire cost of the building was 376,692 francs (about $75,300), so that the cost of the building per square meter was 92.19 francs (about $1.70 per square ft.).

The car house proper contains eight tracks, having a total length of 400 m (1300 ft.), so that about fifty cars can be accommodated in it. The building is heated by steam at low pressure. Large windows on each side and the monitor roof give good light during the day.

Following a number of late American models, about half of the track space is devoted to pit room, and the pit which is about 1.5 m (5 ft.) in depth is continuous under the tracks for half the length of the tracks and for the entire width of the car house. The rails and the wooden floor rest on a special iron framework. The pit floor is also of concrete. Parallel with the trolley wire over the cars in the car house is a dead steel cable, called a "resting wire," against which the trolley poles can be set when it would be convenient to have the poles dead, without pulling them down.

The main repair workshop has a floor area of 914 square m (9870 square ft.) with four tracks, each 12 m (39 ft.) in length, with pits extending their entire length; that is, the length and width of the repair shop, so that there is room for four large cars in the shop. The shop contains seven lathes of different size and construction, one screw-tap, five drilling and cutting machines, one plane, two milling machines, one automatic wheel shaper of American make, one large and one small plate-shearing machine, one punch, one hydraulic press, three grinding machines, one grind-stone, three work-benches with fourteen vises each,

LAYING ASPHALT PAVING

etc. The machine tools are all driven from a main shaft by a 15-hp electric motor. There are also two cranes, each able to carry 4000 kg (8800 lbs.). The winding is done in a gallery, which is 32 m (105 ft.) x 8 m (26 ft.).

In the same building is the smithy, of 73 square m (786 square ft.) floor space, containing a double forge with fan and hood, power hammer, three anvils, and miscellaneous equipment. Adjoining the smithy are the office of the superintendent of the repair shop, and the model-room, while on the second floor are the tailoring department and lockers.

An extension to the building contains the carpenter's shop, of 180 square m (1940 square ft.) floor space, in which a band saw, a planing machine and a universal machine for planing, drilling, etc., are operated from a shaft driven by a 15-hp motor; the same shaft operates an exhaust fan for removing shavings and dust from the woodworking machines. The same building also contains the painting and varnishing shop, of 380 square m (4090 square ft.) area, in which eight cars can be accommodated.

The store-rooms are partly in the main building and partly in the extension, the total floor space being 632 square m (6800 square ft.). In a special fireproof room,

which contains a small crane for handling the barrels, oil, paint and grease are stored.

The office building, which adjoins the car house, has, on the ground floor, a room for conductors, with twenty-six lockers, the office of the accountant and the office of the superintendent of the shop. On the second floor is a room for the motormen and a dining-room. The third floor contains the living rooms of the shop superintendent. In the cellar there is a bath-room with shower baths for the use of the employees, and below the roof there is a room for drying wet uniforms. The whole house is heated by the hot-water system.

The cubic area of the building is 2165 cubic m (76,468 cubic ft.), and its cost was 60,856 francs (or about $12,200), i. e., 28.10 francs per cubic meter (or about 15 cents per cubic foot).

INTERIOR OF CAR HOUSE ON SEEFELDSTRASSE

VIEW OF WAITING STATION AT PARADEPLATZ

The car house at Badener Strasse contains fourteen tracks. The total length of track in the car house is 435 m (1430 ft.), of which 159 m (522 ft.) are situated over a large pit. The car house has a capacity of forty-eight cars of 8 m (26 ft.) length. There is a small repair-shop room of 110 square m (1180 square ft.) floor space, and a storeroom. The office building is of nearly the same arrangement as that at Seefeld Strasse. The total floor space of this car house is 2050 square m (22,076 square ft.), and its cost was 170,089 francs (about $35,800), i. e., 87.16 francs per square meter (or about $1.62 per square ft.). There is a space of 2100 square m (22,600 square ft.) available for future extensions.

A smaller depot is situated in Mutschellen Strasse; it contains four tracks, three being each 46 m (151 ft.) long. The fourth is 56 m (184 ft.) long and leads to the repair

shop. The car house has a capacity of twenty cars. The repair shop has a floor space of 75 square m (807 square ft.), and the store-room of 28 square m (301 square ft.). The total cost was 73,495 francs (about $14,700), i. e., 77.52 francs per square meter (or about $1.44 per square ft.). There is enough additional space available for doubling the capacity of the car house in the future.

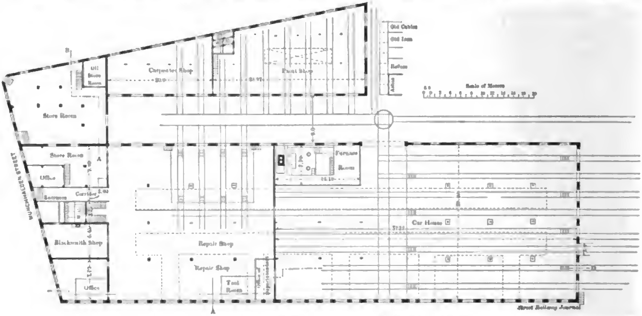


FIG. 9.—PLAN OF CONCRETE CAR HOUSE IN SEEFELDSTRASSE

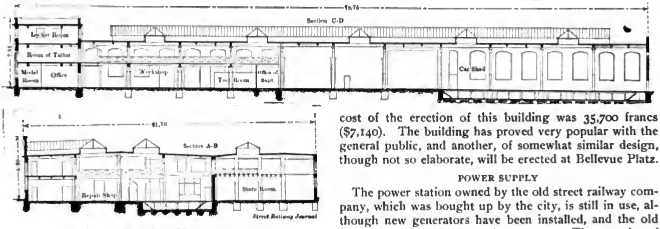


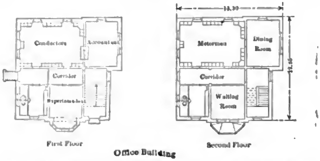
FIG. 10.—SECTIONS OF CAR HOUSE

WAITING ROOM

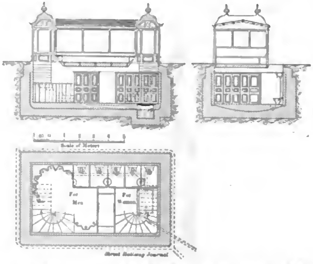
An account of the buildings belonging to the Zurich system would not be complete without a reference to the waiting-room at Parade Platz, which is illustrated herewith, and which is much better known to the public than the car houses already described. It measures 5.25 m x 3.5 m (17 ft. x 11½ ft.), and has separate toilet accommodations, for men and women, in the basement, as indicated in the cross section. The inside and outside walls of the waiting-room are rented out for advertising purposes. The cost of the erection of this building was 35,700 francs ($7,140). The building has proved very popular with the general public, and another, of somewhat similar design, though not so elaborate, will be erected at Bellevue Platz.

POWER SUPPLY

The power station owned by the old street railway company, which was bought up by the city, is still in use, although new generators have been installed, and the old machines are now only used as reserve. The capacity of this plant is, however, not sufficient to furnish the power



PLANS OF FIRST AND SECOND FLOORS OF OFFICE BUILDING



SECTIONS AND PLAN OF BASEMENT OF WAITING STATION

for the entire system. A sub-station has, therefore, been erected, which is supplied with 2000-volt, three-phase current from the municipal central station. Three 200-kw rotary converters change the three-phase current into 550-volt direct current. The charge of the central station is 12 centimes (2.4 cents) per kw-hour, measured at the direct-current terminals of the rotaries. The cost of coal in Zurich is about 34 francs ($6.80 per ton).

OVERHEAD CONSTRUCTION

The trolley line is divided into fourteen sections. In most cases, besides the outgoing feeder, a return feeder serves each section. Both outgoing and return conductors are laid in clay conduits 0.9 m (3 ft.) below the surface of the street. The outgoing feeders are connected to the trolley line by means of Edstroem switch boxes, one of which, open and closed, is shown on this page.

The trolley wire consists, throughout, of two harddrawn copper wires of 8 mm (1/3 in.) diameter. For each section of the line, at least one lightning arrester is provided. Three different systems are in use, viz., those of the Garton-Daniels Company, of Keokuk, Ia., which depend on the action of a solenoid, the General Electric, of Schenectady, which has a magnetic blow-out, and the Siemens & Halske, of Berlin, which is of the "horn arrester" type. The power station is protected by lightning arresters of the Oerlikon Company. Guard wires earthed at suitable distances are used. For rail-bonds both the Bryan and the Edison-Brown plastic bond are employed.


DOUBLE-TRACK CROSS-OVER ON THE SIHLBRUCKE

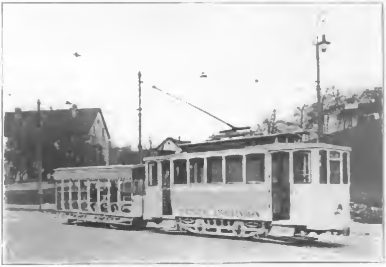
SECTION SWITCH BOXES, OPEN AND CLOSED

ROLLING STOCK

When the change from horse to electric traction was decided upon, the tramway managers expected to buy fifty new motor cars, and to use twenty old horse cars, after proper changes, as trailers. Up to the present time, however, only forty-two motor cars have been bought. These cars are vestibuled, and have, on their platforms, standing room for seventeen passengers, as, according to the usual European practice, passengers are allowed on the front platform. The interior of the car has a seating capacity for sixteen passengers. The standard car weighs 8400 kg (18,480 lbs.), including the electric motors, etc. Most of the cars are mounted on Peckham trucks. Each motor car is equipped with two 20-hp motors, either G. E. or Oerlikon make. Each car has also been fitted with an ingenious device for cutting out any defective lamp in the car, invented by Mr. Schoehli, superintendent of repair


AUTOMATIC CUT-OUT AND ROLLING DOORS OF CAR HOUSE

shops. The terminals for each lamp in use, as well as for one extra lamp, are brought to a small board with sockets over one of the doors, and one lamp can easily be short-circuited by a plug, and the extra lamp cut in to make the five in series required. The car bodies were supplied by



STANDARD CLOSED CAR AND OPEN TRAILER

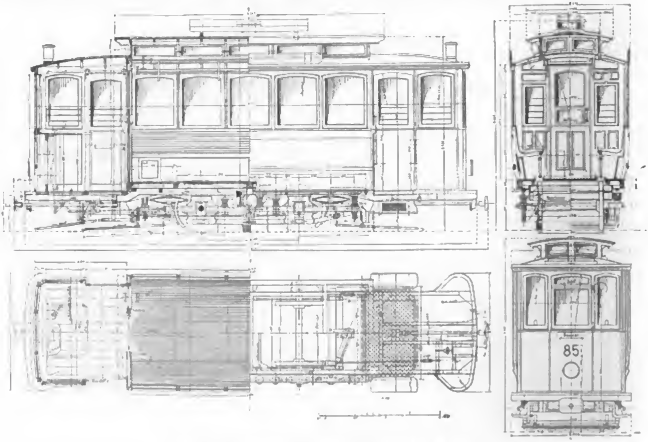
Giessberger & Co., of Zurich, and the Schweizerische Industrie-Gesellschaft, of Neuhausen.

An open car body, as shown in one of the illustrations herewith, was bought for trial purposes, in view of the extended use of such cars in America and elsewhere. It is mounted on a single truck, and its platform is easily accessible, being only 0.6 m (2 ft.) above the top of the rails. The car has proved very popular on hot days, but as it can not be used during the morning hours and on cooler days, no more cars of this kind will be bought.

CONSTRUCTION WORK

The work of changing the horse-car lines over to electric operation was begun on June 18, 1900, and was finished on Oct. 1, of the same year, in accordance with the programme. The force required consisted of 4 engineers, 9 foremen and 493 workingmen. There were only 6½ days on which rain interrupted the work; the construction was, therefore, finished in 89½ days. As the length of the old horse railway lines was 9802 m (32,150 ft.) and the length of track (reduced to single track) was 19,201 m (62,980 ft.), and an average 110 m (361 ft.) of the line, or 215 m (705 ft.) of track, were finished per real working day. The working hours were from 4 a. m. to 7:30 p. m., or from 6 a. m. to 9 p. m. Night work was done only in exceptional cases.

An experiment was tried, during this work, of using a cheaper cement than Portland cement for making concrete. For the concrete substruction, in Theater Strasse, Choindez cement was, therefore, used, but did not prove quite satisfactory, in spite of great care used in its employment. The same cement was also used for a short section of track on Bleicherweg. On all other lines, however, the concrete was made of Portland cement.



SIDE ELEVATION AND SECTION OF STANDARD MOTOR CAR

The following mixtures were used in making the concrete: For the lower concrete layer (1:8), 1 part of Portland cement or Choindez cement, 3 parts of sand, and 5 parts of screened gravel; for the upper concrete layer (1:6), 1 part of Portland cement, 2½ parts of sand, and 3½ parts

of screened gravel; for 1 : 2 concrete, 1 part of Portland cement, 1 part of sand, and 1 part of screened gravel. In Figs. 4 and 5 the proportion of the mixture used in the different places is indicated.

One of the contractors made the concrete in the immediate neighborhood of the construction work, while the other contractor made it at a distance of 2 km (more than a mile) and transported the concrete on trucks to the place of construction. On very hot days the trucks were covered with wet cloths. The preparation of the concrete was continually watched by experts of the city. The surface of the concrete was covered with a layer of cement mortar of 1 cm (0.4 in.) thickness.

The heating of the powdered asphalt was not done in the immediate neighborhood of the streets to be paved, but in the yard of the shops at Sihlfeld. It was heated there to 150 degs. C. (302 degs. F.), and was transported to the place of construction in covered trucks. At arrival, the temperature was 130 degs. C. (266 degs. F.). The powdered asphalt was then placed upon the foundation, about 62 mm (2½ ins.) thick, and was then rolled at once with a warm hand-roller of 350 kg (770 lbs.) weight, 0.8 m (2⅔ ft.) diameter and 0.5 m (1⅔ ft.) width. It was then rammed with hot rammers and afterward leveled with a second roller of 900 kg (1980 lbs.) weight, 1.3 m (4¼ ft.) diameter, and 0.5 m (1⅔ ft.) width. The asphalt was finally polished with hot iron. When finished, the layer of asphalt had a thickness of 45 mm (1¾ ins.). The street was opened to the public after two days.

During the hottest days of the construction work it was necessary to cool the pavement artificially at repeated intervals with water.

From experience obtained in other streets, the engineers did not consider it advisable to lay the rammed asphalt directly against the rails, because in this position it was found to get loose soon and crumble off. They, therefore, decided to place a strip of cast asphalt of 3.5 mm between the rammed asphalt and the rail. The approved form of construction is shown in Fig. 8.

A considerable part of the overhead and other equipment of the system was supplied by Alf. Diener & Company, of Zurich, manufacturers and agents of electric railway supplies.

Although the last horse-car line was changed to electric traction during the end of September, 1901, so that the whole line was in operation by the beginning of October, the work of construction was not fully finished at that time, and work was continued all through the year 1901. The official report, dated January, 1902, states that some further work will be done in 1902, which will require an expense of 78,000 francs ($15,600). When the whole work is finished, the expense will be lower than the original estimates. These called for an expenditure of 4,000,000 francs ($800,000), but the total expense will be only in the neighborhood of 3,600,000 francs ($720,000).

The manager of the system is A. Bertschinger, and the paving work was supervised by W. Dick, superintendent of streets for the city of Zurich.

The Utica & Mohawk Valley Railway Company, of Utica, N. Y., is planning to establish an express service on all of its lines this month. The main express office will be at Utica.

Opening of the Valtellina Three-Phase Railway

On Sept. 4 the two northern sections of the Valtellina Railway, Italy, which has been equipped with the Ganz three-phase system of electric traction, were put in operation.

STANDARD CLOSED CAR AND CLOSED TRAILER, ZURICH

The Valtellina Railway, which has frequently been referred to in these columns, and which has attracted wide attention as being the most important installation of three-phase electric traction in the world, extends from Lecco, on Lake Como, to Colico, and from that point two branches are run to Chiavanna and Sondrio. It was these latter divisions on which the service was inaugurated for both freight and passenger traffic, and the line, according to latest reports, has been in operation successfully ever since.

The delay in opening the line, according to local testimony, seems to have been due more to mechanical difficulties experienced in the overhead construction rather than to any trouble with the electrical apparatus, for the electrical equipment has been on the ground for a number of months. The route of the road for the greater part of its distance extends along the eastern side of Lake Como, and passes through a large number of tunnels. According to engineers on the ground, the high speed of the electric cars required a greater elevation of the outside rails and curves. When these rails were raised the adjustment of the two wires required in the overhead system to the new track elevation required considerable time. In addition, the varying heights of the trolley wire, due to the large number of tunnels on the line and the fact that the insulation of the overhead line, particularly in the tunnels, suffered deterioration through the smoke consequent upon the constant operation of steam trains necessary to care for the regular traffic, were the principal difficulties in completing the electrical equipment. The overhead system has in consequence been subjected to a number of changes, but it is now thought to have become standardized, and the sparking at the 3000 volts used on the trolley line does not seem to be any more severe than that experienced in ordinary 500-volt direct-current operation.

The system of lightning arresters in the primary circuits has also been changed, and at the power station at Morbego a novelty has been introduced in the use of a jet of water for the high resistance of the arrester. The water resistances in the car have also been provided with cooling apparatus. An extension of the line from Lecco to Milan is contemplated.

The Electric Urban and Interurban Railway at the St. Louis Exposition

BY W. E. GOLDSBOROUGH

The presentation of electric railway exhibits on a scale and in a manner to meet the approval and expectation of the men who are so rapidly building up this new department of transportation, is a matter that will require active and strenuous effort during the months that intervene until the time of the opening of the great Louisiana Purchase Exposition. When the total volume of the energy that is being put into the electric railway movement is realized, the difficulties in the way of giving the public a true picture of this wonderful activity present themselves. The progress in electric railroading is in fact so rapid, that the things which are new to-day are old to-morrow. There is hardly any department of engineering of which this can be said in anything like the same degree as electric railroading, and it is not too much to expect that the practice of to-day will be superseded or modified prior to the close of the exposition, by some new and better creation. This is the spirit, this is the unprecedented activity, which typifies the national progress that the directorate of the exposition has undertaken to picture. It is needless to say that a great work confronts all exposition workers, and in this particular instance the task is much more exacting than any which met the builders of previous expositions. A new condition has to be faced. Almost a new problem has to be solved. The people of America have in a few short years, since the Columbian Exposition, been educated to such an extent in matters pertaining to expositions that they are developing an appetite for the new, the interesting and the edifying, in a measure almost eclipsing in its growth the great advances in science and industry.

TRANSPORTATION BUILDING AT ST. LOUIS

To be a success and meet the approval of America and the world, to gain historic standing as a great world's event, the St. Louis Exposition must bring out latent elements in exposition work with such force, such vigor and such attractiveness, as to cause the great world public to stop and listen, if but for a moment, to the story of the fame of this new city of to-day.

Linked with this great undertaking, among many other important problems, is that of the proper presentation of the electric urban and interurban railway interests. Those who are interested in the progress and development of electric transportation are stimulated in their work by the personal interest and pride they take in two of the great divisions of engineering. At heart they are all railway men, and they put into their railway work the heart and brain power which would bring success in any sphere of railway engineering. Added to this, they feel to a man, with a keen sense of satisfaction and pleasure, that they are making chapters in the history of the development of electricity and electrical engineering. They have a wonderfully firm belief in the possibilities of electricity, and this belief is confirmed and stimulated by every electrical advance, whether it be directly connected with the electric railway problem or be in some other department of electrical endeavor.

To meet the expectations of the electric railway men, it has been decided to give them a large share in two of the principal exhibit pictures that will be presented on the exposition grounds. The electric railway properties, gaged strictly as a railway problem, have attained to such magnitude that transportation would not be doing justice to itself did it not picture on a large scale and in a broad way all those transportation devices which combine to make the electric railway mechanically successful. So also has the electrical side of this great problem assumed such proportions that it stands at the head of all the electrical undertakings of the age. No story of the industrial application of electricity would therefore be complete without a recognition in a most comprehensive way of all that the railway engineers have done to build up and expand, to improve and to ramify the transmission and the application of electricity in many different ways.

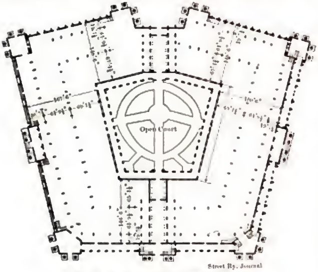
I am advised by Willard Smith, chief of transportation, who has been long and favorably known to the transportation world on account of the distinguished success attained by the Transportation Department of the Columbian Exposition, as well as through his intimate connection with the general railway interests of the country, that the urban and interurban transportation problem will receive a most adequate presentation on the four miles of track which are brought within the limits of the great Transportation Building. In the Transportation Building, therefore, electric railway rolling stock, trucks, tenders, passenger coaches, parlor, freight and service cars, track sweepers and snow plows will be exploited, and in addition, all matters pertaining to maintenance of way, grading and bridges, ties,

spikes, chairs, fishplates and other parts of the track; switches and crossings; transfer tables, turn tables and bridges; signal systems and apparatus for securing the safety of traffic, will be here shown. Exhibits will also be made covering general railway management; time tables, distribution of rolling stock; cleaning and disinfection; handling of traffic, passengers, freight, postoffice matters, express, parcels, tariffs; and methods and equipment for caring for the needs of all the interests having occasion to use or make use of electric railways. No elements of importance are to be neglected in any way.

In the Electricity Building space is to be given to all those matters that pertain to the generation and distribution of electricity and to the use of electricity as a motive power. In the Electricity Department, therefore, generators producing direct, alternating and multiphase currents will be exhibited. Boosters, motor generators, transformers and rotary converters will also be shown here. Direct current and alternating current railway motors, electric locomotives and methods for the control of cars and trains; overhead, third rail, contact and underground conduit systems; multiple control methods and other special railway devices, such as electric signaling apparatus, complete station and sub-station switchboards, instruments, lightning arresters, circuit breakers, telegraph and telephone appliances, storage battery equipment, bonds and bonding, and overhead construction material will all be given place.

The electric railway needs and demands in one way or another almost all of the electrical apparatus to be found on the market, and consequently it is a logical conclusion to group all these electrical appliances together in such a manner as to enable them to be most advantageously studied.

From the foregoing it will be seen that by the fortunate provisions of the official classification of the exposition, the electric railway engineer will go to the Transportation Building to study all matters pertaining to maintenance of way, traffic maintenance, service equipments and all other matters that pertain directly to the mechanical side of this great problem. While on the other hand, he will go to the Electricity Building to study the street railway or the electric railway problem from the generator through the transmission system, the transforming devices, the sub-station and the storage battery, out over the line and through the motors to the car axle.



PLAN OF ELECTRICITY BUILDING

It is not only with exhibit matters that Mr. Smith and myself are concerned in our endeavor to have our presentation of the electric railway problem include all those elements which make it attractive and interesting to the electric railway men; the active operating side of the railway problem needs recognition which has never yet been accorded to it by an international exposition, and it has been especially along this line that efforts have been directed to enable us to provide for space for the actual operation and test of railway equipments. After working on the matter for several months, it has finally been deemed expedient to set apart a space for this purpose north of the Transportation Building and paralleling it, which will be 1300 ft. long and 25 ft wide. This right of way will admit of the installation of double tracks upon which an outdoor exhibit can be made of the actual operating efficiency and reliability of railway equipments. I take great satisfaction in being able to make this announcement for the reason that I feel certain it will be a matter of much gratification, not only to the superintendents and engineers of operating railways, but also to the manufacturers of electric railway equipments. It is our desire that these tests shall be organized along very broad lines and that during the progress of the fair much data and information shall be recorded which will be of enduring benefit to the railway interests. At the present time it seems very probable that by the summer of 1904 numerous systems for electric railway operation using alternating current will be in the field, as well as the systems we now have for the operation of electric railways by direct current, and it should be a source of much gratification to us all to contemplate the possibility of being able to study all of these systems exploited at the same time, on the same ground, by engineers and experts of the several companies making exhibits.

THE PALACE OF ELECTRICITY

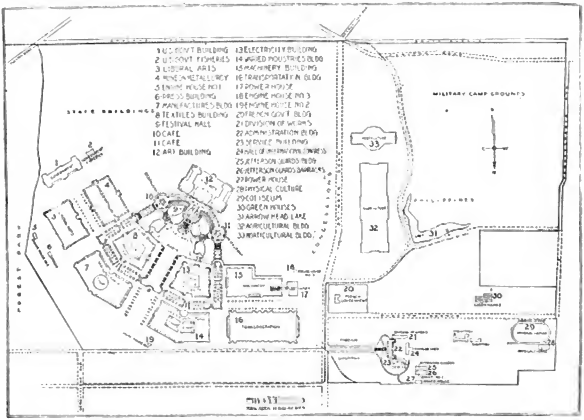
The plans of the exposition contemplate even a more radical step in opening up avenues for exploitation along the line of electric transportation. In order that inventors shall be stimulated to use their best efforts in devising

means whereby motive power equipments for use in aerial navigation may be improved, the exposition has offered a prize of $3,000 for a successful attempt to drive an airship motor by energy transmitted through space either as electric radiation or in some other form of electric energy to an actual amount of 1-10 hp at the point of reception and at a distance of at least 1000 ft. The test must be made on the exposition grounds by experts satisfactory to the jury. This last provision it is thought rounds out and completes a picture which embodies in it opportunities in every avenue of electric transportation.

The Transportation Exhibits Building is placed on the extreme northwest corner of the main picture of the fair. It is the most expansive structure yet designed for the Louisiana Purchase Exposition. When all the exposition buildings are up it will be exceeded in size only by the palatial Agricultural Building. The Transportation Exhibits Building covers an area of 525 ft. by 1300 ft. and includes more than 15 acres. The facades show a most pleasing adaptation of the French Renaissance. The building combines a feeling of the magnificent exposition building and of the high-class railroad depot which prevail on the European continent. These two essential elements are apparent throughout the structure.

On the east and west fronts are three magnificent arches which embrace more than half of the entire facade. Each of these arched openings will be 64 ft. wide and 52 ft. high. Through these archways 14 permanent railroad tracks will be laid from one end of the building to the other. At the sides of these three openings the projecting angles are accentuated by tower or pylon effect, which reach to a height of 150 ft. to the base of the crowning statue. These pylons are not so much accentuated as to be obtrusive, or out of harmony with the structure. A floor plan of this building was published in the STREET RAILWAY JOURNAL, Aug. 16, 1902.

On the north and south fronts the architect has deemed it well to repeat the three massive archways which form the center feature of smaller fronts. This treatment pleasantly breaks the unwieldy facade of 1300 ft. On the north and south fronts the pylon feature is omitted, but massive piers are repeated at intervals and lend dignity to the design. Flanking these three openings on the long fronts are great rows of magnificent windows as wide as the archways. Not only will visitors be admitted through the twelve huge portals mentioned, but subsidiary entrances are supplied at frequent intervals in the remaining stretch of walls. The roof treatment of the building is peculiarly happy. Over each of the big archways is a lofty curve which supplies a back-ground for the architectual features.



PLAN OF GROUNDS AND ARRANGEMENT OF BUILDINGS AT ST. LOUIS EXPOSITION

The statuary is happily placed in front and at the base of the main piers, at the sides of the grand openings. This affords 16 groups which will illustrate transportation in all its phases as well as the progress made by the United States in this science. There will also be four groups of statuary surrounding the four pylons placed at the east and west fronts. The architect has subdued the use of sculpture in the building. He depends on mass effects and on the grouping of masses. That is, he depends on architecture rather than on tawdry decorations for his effect. The management of the plan is simple and direct. The entire width of the building is spanned by five well designed uniform trusses. Special endeavor has been made to afford plenty of illumination by day without the use of skylights. Light is introduced through the monitor windows over each span of the five trusses.

The building will contain about four miles of standard-gage railroad track. Even with this immense trackage two entire bents of the building are left free of rails and afford an exhibit space of 270,000 sq. ft.

There is a novel disposition of the toilet rooms of the building. They are placed in the bases of the projecting

pylons, and are so arranged as to receive light and ventilation and be accessible from the exterior, so that no exhibitor can make the objection that he has been placed in the neighborhood of the plumbing conveniences. At the east end a gallery 20 ft. in width extends across the building. This affords a place for guard rooms and for the office of the department chief, and will be an excellent place from which to view the picture below.

The Electricity Building of the Universal Exposition of St. Louis in 1904 is the largest ever provided for electrical exhibits and displays. It covers virtually 300,000 sq. ft. of ground space as against 250,000 sq. ft. covered by the Electricity Building at the Columbian Exposition at Chicago in 1893, and 75,000 sq. ft. by the Electricity Building at the Pan-American at Buffalo in 1901. It is of most graceful design and proportions, forming an elaborate pentagon, each of its five sides presenting a succession of splendid columns after the richest Corinthian order, and on four sides being surrounded by a balcony of rare grace and beauty. It encloses an open central circular court surrounded by rich colonnades, which will be banked with masses of flowers and make a pleasing retreat for visitors to the building.

Its location within the exposition grounds is most favorable. It rises directly at the foot of the grand terrace and cascades and thus constitutes a prominent feature of the main arrangement of the rich section which is called the main picture of the exposition. The eastern exposure of the building fronts 525 feet on the main avenue of the exposition. This broad thoroughfare leads up from the main entrance to the Grand Basin and cascades and is penetrated by the central lagoon. The southern exposure, facing the Grand Basin and cascades, is in direct view of the electric fountains, the peristyle of the Festival Hall and the Fine Arts Palaces. On the west and north the building is bordered by other principal avenues of the exposition and additional extended arms of the lagoon. It is therefore completely surrounded by water. It is led up to by splendid arch bridges which will discharge the crowds into the broad avenues directly surrounding the building. Four main entrances are provided, one imposing portal at the meeting of the two north facades, and one at the centre of each of the other sides. Graceful and ample entrances are also provided at the corners of the building. The doors are of gigantic dimensions, 11 ft. x 18 ft. The north facades of the building measure 600 ft., which makes its greater dimensions 525 ft. x 600 ft.; 176 trusses and 185 tons of steel have been used in its construction.

The details of the building are well executed in every respect. The columns supporting and adorning the sides are carried down close to the ground to give height and effect to the facades. The facades are accentuated by elevated pediments and tower effects which rise over the four main entrances and at the corners. For variation, a twin column treatment is provided at different intervals along the sides and over these as well as over the elaborate entrances and corners opportunity for ample sculptural decoration is supplied.

The fenestration of the building is bold, liberal and appropriate, giving ample light, while affording substantial wall treatment. On two sides graceful and capacious loggias have been extended which enhance the general beauty of the facades, offering pleasing effects of light and shadow. A rare scheme of indirect illumination is being worked out and will be applied to the building, which will accentuate its beauty at night.

The design of the building and its general and special proportions and arrangement are peculiarly adapted for an effective display of exhibits. There are numerous openings in the facades, such as exhibitors seek in selecting their exhibit spaces, and the entire 300,000 ft. of floor space is directly available, advantageously situated, compact, symmetrical, well lighted, well distributed according to aisles and entrances, and well provided with all conveniences. Most important of all, it is all ground floor space, there being not a foot of gallery space in the building nor in any other exhibit building of the exposition, a feature of the Electricity Building and of the Universal Exposition that will be welcomed and appreciated by exhibitors and visitors alike.

A great traveling crane to be used in the placing of the heavy electrical machinery which is to be exhibited, will be installed in the building, and all other conveniences afforded to exhibitors in locating and placing their exhibits.

Improvements in San Francisco

The United Railroads of San Francisco, which is the name of the new company which has consolidated the Market Street and other important systems in that city, have inaugurated a number of important improvements. One of these is an extension from San Francisco to San Mateo. The extension is about 12 miles long, double track, and is being laid with Falk cast-welded joints. It will be completed by about Dec. 15. The cars on this line will run at high speed after leaving the city limits, and part of the line is built over a private right of way. The overhead trolley is being used. The company has just placed an order with the Laclede Car Company for twenty cars for this service. The cars are 45 ft. 9 ins. over all, and are provided with smoking compartments and twenty-four cross seats each. Four G. E. 57 motors and K-14 controllers will be used, mounted on Brill 27 trucks. The company expects to run the round trip of 45 miles in 170 minutes.

The company is also building a large power house at North Beach. The dimensions of the building are 130 ft. x 330 ft. The equipment will include Babcock & Wilcox boilers, two Union Iron Works marine vertical engines of 4000 hp each, and two General Electric 1200-kw alternators, with distribution at 13,000 volts. Two sub-stations will be installed. This station, like all of the other power stations of the company, will use oil as fuel. The company is also building a car house at Twenty-fourth and Nebraska Streets with a capacity of one hundred cars.

The extent and variety of the company's service is shown by the following statement of some of the equipments now in operation on its lines:

326 combination cable cars.
49 open cable cars.
2 United States mail cable cars.
63 dummy cable cars.
383 combination electric cars.
1 parlor electric car.
1 observation electric car.
2 funeral electric cars.
1 mail electric car.
2 tower electric cars.
11 freight electric cars.
2 electric cars for carrying street sweepings.
2 oil tank cars for delivering fuel oil to power houses.
16 steam coaches.
4 locomotives.
5 horse cars.

It will be remembered that the general manager of the company is George F. Chapman, formerly of the North Jersey Street Railway Company. The master mechanic of the United Railroads of San Francisco, F. F. Bodler, was also formerly connected with the North Jersey system.

The Bremgarten-Dietikon Interurban Electric Railway

The confines of Switzerland are not large enough, and the country does not contain sufficiently large cities, to justify the construction of such interurban electric railway systems as are built in the United States, but a number of short interurban lines have been installed in that country, and some of them are extremely interesting. The road which is made the subject of this article differs from most of the European electric railways in that it combines a passenger and freight business, and has a large traffic in the haulage of freight in one of the illustrations on the following page. The gage of the line, which is a single-track road, is 1 m. There are several turnouts, the inside rails of which are spaced 35 m apart, so that there is a space between the cars, which are

TYPICAL SCENES ALONG THE BREMGARTEN-DIETIKON INTERURBAN RAILWAY

The total length of the line, which extends from the station at Dietikon to Bremgarten, is 10.96 km, of which practically all is on the highway with the exception of the four curves, where the sharp corner of the public highway compelled the railway company to purchase right of way in order to have a curve of longer radius, as is clearly shown 2.2 m in width, of 1.3 m. A clear space is left between the cars and any buildings along the line of 2.1 m.

The sharpest curve on the regular track is 30-m radius, although in the car house there are several of 25-m radius. Of the total length of track there are 2.81 km on curved and 8.15 km on straight track.

The maximum grade is 6 per cent for a distance of 90 m, and is close to the town of Dietikon. The average grade on the entire line is 3.15 per cent.

The track is substantially laid on a ballast of broken stone, on which is a dressing of macadam, having a total thickness of from 25 cm to 30 cm, and a width of 2 m. In the cities, where paving is required, the rails are laid on a sub-base of concrete.

Within the cities and towns girder rails are used. These rails have a weight of 30.46 kg per meter, a height of 115 mm, a base of 88 mm, and a groove of 30 mm in depth. The rails are rolled in 12-m lengths. The ties, which are of iron, are 1.50 m long, weigh 25 kg each, and are spaced eleven to the rail length in straight track and thirteen to the rail length on curves. The weight per running meter of track, angle-plates, ties, bolts, etc., is 88 kg.

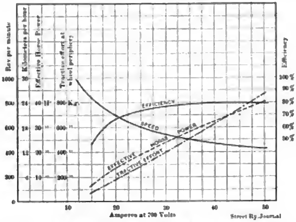
The Vignole or T-rail used on the company's right of way have a weight of 24.2 kg per meter, a height of 110 mm, a base of 90 mm, and a web of 9 mm thick. These rails, which are also 12 m in length, are laid on ties which are spaced fourteen to a rail length in straight track and fifteen to a rail length on curves. The ties are of the same length as with the girder rails, but weigh 5 kg less apiece. The total weight of this track, with angle-plates, etc., is 75 kg per meter. There are eleven switches required on the section laid with girder rails. The curves have an initial radius of 40 m. There are only two switches required on the T-rail section, and these have an initial curve radius of 50 m.

In Bremgarten a waiting station has been erected, which includes not only rooms for passengers, but also the office building, residence and restaurant, together with a freight station. Adjoining this office building is the car house for four motor cars with the repair shops. At several stations along the line of route attractive waiting stations have been erected, combining a freight station, waiting room for passengers, office and residential rooms for the station master. There is also a small car house in Dietikon.

EXAMPLES OF OVERHEAD AND ROADBED CONSTRUCTION, THE POWER PLANT AND PASSENGER STATIONS

Power is derived from the lighting station in Bremgarten, for which purpose two generators have been installed. These are driven from a turbine by means of a belt. Friction clutches allow each generator to be thrown in and out of connection with a common pulley, so that either machine can be driven. Usually one generator answers for the power demands of the line. The generators are of the standard compound four-pole railway type of the Oerlikon Maschinenfabrik, having an output of 35 hp each, and running at 170 r. p. m., with 750 volts pressure. The armature has a diameter of 520 mm. In each of the slots are two coils, consisting each of 2 x 2 conductors, of which each consists of two parallel wires of 2.8 mm x 3.4 mm. The commutator has a diameter of

380 mm, a width of 75 mm and 199 bars. The field winding on each pole consists of 3720 turns, of 1.3 mm x 1.5 mm wire for the shunt coil, and 13.5 turns of 0.5 mm x 105 mm copper band for the series coil. The weight of the machine, with base plate, is 3090 kg, and that of the armature 825 kg. The machine has an efficiency of 91 per cent on full load, 88 per cent on half loads, and 76 per cent on



CHARACTERISTIC CURVES OF OERLIKON MOTOR

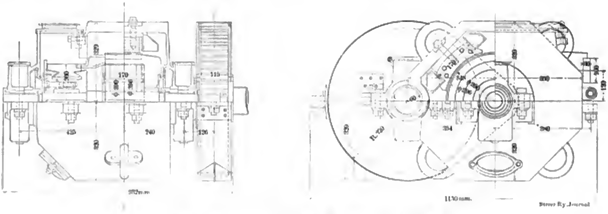
quarter loads. Adjoining the engine room is a storage battery installation for the balancing of the load. This consists of 400 cells, with a capacity of 123 amp.-hours, at the one-hour discharge rate. The switchboard is of white marble on an iron frame.

There are two feeders from the power station, each consisting of a bare cable of 100 sq. mm, connected to the trolley wire at five points. The length of feeders, which are protected by lightning arresters, is about 3 km. The trolley wire has a diameter of 8 mm, and is carried about 6.4 m above the track. Four section insulators are employed, and the trolley wire is protected by thirteen lightning arresters. Both span and bracket overhead construction are employed, and the trolley wires are trebly insulated. The poles are of impregnated wood. They are from 8 m to 9½ m in length, and protected and ornamented by cast-iron caps. About 470 poles are employed. The voltage on the line is 70.t.

The rolling stock consists of three motor cars, three passenger trail cars, and two open and two closed freight cars. The motor and trail passenger cars have accommodations for eighteen sitting and ten standing passengers. The length of these cars over buffers is 8.1 m. The cars are mounted on single trucks, with a wheel base of 2 m. The wheels are steel-tired. The cars are furnished with wheel guards and ratchet hand-brakes. The motors are designed to carry a car up a grade of 5 per cent at a speed of 12 km per hour for a maximum grade length of 697 m, hauling a loaded trail car.

The motors are of the enclosed type. The armature has a diameter of 390 mm. Each of the forty-five slots, which are 41 mm x 11 mm, contains thirty-six wires of 2.4 mm x 2.65 mm. The commutator is 265 mm in diameter, 115 mm wide, and has 135 bars. The field coils have 138 turns, of 4.6 mm x 5 mm wire. The gear reduction is 1 to 5. A series parallel controller is used with electrical and short circuit brake, and is fitted for the connections with electromagnetic brake. On each car are seven lamps, of which six only are in use at one time, viz.: two headlight lamps, two single lamps and three lamps for the interior illumination of the car. The cars are also equipped with electric heaters, and the motor cars are equipped with electric couplings for the lamps, heaters and electromagnetic brakes on the trail cars. The freight cars are also equipped with electromagnetic brakes.

The entire installation was made by the Maschinenfabrik Oerlikon and Locher & Co., of Zurich, and cost 318,600 francs.



END AND SIDE ELEVATIONS OF OERLIKON MOTOR

Electric Railway for Havana

The plan of the Havana & Janitos Railroad Company, mention of the incorporation of which was made in a recent issue, is to build at this time an electric railway in Havana, with lines to Maraniac and Jaimanitas Beach, about 10 miles from Havana. The first concession that the company secured in Havana and from the Railroad Commission of Cuba gave the company the right to build from the Public Square, Havana, to Marianao and Jaimanitas Beach, but the company has recently applied for additional grants in Havana. It is the desire to build a line that will extend from the Public Square, pass the custom house, post office and other public buildings and give a direct and independent entrance to the city. This would secure for the company considerable local traffic and enable it to carry suburban passengers to their destination with a minimum of discomfort. It is planned to begin construction work as soon as it is possible to get the materials on the ground. Offices will be opened in Havana at once.

In connection with the plan of the company to build the proposed railway, it is said that interests identified with the company have acquired 100,000acres of land about 40 miles west of Havana, which it is proposed to develop for building purposes. To carry out this work the Cuban Land Company has been organized with J. W. Hayes, of Cleveland, as president.

The Graphical Representation of Street Railway Statistics

BY W. C. GOTSHALL

The profits in electric operation depend upon so many factors that the operating manager necessarily must watch very closely every item of expenditure, and be especially careful that the profits do not pass insensibly away through the uneconomical administration of some one or more departments. Fortunately, street railway operation is now so well systematized that it is not difficult to determine whether one department or another is costing too much, provided accurate records are kept and studied, not only with regard to themselves, but also as compared with those of preceding years. The keeping of the records is a comparatively easy task, but it is doubtful whether the full benefit is always obtained from statistics of this kind. Figures of the cost of power house operation, car repairs, trainmen, etc., are in many cases received by the operating manager and are filed away until a time when he shall have a chance to digest them, but this time rarely comes. Again, it is often difficult to grasp fully the significance and the relation to each other of vast numbers of figures spread over three or four tables; and even if the manager himself has the time and the knack of fully understanding these figures and the effect of one item upon another, it is frequently an entirely different thing to impress their significance upon his directors or executive board. The result is that many busy men have come to look upon statistics, "the kilowatt-hour per car mile," "the car miles per passenger carried," "the train expenses per car hour," as calculations which absorb more time than the value warrants, and as introducing a routine of red tape which is almost useless.

Most of the objections to these calculations disappear, however, when, instead of tabulating these statistics, we use a graphical method of recording and comparing them.

Early in the nineties, while seeking a method to analyze the variable costs of the different items entering into the operation of railroads, I devised and used what I then called the graphical method. This method simply consisted in the plotting of the variable expense items upon sheets of co-ordinate paper. To illustrate, taking the car mileage of any given system, and having the receipts per month, the cost of car repair per month, the cost of power house expense per month, the cost of conducting transportation per month, the cost of maintenance of equipment per month and the car mileage for the corresponding period, each of these items was plotted separately by using the axes of abscissæ to represent the various months or other periods of time, and by using the axes of ordinates to represent the cost. By taking a sufficiently large scale on the axes of ordinates, the variations or changes in value are amplified

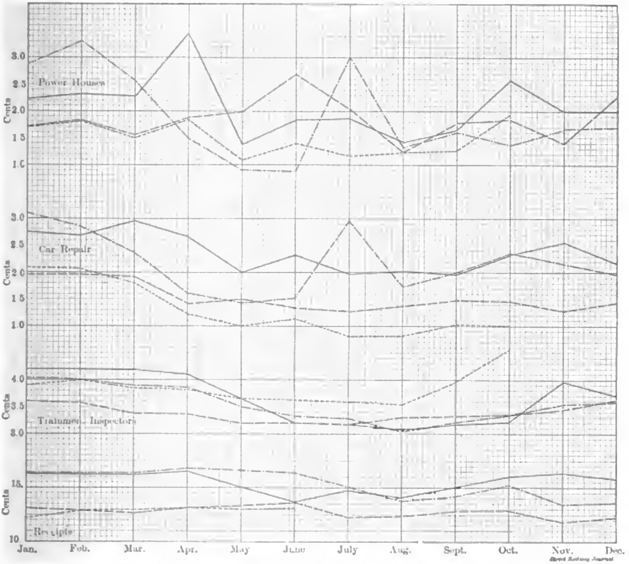


FIG. 1.—DIAGRAM SHOWING METHOD OF PLOTTING STREET RAILWAY OPERATING STATISTICS

and made more evident. Hence a slight variation in the unit cost can be made readily apparent. This is very desirable in the case of the road having a large car mileage, since a slight variation per unit would, of course, mean a considerable difference in the total operating costs for any given period. Subsequently, this system was taken up and developed quite extensively by M. K. Bowen, formerly president of the Chicago City Railway Company, and myself. A great number of curves were prepared, showing the several items entering into the operation of a street railway.

There is shown herewith in Fig. 1 a series of curves which were obtained from the Union Depot Railway Company of St. Louis for the years 1892, 1893, 1894 and 1895. In these diagrams the records for corresponding years are shown by the same kinds of line, that is, the solid lines indicate the records for one, dotted for another year, etc. In an actual notebook or manager's record, it is better to distinguish between the years by lines drawn in inks of different colors. An examination of the diagram will also show that it is not necessary to have a base line of zero for each set of lines, but the ordinates can be selected so that the curves for the different departments will be comparatively near each other without overlapping. This has two advantages; it takes up less room and a comparison between the fluctuations can be much more easily made by the manager. My connection with the Union Depot Railway Company commenced in 1895, but for the purpose of ascertaining what had been transpiring, I collated and plotted the data for the preceding years. The results given are undoubtedly of great interest, not only as showing the operating cost in any period, but by showing the readiness with which any variation in the operating cost can at once be made apparent. This system of plotting data was used in every branch and department of the Union Depot Railway Company; that is, all of the subordinates were compelled to show their results in this manner. The effect is remarkable, for it is only necessary to explain to an individual the meaning of the rise of a line to put him on the *qui vive* and cause him to exert every effort to avoid a repetition thereof. The advantages of the graphical method will at once be apparent, when it is remembered that the old method contemplated long rows of figures, which differed but slightly, and which did not show readily the marked differences that a slightest difference per car mile produces upon a road having a considerable car mileage.

Another advantage of the system is that the relations between the various curves can easily be determined and the nature of the defect, if any exist, detected. For instance, we can take a chart similar to that shown in Fig. 1, but indicate on it by one line the kilowatt-hours per week or per month, and by another line directly above or below it the pounds of coal burned during the same periods. If the station efficiency is constant, that is, if the same number of pounds of coal are burned to produce a kilowatt-hour each week, the kilowatt-hour line and the pounds of coal line, if plotted, one above the other, will remain the same distance apart, although each will have fluctuations depending upon the output. If, however, through the use of an inferior quality of coal, or from some other cause, the station production becomes less efficient, the result is instantly shown by the coal line approaching closer to the kilowatt-hour line if it is below the latter, or departing from it, if it is the upper line. This change in direction instantly points a moral which would be equally shown, of course, by a table, but would not be so visually evident. If we wish to carry the work still farther, other lines can be added to the same chart, or drawn separately to show "car miles run," "passengers carried," etc., and each will point its lesson.

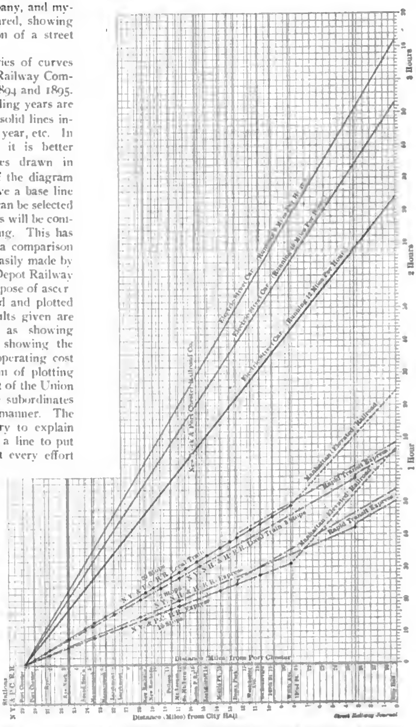


FIG. 2.—METHOD OF GRAPHICALLY ILLUSTRATING VARIOUS RATES OF SPEED

For instance, if the "kilowatt-hour" line plotted by weeks or months is below the "car mile" line and approaches it, it discloses the fact that more power is being taken per car mile than formerly. If the cars are of the same size and carry practically the same loads at the same speed, the inference is that there is some difficulty in the transmission system, and an investigation of the rail-bonds, overhead line or car equipments is in order.

This method can be applied to any system of variable quantities. In the case of an electric light station, it would be but necessary to reduce it to a kilowatt hour basis, and every quantity entering into the cost of the operation of such a station can be applied by using time as abscissæ and cost as ordinates, and any variation in such quantities readily and strikingly shown by making the scale large enough.

This system I have also used in comparing the costs of operation, as well as the earning and other data of several street railways throughout the country. The data is applied upon the ordinary co-ordinate paper; the paper is then mounted on linen, and a number of sheets relating to any sets of data are then bound in book form. For the purpose of showing the exact costs which might be difficult to interpolate upon the sheet of co-ordinate paper, the actual figures are all tabulated and also bound in the same form.

The graphical method was used extensively in the development and representation of the details of the New York & Port Chester Railroad Company before the Railroad Commission of the State of New York in the application of this company for the certificate of the Railroad Commission. One of these charts is reproduced in Fig. 2, whereon are shown the different times occupied by different transportation systems in passing from Port Chester to New York city. The variations are readily seen and appear at once, not only to an engineer, but to laymen interested in such matters. The graphical method is essentially a pictorial representation of such a nature as readily to impress any differences upon the mind.

While the analysis of results may seem comparatively complicated when expressed in type, it will be found not only most simple of comprehension, but as occupying very little time, when the graphical method of comparison and analysis is employed. Co-ordinate paper is now not only cheap, but easily to be obtained in almost every city, and the time required to draw in the lines on a sheet of this kind takes certainly no more time than to keep the figures in a book, and as the records of several years can often be superimposed on each other to advantage, as shown in Fig. 1, the chart occupies very little space.

I also desire to call attention to the fact that while the advantages of the graphical method are so apparent for the keeping of records of street railway and electric lighting enterprises, its applicability does not, by any means, cease there. The method is, of course, invaluable to any engineeringoffice. Its applications for the use of engineers are innumerable, and its value is almost inconceivable. One of the interesting applications of this method is in representing train schedules. In the STREET RAILWAY JOURNAL of December, 1901, there appeared one of the train schedules of the New York & Port Chester Railroad Company, wherein the entire representation was made by means of the graphical method. In its application for this purpose the axes of abcissæ are, of course, used for time, and the axes of ordinates for distance. On the axes of ordinates, at their proper distances from the starting point, are, of course, indicated all the stations. The intersection of a line through any station parallel with the axes of abscissæ with any given run line will, of course, instantly show the exact time at which any car leaving the terminus would pass any station. This can be readily seen by referring to the diagram in the December issue of the STREET RAILWAY JOURNAL for 1901. In addition thereto, its application to almost any business is oftentimes of great advantage. All industries reduce the items of cost of production or output to some unit basis. In the course of a production of any article of necessity, the units will vary and the cost per unit will vary with different seasons of the year and with the variable cost of raw material, etc. These variations can be strikingly shown by a system of plotting similar to that here shown for the Union Depot Railroad Company, and any differences noted and checked before such differences assume serious proportions.

Transformers for Testing Railway Armatures

One of the most troublesome faults to detect in a railway armature is the short-circuited coil; that is to say a spurious contact between two adjacent commutator bars or the wires connected to them. This trouble should be sought for in a recently completed armature and its possibility thoroughly eliminated before it is placed in a machine. There are numerous causes. Careless soldering is a prolific trouble, as extra solder may get in behind the lugs and bridge them. Carelessness in insulating the leads may also give trouble, and in several other ways the difficulty also obtains. The resistance of the armature coil is so low

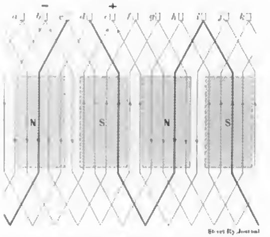


FIG. 1.—DIAGRAM SHOWING WAVE FORM OF WINDING

relatively to the short-circuit that the device of measuring the resistance between adajcent commutator bars all the way around the commutator, fails unless applied with moderate care, and moreover testing the resistance with instruments of any kind is an operation too delicate for the rough-and-ready methods employed in a street railway repair shop, where too often the only testing equipment to be had is two terminals directly connected to the 500-volt service and protected with five lamps in series.

Where alternating current is available, it provides an easy means for detecting short-circuited coils or even coils liable to short-circuit, and is sometimes employed for that purpose. To understand the principle of the apparatus it would be well to consider Fig 1, which displays a four-pole wave winding such as is used on all modern street railway armatures. The shaded surface in the developed plan represents the pole pieces, and the lines together with the small rectangles represent the armature wires and their connections to the commutator bars. It is of course a well-known fact that as this structure revolves under the pole pieces electromotive forces are generated in the wires in the direction shown, and if for any reason there should be a spurious connection between the commutator bars *c* and *d*, or the wires connected thereto, a very heavy current would be generated in the short-circuited coils shown in heavy lines in the figure. This current would be sufficient to burn the coil out if the field were strong enough and the rotations fast enough, and this is exactly what would happen if the

armature were operated practically; therefore this is a contingency to be avoided.

It is very plain that if the armature was rapidly rotated through one polar span first in one direction and then in the other, an alternate current would be generated in the short-circuited coil, which if the motion were sufficiently rapid and the field strong enough, would produce the same result. The short-circuited coil would make itself known by reason of its becoming hot. If the field magnets of the motor were excited with alternate currents, this would have the same effect as oscillating the armature, for the north and south poles would be rapidly exchanging positions. The alternate current method is much more convenient, for it permits of an inspection of the armature while subjected to the alternating flux, and with ordinary frequencies, say sixty cycles, the alternations obtain with more than seven times the frequency that obtains with regular rotation in the field, permitting the use of a lighter and more convenient field magnet on account of the fact that a lesser

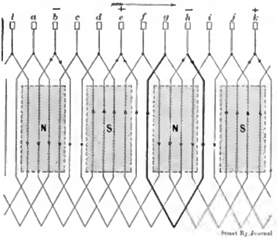


FIG. 2.—DIAGRAM SHOWING LAP FORM OF WINDING

flux will produce equal results under these conditions. Moreover the special magnet core can be built to accommodate many types of armature.

An inspection of the diagram will show that if only two of the pole pieces were thus excited, an e. m. f. would be generated in the coil, and the only effect of omitting the other two pole pieces would be that no e. m. f. would be induced in the wires under them, and current would flow in the short-circuited coil due to half the e. m. f. that it had before, which would be sufficient to warm up the coil and thereby detect its short-circuited condition. Thus one-half of a motor casing could be arranged to be excited with alternate current, the armature could be very readily laid in the same and slowly rotated by hand, and as the short-circuited coil came under the influence of the alternate flux of magnetism, it would warm up and betray its presence. It would thus be possible to test a great many armatures very rapidly and make sure that they were perfect before putting them in the machine for service.

Unfortunately for the simplicity of this arrangement it must be stated that the motor case is not properly constructed to be thus excited by alternate currents. A large portion of its structure is solid and the eddy currents that would be induced would absorb such a large amount of energy that a different design of casing for this purpose would give much better results. A mechanical consideration also enters here, for in a large railway system armatures of many sizes are to be tested and one motor casing would not fit them all, therefore a different plan is still further to be recommended although the principle that has been set forth in the foregoing may be retained.

A precautionary paragraph will be appreciated at this juncture. If an armature with a lap winding such as is used on some generators is treated in this way, the whole armature will warm up under the influence if an alternating magnetic flux be impressed at only a few of the polar positions. This will be plain on consulting Fig. 2. If for instance an alternating flux were applied to the coil terminating at the bars *g h*, it would generate an e. m. f. which would find a circuit through the balance of the winding. The wave-wound armature such as is universally used in railway motors does not encounter this difficulty, for even if alternating flux is applied at only one polar position, it

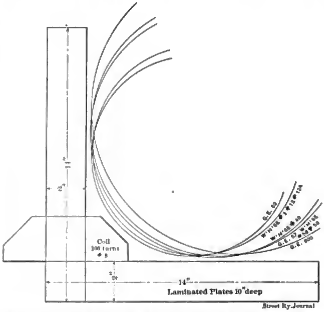


FIG. 3.—SIDE ELEVATION OF TRANSFORMER, SUITABLE FOR TESTING RAILWAY MOTORS

generates an e. m. f. in one coil which is balanced by an equal e. m. f. in an adjacent coil which it will be seen is located in the circuit through which the first coil tends to flow a current in such a way as to oppose and neutralize the flow.

A suitable alternate current magnet for such tests is shown in Fig. 3. It is made of 2-in. sheet iron strips and has a magnetic area of 20 sq. ins. The form of the magnet is right angled so that several sizes of armature, as shown by the circles, will be accommodated, and fluxed at points 90 degs. apart. The winding consists of 100 turns of No. 8 wire and will take somewhat less than 15 amps at 110 volts on a 60-cycle circuit. When testing an armature this energy will be mostly wattless as the power factor will be very low. The procedure should be as follows: First place the armature in its bearings above the magnet and apply the magnet poles, as nearly as the mechanical adjustment will permit. Second, cautiously turn the alternating current into the magnet by means of some rheostatic or reactive device, in the meantime slowly revolving the armature by hand and feeling of the coils as it revolves. After several revolutions have been made the current can be gradually increased to a predetermined maximum, and if no hot coils are found in the armature it may be pronounced free from short circuits. The current should then be shut off and the armature removed, when the apparatus is ready for the next trial.

The current taken by the coil will vary with the iron used in the magnet and particularly with the distance between the magnet and the armature during a test. With

the armature entirely removed the current will increase to several times the testing value and hence it will be well to cut off the current before removing the armature and to protect the testing circuit with an appropriate fuse.

This method has the advantage of not only detecting a short-circuited coil but one that is likely to short-circuit, for at maximum magnetization an e. m. f. is generated in the individual coil, thereby impressing upon the insulation between bars and the wires connected to them a pressure which may break down a faulty place and permanently establish a short-circuit at the weak spot. This of course is much better than to have the same trouble occur when the machine is in practical operation under a car. For this reason the device is superior to a resistance test which would have difficulty in detecting a latent trouble of this character.

Removal of Sleet from a Third Rail

BY GEORGE T. HANCHETT

A formidable obstacle in the case of overhead trolley work is that presented by clinging sleet. In third-rail systems this is a much more serious consideration, and it forms an almost fatal stumbling block to the sectional conductor systems. The sleet to which we have reference is not the shaling ice which sometimes coats the rail, and which will crumble and drop off with a blow, but is more like a coat of varnish. A blow with a sharp instrument, such as a chisel, makes a very narrow mark the thickness of its edge. Another mark ½ of an inch away leaves a little strip which can only be removed by prying off with a sharp point, as a pen-knife. This ice is formed at times when a light rain falls immediately after a cold snap. The metal work of the rails and wires and the lower stratum of air is below 32 degs. F., and as the rain falls into this zone it naturally freezes tightly to anything that it touches. When this occurs on a third rail even only once or twice during the year it forms a serious obstacle to traffic, and an efficient remedy is worthy of consideration.

It is hardly necessary to say that many methods have been tried. Scrapers of many forms have been used with very little success, for those that bear on the third rail hard enough to do any good and at a sufficiently sharp angle to scrape properly, are promptly broken off their supports when they strike the rail-joint.

The overhead trolley has less trouble than the third rail, partly for the reason that in operation it is bent slightly as the trolley wheel passes along it, which tends to crack the sleet off, and partly because its small area enables the currents which it carries to raise its temperature, and a very little rise in temperature suffices to prevent the ice from freezing to it. This suggests a plan whereby the third rail might be relieved of this obstacle, which is so serious as practically to tie up traffic for long periods of time. The expedient is unusual, but great evils justify unusual remedies and possibly the one to be suggested.

The plan is, briefly, to construct the line so that the overhead feeders to the third rail can be switched over and made to reinforce the ground return, thereby causing the third rail to carry full current. This, of course, causes a great drop in the third rail and an undoubted reduction of schedule speed. But if the plan is properly carried out the temperature of the third rail will be raised 8 degs. or 10 degs., which will suffice to melt the sleet already upon it and prevent the freezing of any more thereon. The proposition is rather a bold one, and it is therefore interesting to get down to figures. The specific heat of iron is .1298, that is to say, it requires .1298 B. T. U. to raise 1 lb. 1 deg. F. For 10 degs. we would therefore require 1.298 B. T. U. per pound, or in a 60-lb. rail 77.88 B. T. U. per yard. A mile of third rail would therefore require 137,000 B. T. U., from which it may readily be computed that about 3200 hp would be required to put this heat in the rail in one minute. In ten minutes, however, 320 hp would be sufficient, and if the current could be applied for an hour a little over 50 hp would suffice. Radiation need not be considered in this case, for the temperature of the third rail to start with is assumed to be lower than the surrounding air, otherwise the rain would freeze or turn to snow before it touched the rail. Consequently up to the temperature of the surrounding air the rail will retain all of the heat that it receives. A few degrees above the temperature of the air will cause very little loss of heat by radiation, and in times of sleet of this character all objects in the vicinity are gradually rising to a temperature above 32 F. Furthermore, it must be considered that in supplying 320 hp to the rail an additional amount must be impressed in order to make up for the losses in the return circuits. It would, perhaps, be better to consider a concrete case.

Assume that by properly switching over the third rail feeders to reinforce the ground return we could divide the 500 volts as follows: 10 per cent in the return, 40 per cent in the mile of third rail, and 50 per cent in the operating equipments. This is not an impossible condition of affairs, but would require a thick rail of small action and will reduce the speed of the equipments about three-eighths of their normal velocity, this figure, of course, being subject to modification according to the normal arrangement of the feeders with reference to the third rail. This arrangement would require that about 1000 amps. should flow in the third rail, the equivalent of about four ordinary elevated trains, in order to clear away the sleet in about ten minutes. Lesser amounts of power would suffice if more time for clearing away the sleet could be taken. In any event it does not seem difficult to believe that a railroad management would gladly submit to this condition of affairs for about one-half an hour or more to get rid of the coat of sleet on the third rail, which would otherwise delay the entire traffic.

Another method of applying the same remedy, which is, perhaps, more convenient and universal in its application, is the use of a transformer car. This car should be equipped with heavy shoes, capable of making substantial contact with the third rail and located as far apart as it is convenient to place them. This car should take current from the third rail and pass it through the direct-current side of a rotary converter to ground. The alternating-current side of the rotary converter should feed the primary of a static transformer, the secondary of which is designed for appropriate voltage, and has for its terminals the two shoes of the car. Such an arrangement could readily be designed to pass 2000 amps. or more through the third rail long enough to melt off the sleet and to raise it to such a temperature that it would not be likely to become coated again. This device permits the method to be applied on isolated sections of third rail, and does not confine it to continuous length, as does the other plan, and, moreover, does not require rearrangement of feeders, which in large systems would involve extensive and complicated switching. Furthermore, it will not produce a general reduction of potential on the line. It would require to have very heavy shoes and to run slowly, but it could precede a motor car, thereby leaving a clean third rail for the motor car to traverse. The shoes, while bearing heavily on the third rail, should not be too large, for it

is desirable that they become warm, in order that they may melt through to a contact surface.

Summing up the situation, it may be said that the application of this method is by no means impossible. The necessary amounts of power are not ridiculously large, and are in all cases available where the installation is heavy enough for third-rail work.

How the Berlin Press was Educated in Street Railway Operation

BY LOUIS J. MAGEE

The company which owns practically all the street railways of Berlin, having always been the subject of criticism in the daily papers, decided about a year ago to educate the press so that future criticism would at least be fair and intelligent, if not entirely free from enmity and prejudice.

The plan adopted consisted in a "trolley ride" through the city from a special meeting-place to one of the car houses outside of the city. Representatives of the press in general were invited, the managing directors were on the ground to receive their guests, and the conductor, instead of collecting fares on the way, busied himself with passing a box of cigars. At the car house the newest types of cars and trucks were explained, experiments were made

INSTRUCTING A CLASS IN THE USE OF THE CONTROLLER

with various types of fenders, straw dummies being used for the purpose; and the course of instruction for the motormen was illustrated by putting a class through an oral examination. The party was also shown, on a neighboring street, interesting experiments with various systems of brakes. Great pains were taken to give the information in a popular way and to explain to the journalists the actual difficulties in the street railway service of a great city and the constant efforts being made to meet these difficulties.

An elaborate luncheon was then served in the car house and the general manager made a sensible speech, calling upon the members of the press to do their part in warning, helping and informing the public regarding the great transportation system upon which it is so dependent.

The success of the affair proved the advantages of introducing the public to the details of street railway work, and a second meeting has just taken place along the same lines. On this occasion the visit was to the chief repair shops, situated in another part of the city, and an entirely new set of object lessons was given. One of the most interesting features was the first horse car, No. 1, built in 1865. Another feature was a long row of fenders of discarded types. Trucks without car bodies, completely mounted with motors, air compressors and electric brakes were explained in popular language. The methods of disposing of windows to change a closed into an open car were also shown, and a

A CLASS ROOM FOR MOTORMEN IN BERLIN

walk through the extensive shops showed car bodies, armatures, controllers, etc., in every stage of repair.

The past autumn has practically marked the cessation of horse traction in Berlin, although a few cars, especially outside of the town, have still for a few months longer to be drawn by horses.

In 1893 only 182 men were engaged in keeping up the rolling stock, whereas there are at present 1060 repair shop men, of which 630 are in the main shops. In 1895 there were 1087 cars, and at present 2766, about half of which are motor cars, the other half trailers. These figures would be somewhat increased if the rolling material of another line which is owned by the company were included.

The development of electric traction in Berlin has been very rapid. Hamburg and other cities of Germany were comparatively progressive, but the introduction of the overhead trolley system presented difficulties for the chief residence city of the King, which the authorities could not see their way to overcome.

In 1896 two lines were equipped with trolleys, with the addition of certain stretches of conduit. These latter gave enough trouble (as they were isolated short pieces of conduit) to make the system seem impracticable for any great distance. The mixed system with accumulators, which had given external appearances of success in Hanover, was then adopted in Berlin. But it proved a failure, and familiarity with the trolley construction, which in Berlin has always been first-class, combined, perhaps, with some changes in the city government and more liberal views in general, brought about much more toleration. The result was that to-day the accumulators are all being thrown out and the few pieces of track over which the trolley is not allowed, about a mile in all, are being equipped with conduit. The system was equipped by the Union Electricitäts Gesellschaft.

CORRESPONDENCE

The Zossen Test

MILAN, Italy, Sept. 6, 1902.

EDITORS STREET RAILWAY JOURNAL:

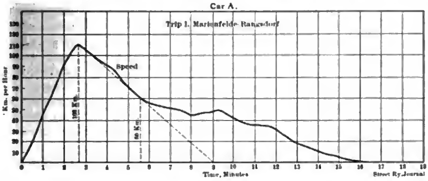
I have just read in the August number of your paper the abstract which you published of the lecture of Mr. Geh. Baur. Lochner on the experiments with high-speed electric traction on the Berlin-Zossen line, and I take the liberty of making certain suggestions in regard to the method followed during that test in calculating the train resistance of car A, taking as the basis the coasting-speed curves.

Mr. Lochner proceeds upon the assumption that the speed diminishes uniformly and in consequence concludes that the resistance per ton is 3.6 kg, although the formula

$$\left(2.5 + \frac{V^2}{1300}\right)\frac{Mg}{1000}$$

gives a value of 5.4 kg.

But it is very evident from the diagrams showing the coasting curves that the retardation is not a constant quantity. It can only be considered as constant between velocities of from 108 km to 60 km per hour.



TIME SPEED DIAGRAM OF CAR A IN ZOSSEN TEST

This will be seen by an examination of the upper curve (Fig. 2) in the article which is reproduced herewith. If now the tangent to the upper part of the curve is prolonged tothe axis of the abscissæ, as has been done by the dotted line in the accompanying cut, it will give the time necessary for making a stop, provided the retardation is constant and equal to that which it has been proved to be at a velocity of about 100 km per hour. If this is also done on the second coasting-curve and we take the average of the two times of stopping, we must reach the conclusion that the car would have been stopped in 360 seconds under the conditions assumed. In other words, the train resistance at these higher velocities would amount to 8.85 kg per ton instead of 3.6 kg as given.

It is possible to check this value of 8.85 kg for the resistance of the car, with the figures given as to the power absorbed from the power station. From the diagrams published with the article it will be seen that at a speed of 120 km per hour the cars A and S absorbed from 400 kw to 500 kw from the power station. If the efficiency of the line with that of the transformers and motors is taken as about 70 per cent., which would be approximately correct, the conclusion is reached that it is necessary to supply to the periphery of the wheels from 280 kw to 350 kw, from which by a very simple calculation it will be seen that the resistance of the cars at 120 km per hour amounts to from 8.10 kg to 10 kg per ton.

From this I am lead to believe: (1) The value of 3.6 kg as derived by Mr. Loehner is too small and is opposed to the results obtained during the Zossen trials; and (2), that the total resistance of the cars at a speed of 120 m per hour was about 9 kg per ton. A. PANZARASA.

The Lighting Circuit of the Car

NEW YORK, Oct. 20, 1902.

EDITORS STREET RAILWAY JOURNAL:

The subject of railway lighting circuits is one which seems to the superficial observer stale and unprofitable. Combinations of five lamps in series seem to cover the situation, a summation of data containing nothing startling. The arrangement, however, has its objections. If one lamp goes out four others share the same fate. The wiring is all high-voltage work, and the repair man has trouble with it, even if the passenger does not. The slender filaments do not withstand either the jar or the varying voltage, and last, but not least, the light is notoriously bad when the car is pulling heavily at distant points on the line. We will preface further remarks by the words "storage battery," so that any readers of your journal who are prejudiced against the battery can pass to the next letter and leave what follows to the perusal of those who really want better light at very little additional trouble and expense.

The storage battery is to consist of five cells. Its negative terminal is to be grounded and its positive is to serve as the ground for all power circuits on the car. All current must pay toll to it before reaching the ground. The lamps are to be connected around the storage battery. Now for a discussion of the results.

In the first place the battery is automatically charged; in fact, on a car that is doing any business the battery is charged so often that sulphating is practically out of the question. Buckling, too, is eliminated, because the rate of charge and discharge never exceeds a certain quantity to which the battery may be proportioned. Even if the battery should suffer serious loss of capacity it could scarcely be placed *hors de combat*, because most of the time its voltage would be maintained by the car current, and the time that it would be compelled to deliver current on its own account would be relatively very short. This, of course, would be true only of a car doing active urban work, in which case the battery could almost deteriorate to the condition of a counter regulating cell and still give a service which would be satisfactory.

An occasional renewal of the electrolyte and a cleaning once a year would practically constitute the maintenance. What is to be had in return for this trouble? First, a multiple system of lighting not limited to lamps of uniform candle-power or multiples of five. Second, a system independent of feeder potential, which means uniformly brilliant lamps at all times. Third, short, stumpy lamp filaments practically impervious to vibration and better able to withstand varying potentials. Fourth, lights at all times even if the trolley is off, or the circuit breaker is out, a consideration in headlight work. Fifth, a reliable low-voltage source of potential for all bell work on the car. Lastly, a low-voltage system of lamp wiring safe to handle and not likely to ground. Is this sufficient compensation? There are, of course, many cases where it will not be, but perhaps a few exist where it will be worth a trial.

R. P. GORHAM.

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After a somewhat protracted investigation the Railroad Commissioners of Massachusetts have officially placed the blame of the unhappy accident in which President Roosevelt was injured upon both the motorman and the operating company. It holds the former responsible for running at a dangerous speed in a particularly dangerous location, and the latter at fault for not enforcing safe speed at this point in general, and condoning by the presence of a prominent official the high rate of speed in this particular instance. We hold no brief for the railway company, but it seems to us that in distributing its favors the Railroad Commission might also very properly have censured the local authorities first for failure to enforce at all times reasonable regulations regarding the speed of cars, and, second, for very inefficient precautions for the safety of the Chief Magistrates of the Nation and Commonwealth. We should by this time have learned that a Presidential guard ought to attend to business first, last and all the time, and should not consider its functions purely ornamental. The cavalry squad of tinsel soldiers that allowed a fast-running car to plunge down upon the carriage they were set to protect ought to be held up to public scorn. Fancy a German car breaking through a squad of Uhlans and bowling over the carriage of Wilhelm the Unresting.

Of course the finding of the Commissioners will sooner or later be reviewed by the civil and criminal courts in the actions which will come to trial, but the main facts stand out with unpleasant distinctness, and will probably remain uncontroverted. The car, whatever may have been its exact speed, was certainly running at a speed which the event proved to be unsafe, and it assuredly was not under effective control when approaching a crossing. Just the degree of blame that must attach to the motorman's act in this particular instance is a matter for the jury to determine, but there is no evidence to show that he was running at a speed much, if at all, higher than was customary at this particular point, or than is often the practice on other interurban roads. The assumption that an electric car has a general right of way which other vehicles infringe at their peril is one which is rarely taken in ordinary urban traction where the street cars are more often sinned against than sinning, but is a license which is often assumed in the case of fast interurban lines. The peculiar danger of the situation lies in the fact that safe operation runs into unsafe by imperceptible gradations, and may pass from one to the other before the situation is fully recognized.

The Railroad Commission has laid down in its recent finding two principles so plain that they should not be disregarded. These are: "There can be no excuse for the frequent recurrence of accidents due to collision. No plea of economy can be properly advanced in defense of inadequate equipment, and no plea of the necessity of rapid transit in defense of dangerous speeds." These principles are thoroughly sound, and few street railway men will be disposed to question their justice. They might, of course, be unwisely applied, but in the matter of rapid transit the interests of the street railways and those of the public are coincident. No community will long permit the road that serves it to be burdened with absurd limitations of speed or oppressed by unreasonable demands in the matter of equipment. On the other hand, it will not long tolerate parsimonious management or reckless running, and the road that cultivates either vice will soon come to grief.

In large distribution systems for lighting or power it is a very common device to install sub-stations whereby alternating-current power is taken from a line and converted through a rotary and stored in a storage battery. The stored power is utilized in many ways to hold up the peak of a direct-current load or even an alternating-current load by the use of the inverted rotary. In connection with such a system there is a possibility of a disaster which is far-reaching in its results and is capable of wrecking every sub-station on the line. This is a heavy inductive circuit such as would be caused by throwing in multiple with the line a large alternator or synchronizing motor without proper regard to synchronism. The result is a tremendous demand for lagging current, which reacts on the converters and wipes out the field excitation. An inverted converter is a dangerous proposition when its field is weakened by means of its drawing a large lagging current from its collector rings. Its speed rises rapidly, and the trouble is cumulative, for the lagging current weakens the field, and the weakened field permits the cur-

rent to lag more. The passing of speed from the normal to a dangerous value is a matter of seconds only. An experienced attendant who happens to be on the alert can detect the increasing speed and may be able to reach the switchboard in time to save the apparatus, but the chances are that he will not and that serious damage will follow. This trouble may occur with currents less than full-load value, and hence will not be protected by the circuit breakers. As this arrangement is so frequently used, it seems essential that adequate forms of protection be devised and exploited. The situation can be relieved by opening the alternating-current and direct-current circuits of the sub-stations. The trouble is coincident with the appearance of a very heavy lagging current in the alternating-current rotary leads, and it ought not to be difficult to provide a device whereby the appearance of this disturbing factor shall actuate the proper circuit breakers. The following method suggests itself as being a practical device.

Two small transformers are installed, one a series transformer inserted in the rotary leads, the other a potential transformer across the line. The secondaries of these two transformers are to be separately led to two independent circuits on a little two-phase induction motor of special design. As long as there is no difference in phase between these e. m. fs. there will be no torque on the shaft of the induction motor, but as soon as current begins to lag the induction motor will tend to turn. This tendency to turn can be balanced by a spring so that the lag must reach a predetermined amount before it will succeed in turning the shaft. The shaft of this motor should be connected to appropriate switches, which will energize proper trip coils on the circuit breakers to relieve the situation. As long as there is a legitimate load on the rotary, even though somewhat lagging, the torque on the induction motor will be slight and can be balanced by the spring. A heavy load on the rotary of small power factor will then not affect the induction motor, but a heavy lagging load, which is a dangerous element, will instantly operate the motor and cut out the sub-station.

In spite of the fact that transfers in some form have been in use for almost as long a period as street railways have been in operation, there has been almost no time when there has been greater diversity of opinion than at present as to the proper form of transfer, the most desirable way of marking on them the various checks which experience has dictated are necessary, or the best method of registering and of otherwise keeping track of these small, but most troublesome, slips of paper. We have already commented on the discussion which followed the presentation of the paper on this subject at the recent convention of the American Street Railway Association, and which indicated a wide divergence of policy as to the treatment of transfers. But if the subject is a complicated one to the railway manager himself, it is even more so to the average passenger, who nearly always believes himself entitled, on the payment of a 5-cent fare, to ride without additional charge to his destination, wherever it may be, provided it is on the lines of the company, and if he is not given a transfer he usually makes strenuous remarks about corporations in general, and feels mortally aggrieved.

Now the passenger's desire for a free transfer is entirely natural and proper, and not without a basis of reason, but his diagnosis of his inability to get one is generally very wide of the mark. As a rule, the operating company would be entirely willing to give him his free transfer for a long extra ride if that were the only question involved, but it naturally objects to setting itself up as an easy mark for peculation or an institution for the encouragement of dead beats. Moreover, it must, as part of its plain duty to the public, conduct its traffic so as to avoid, rather than court, congestion. In this connection we fancy that Mr. Meneely's paper at the convention will be an eye-opener to the layman. When a road proposes so elaborate a system of registration of transfers, inaugurates a secret service, and even plans to offer considerable cash prizes to engage the co-operation of its patrons, it means that the misuse of transfers has become a very serious matter from the dollar-and-cent standpoint. A system like that is not introduced for fun or to exploit the ingenuity of the traffic manager. It is there because it is badly needed, and for no other reason. We earnestly wish that some experienced street railway man would at the next convention bring out the facts and figures relating to the abuse of transfers, so that there would no longer be any chance for misunderstanding on the part of the public. An "experience meeting" bearing on this topic would be of no little interest and value, and would probably disclose feats of ingenious fraud that would be almost past belief. It is the collusion between an occasional employee and a patron quite willing to "beat the company," or, quite as often, the dense moral obliquity of the average passenger himself, that makes the mischief far more than any misuse of transfers legitimately obtained, which, at the most, would secure a rather useless round trip at cut rates.

A still more considerable difficulty encountered in planning a free transfer system is its tendency to produce, unless very skilfully arranged, severe congestion at certain points in the system. This is particularly exemplified here in New York where a really liberal management is frequently abused for not granting transfers which would in fact greatly inconvenience most of the traveling public. Transfer points, whenever possible, must be so arranged as not to throw the burden of a heavy transfer business on lines which are already overcrowded. There is a physical limit to the amount of passengers conveniently accommodated on a single line, and no good comes of passing this limit even with the best intentions in the world. Now, when one adds to these physical requirements the troubles that arise from the readiness of a considerable proportion of the community to take advantage of the company when possible, the problem of getting a convenient and workable transfer system becomes serious. Each new free transfer is related, in a way sometimes very complex, to the system already existing, and it takes the wisdom of the serpent to untangle the matter. And with ever so great care it is often extremely difficult to get at the facts on which to base a sound decision. For instance, suppose a case which frequently exists. Let two fairly long suburban lines meet at an acute angle. Is it wise to give free transfers in view of the fact that transfers at their outer termini nearly, or quite, unite the lines? How serious will the misuse of transfers become, granting that the bulk of them will be used legitimately. Here is a question of amounts which it is extremely difficult to answer. It would doubtless be better to let a few beats get occasional

free rides than to inconvenience a large body of patrons who are properly within a single-fare region, and we think most street railway managers would concur in this opinion; but there might come about a serious leakage in revenue, and the whole question is one of relative amounts which only an appeal to experience could answer. All these intricacies of tramway *finesse* are quite outside the experience of the ordinary citizen, and it would be a most useful bit of missionary work to bring before the public the real conditions which arise in so plain a manner that they would make a permanent impression. And the public, when it understands a case, can usually be trusted to see fair play.

Interurban Braking

Although it is a well recognized fact that on interurban electric roads the rate of acceleration in common, every-day practice is far more rapid than on local trains on steam railroads, there is another fact not so commonly recognized, namely, that the negative acceleration or rate of braking is considerably higher than is common on steam passenger trains. There are two very simple and natural reasons for this state of affairs. One is that the necessity for such rapid retardation has been felt more in interurban work and the other is the superior control of the braking pressure which a motorman on an interurban car equipped with straight air brakes has as compared with the engineer on a steam train equipped with automatic brakes. The automatic air brakes on steam trains necessarily have their brake shoe pressures adjusted to allow a liberal margin under the slipping point of the wheels. On an interurban car it is feasible to work much nearer to the sliding point.

Recently one of our highest speed interurban roads has found it desirable to adopt measures for securing even more rapid retardation than is common on such lines,—the exceptionally high speeds and frequent stops pointing to the desirability of such a move. It has been known for years that the friction between brake shoes and car wheels is considerably less at high speeds than at low with a given brake-shoe pressure. The practical effect of this is that if the brakes are applied at a constant pressure while a train is being retarded they will not retard the train anywhere near as fast at 50 miles or 60 miles an hour as at 10 miles an hour and less, thus increasing very much the distance in which a train can be stopped. If the brakes are applied with sufficient pressure to give the maximum retardation at high speeds the friction between brake shoes and wheels will so increase at lower speeds as to make the wheels slide, since the friction between rolling wheels and rails is practically constant. The maximum braking effect can only be obtained by applying as much pressure as can safely be put on without sliding the wheels at the highest speeds and reducing this pressure as the speed falls off so as to keep it under the sliding point. Of course simple automatic means to accomplish this are desirable, but in the absence of this the motormen on the road referred to are being taught to apply maximum pressure at first at the highest speed and slowly let air out of the brake cylinder as the speed falls off. In order to do this and get the maximum braking effect, air in the storage reservoir from which the brake cylinders are supplied must be carried at a pressure high enough to slide the wheels at low speeds. This is not a practice in itself desirable because with careless use of the brakes there is a chance for flat wheels, but it is justifiable when very high speeds of over 50 miles an hour must be dealt with.

The automatic reduction of brake-shoe pressure as the speed decreases has long been recognized as desirable in steam road practice where, on account of the nature of the automatic air brake, it is not possible to do this by hand. It is only on the fastest trains and within the past few years, however, that the "high-speed brake" which after a manner accomplishes this has been used, and it is doubtful whether this will ever find much favor in electric railway practice. Of course a simple device which would vary the maximum brake-shoe pressure according to the speed would be desirable for use with a straight air brake, but the complications apparently involved in an apparatus which will really do this would seem to be great.

In connection with interurban braking it is noteworthy that a few years ago a number of interurban cars were equipped with automatic air brakes, following accepted steam railroad practice in this respect. It was doubtless considered at that time that since steam railways had found the automatic air brake the proper thing, the wisest thing for interurban roads to do was to profit by the experience. It is noteworthy, however, that at the present time, the automatic air brake for interurban electric cars has been practically abandoned in favor of straight air brakes. The reason for this seems to have been that the automatic air brake, in which the braking pressure is governed not directly by the motorman's valve but indirectly by a reduction of pressure in the train line, involves more complication than is desirable both in operation and maintenance. Where trains of many cars are operated, as on steam roads, this complication seems to be necessary, but on an interburan road, where but one or, at most, two cars are run in a train, experience seems to have shown that the straight air brake is preferable on account of its simplicity in both construction and operation. With the straight air brake the motorman can have direct and instantaneous control over the pressure in the brake cylinder at any instant. With the automatic air brake, the pressure in the brake cylinder is regulated by reducing the pressure in the train line. Letting all the air out of the train line gives an emergency application. If the motorman wishes something less than an emergency application, he must let some of the pressure out of the train line, and the pressure with which the brakes are applied depends both on the suddenness and amount of the reduction in the train line pressure. It is only by considerable practice that enough skill can be acquired to enable a man to apply the brakes with a definite pressure, and even then the motorman has not the control over the pressure in the brake cylinders where the automatic air brake is used, that is offered by a straight air brake system, where it is simply a matter of turning more or less pressure directly from the storage reservoir into the brake cylinders. With the straight air brake, the control of the brake pressure is direct, while with the automatic air brake it is indirect and depends on a number of elements, the variation of any one of which will change the ultimate result. Then, too, the automatic air brake is much more difficult for employees to understand and maintain and is in fact the most complicated mechanism that steam railway trainmen have to deal with. This is so true that steam railways have been obliged to establish air brake schools for their employees. With the straight air brake, there is but little that a man cannot master in a few hours.

Modern Switchboard Practice.

BY H. P. DAVIS

The switchboard is the most important part of a modern electrical installation and to be reliable must be thoroughly suitable in design and construction and in the selection of apparatus and instruments. Convenience, simplicity and ease of operation are factors to be considered in order to realize the ideal of operation, namely, uninterrupted service.

There is hardly an installation that does not have peculiarities of its own necessitating a most careful consideration, while station plans are being prepared, of the requirements of the switchboard and its relation to the building, in order that proper provision may be made for the most efficient and satisfactory layout of circuits and apparatus. Indeed, it often happens that a special construction of the station is necessary to obtain the best arrangement. There are many plants to-day operating with dangerous, inadequate and poorly arranged switchboard layouts, simply because of failure to recognize the importance of the switchboard when originally designing the station.

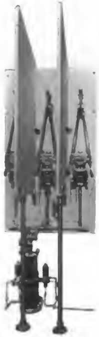


FIG. 1.—ELECTRO-PNEUMATIC CIRCUIT BREAKER FOR 550 AMPERES AT 6600 VOLTS

GENERAL TYPES

In laying out the switchboards for a large system such as are now becoming so common, the designer is immediately confronted with a fundamental question of control; that is, shall the apparatus be operated by hand or by power? Each method has applications for which it is better suited than the other, and it is sometimes a matter of great perplexity to determine which method is most desirable, especially as there is a wide difference in the matter of expense and space required.

Simplicity and reliability usually go hand in hand; it is therefore always advisable to choose the simplicity of the hand operation when possible, as a certain degree of complexity and intricacy is unavoidable with all methods employing auxiliary means for operation of apparatus.

The marble panel type of switchboard now so commonly used represents the most satisfactory switchboard practice when hand operation is allowable, as this method combines a pleasing appearance and great flexibility with maximum economy of space. This method of switchboard construction suffices for the majority of installations, but ease and safety of operation impose limits upon the e. m. f. which can be employed, and in the capacity of the apparatus, beyond which no choice is left so that auxiliary operation is necessary.

Further, it is obviously objectionable to combine so many panels into one switchboard, that its operation is cumbersome and confusing. If the apparatus and circuits are not of such a nature that the panels can be segregated into separate switchboards, it is better practice to resort to auxiliary power with control from a central point.

Hand-operated switchboards are usually built of highly polished slabs of white Italian or blue Vermont marble, 2 ins. thick, with beveled edges, and of a width sufficient to provide space for the necessary apparatus and instruments. Each panel is supported by a rigid angle-iron frame-work of L-section and the individual panels are built into switchboards by placing them side by side and connecting them

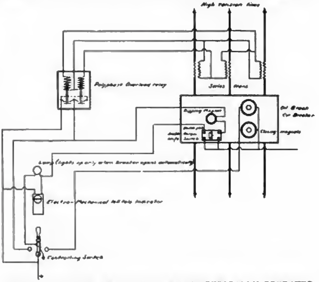


FIG. 3.—WIRING DIAGRAM FOR ELECTRICALLY-OPERATED AUTOMATIC OIL-BREAK CIRCUIT BREAKER AND AUXILIARY CONTROLLING AND INDICATING DEVICES

together by bolts through the angle iron frames at the back This iron frame-work is then bolted at the bottom to a channel iron which serves as a foundation. At the top the frame-work is bolted to an iron bar which runs the whole

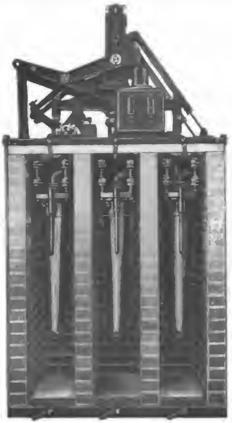


FIG. 2.—HIGH TENSION OIL-BREAK CIRCUIT BREAKER, OPERATED BY ELECTROMAGNETS

length of the switchboard. Provision is made for braces, by which the switchboard may be rigidly supported from the station wall. One panel is always installed for each machine circuit and one panel for each one or two feeders.

The apparatus and instruments are mounted on the mar-

ble and form part of the panels. The connections between the apparatus and the instruments are made directly on the back of the panels, while the bus-bars are carried on porcelain-insulated brackets supported from the angle-iron frame.

The large systems of the present day, involving as they do immense stations with generating units of great size, delivering vast amounts of power, usally at a high e. m. f., present unusual and serious problems requiring special switchboard construction, design and grouping of the apparatus and details to insure the highest degree of safety and reliability of operation. The space required, the capacity of the apparatus, the e. m. f. employed, the isolation of the switching devices, the necessity of fire-proofing and insulating the conductors, all enter as factors in switchboard design, requiring a method of treatment widely different from the marble panel construction.

It is essential in intallations of this sort that the switching and circuit breaking apparatus should be designed and located so that all arcing and current-carrying contacts are accessible for free and ready inspection, while ample space must be provided between the poles of the apparatus, and each should be in a separate and fire-proof compartment. The bus bars and all connections differing in potential must be arranged in the simplest and most direct manner and also in separate fire-proof compartments. Crossing of conductors should be avoided. All inflammable insulation, such as is usual on cables and other similar conductors, and all materials liable to deterioration should be rigidly excluded. To meet these requirements, the switchboard structure should be of brick or concrete, where fire-proofing alone is necessary, and where insulation is required, marble, soapstone, porcelain or glass must be used. The arrangement of bus bars and all conductors must be such that they will be in plain view and easily gotten at, and at the same time no bare metal or live conductors should be so placed as to be dangerous to the attendant. Much space is required for such a construction and it is usual to provide for it by the use of galleries. The cables carrying the high tension currents are lead from one gallery to another in vertical risers forming part of the masonry structure, which can be built with cells or pockets for the installation of instruments, transformers and fuses.

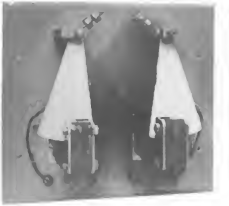


FIG. 4.—POLYPHASE OVERLOAD RELAY

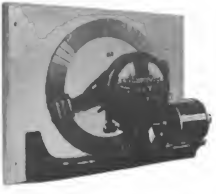


FIG. 5.—GENERATOR FIELD RHEOSTAT, OPERATED BY MOTOR

In general it may be said that the characteristics and important features of this type of switchboard construction is directness and simplicity of connections, with absolute safety from fire and short circuits.

In a construction of this kind, spread out over considerable space, or arranged in several galleries, the apparatus is out of the range of observation of the operator. It is necessary, therefore, that some central or convenient spot be selected from which the apparatus can be controlled by means of auxiliary power, while indicators and signals will communicate to the operator the position and movements of the apparatus.

SYSTEMS OF AUXILIARY CONTROL

Three methods of auxiliary control may be employed for the apparatus, namely, straight pneumatic, straight electric and electro-pneumatic.

In the last two methods there is one fundamental feature common to both, which is, that the connections between the apparatus and the controlling board are electrical and the source of energy for the control circuits is the same, namely, the station exciters or a storage battery. So far as certainty of actual operation of the apparatus itself is concerned, there is practically no preference between the two methods, since successful operation by either can be guaranteed. The primary element of a system of straight pneumatic control is a cylinder and piston operated by compressed air, which to that extent is a simple and powerful operating device. To be controlled at a central point, however, necessitates the running of many small pipes from the cylinders, which are located at the apparatus, to the controlling station or platform where pneumatic valves must be placed. It is at once evident that a system of this kind would be impracticable, except in a small installation, since the amount of small piping would be so great as to make it impossible to keep it in an air-tight condition.

In the use of electro-pneumatic control these difficulties are overcome. The main pipes supplying air for the system can be run directly to the apparatus, and the only small piping necessary consists of short lengths required for connecting the valves on the cylinders to this supply pipe. Small wires are run from the valves to the controlling station to control them electrically, instead of the small pipes necessary in the case of a straight pneumatic control. This system is commonly used. It requires, however, as many electrical connections between the controlling platform and the switches, as the straight electric control, which will be described later. It is evident, therefore, that the use of compressed air, even when the electro-pneumatic method is used, adds a link to the chain of operation which is not required when straight electric control is employed, since it requires a source of compressed air, with the complications introduced by valves and piping.

With the straight electric control all intermediary devices can be omitted, which is a decided step towards simplification and is naturally in a layout of this kind of great importance. Two methods of driving can be used, by motors, or by electromagnets, each having applications for which it is peculiarly suited. Devices which are rotary in their operation, as for instance rheostat face plates, are best driven by electric motors. Devices which reciprocate in their action, such as switches and circuit breakers, are preferably operated by electromagnets.

A revolving motor requires some form of gearing, usually a worm, in order to transform the rotary motion of the motor armature to the reciprocating motion of the switch, and to obtain sufficient power for operation it is necessary to allow the motor armature to make a considerable number of revolutions during one operation of the switch. With an electric motor geared by means of a worm to the switch, it is necessary to throw the motor in

and out of engagement by means of an electric clutch. Again, when a switch is operated in this way, by means of a worm, there is a positive connection to the driving power and failure of the latter in operation is liable to leave the switch in whatever position it may happen to be at that time. Moreover, it is necessary to supply cut-out switches

FIG. 6.—GENERATOR FIELD SWITCH, ELECTRICALLY OPERATED

to open the motor circuit at the limits of travel, devices which are small and to a certain extent increase the possibility of trouble.

The use of electromagnets obviates many of the difficulties mentioned. For this system of operation, the connection is very direct, the moving cores of the closing magnets being connected directly to the mechanism of the switch. The pull of the magnet is, therefore, exerted directly upon the closing mechanism without gearing of any kind. A switch or circuit breaker so operated has no intermediate position in which it may stay, except that of fully closed or open. When a motor is used to close the switch, should the power fail and if it be desired to have the switches open, it is necessary to disengage the worm of the motor shaft from the wheel before the switch can be operated by hand, or, if power is off and it is desired to close the switch, the same disconnections must be made. On the other hand, in case of switches operated by electromagnets, they may be readily closed or opened by hand without changing the switch mechanism in any way.

With electric control the connections between the apparatus and the controlling platform are small wires and the source of power can be either the exciters or a storage battery. As already noted the control must be centralized, for any one of these methods, at a controlling station or platform where will be suitably mounted the small switches and other devices for handling at a distance all of the apparatus in the station, while automatic indicators and signals will make known to the operator all circuit changes of the apparatus whether made by hand or automatically.

SWITCHES AND CIRCUIT BREAKERS

The most vital elements of every system are its switching and protective devices. Very great credit is due to the designers of electrical details for the way in which they have step by step met the ever increasing demand and requirements occasioned by the remarkable growth of our generating stations, until apparatus for this service is now produced and is operated with the greatest certainty and with little apparent effort, under conditions which a few years ago would have seemed beyond the bounds of possibility. A most exceptional record when it is remembered that but a very few years ago, most alternating current switchboards were operated with open knife switches.

On account of the great importance of this apparatus and the interest which naturally centers in it, and to illustrate how rapidly development progresses, and how the shortcomings of existing types are recognized and eliminated, descriptions of some of the latest designs that are recognized as approved Westinghouse practice are here presented.

Two types of switches or circuit breakers have been developed for very severe and heavy service, namely, the carbon-shunt, open-air type, in which the arc is ruptured in the open air; and the oil-break type, in which the arc is ruptured in an enclosed chamber filled with a special oil.

Fig. 1 illustrates a switch of the former type. This circuit-opening device is constructed on the general principle of employing the open arc and carbon break. It is obviously the most simple type of apparatus, and one in which the extinction of the arc depends simply on mechanical distance and not upon the character of materials used in constructing the apparatus. Whenever an arc is confined it must necessarily have a deteriorating effect upon the materials with which it comes in contact. When the currents are heavy or the voltages high, it is obvious that very great

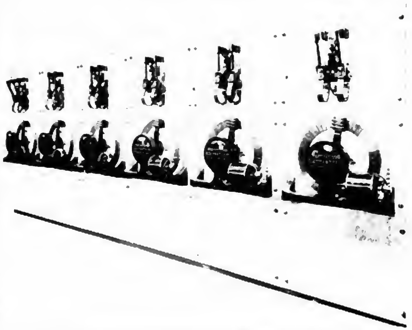


FIG 7.—FIELD SWITCH AND RHEOSTAT SWITCHBOARD, ELECTRICALLY OPERATED

responsibility is placed upon the integrity of the materials composing the switch.

The fundamental principle underlying these circuit breakers is a rational and correct one. The circuit breaker illustrated in the cut is of 500 amps. capacity, designed for use on a three-phase, 6600-volt circuit, and is arranged for electro-pneumatic operation. As will be noted, two cylinders are made use of, the purpose being to obtain a quick action in closing when synchronizing. The method of operation is first partially to close the circuit breaker with one cylinder, the air remaining in the cylinder holding the

circuit breaker in this position, and when it is desired fully to close the breaker air is admitted to the second cylinder, which, through the medium of a floating lever acting on the first cylinder as a fulcrum, quickly throws the circuit breaker into a closed position. As shown each pole of the circuit breaker is protected from the adjacent one by heavy marble barriers, making a short circuit between poles practically impossible.

FIG. 8.—INSTRUMENT STAND

The circuit breaker is so designed that the arcing and the current-carrying contacts are in plain view, a most important feature, allowing the attendant to see at a glance the condition of the working parts. The essential features are the laminated copper brush, the swinging arm, the contact blocks, and the carbon shunts at the top. The contact is made by laminated copper brushes against a flat copper block. The contact pressure of ths brush is sufficient to help the releasing spring throw out the movable arm of the circuit breaker when it is tripped—a very important feature on heavy capacities. The current-carrying contacts are protected by copper shunts, so that, when the breaker is opened, the current is gradually shunted from the current-carrying contacts to the carbons by steps of such low resistance that no arcing can occur until the final break is made on the carbons. This feature obviates all possibility of blistering the copper or current-carrying contacts.

The length of break, or opening of the circuit breaker, is proportioned to the voltage of the circuit. The arc occurs on the carbon terminals above, and is well removed from the metal parts. This construction aids the natural tendency of the arc to rise and prevents any possibility of communication of the arc to any live parts below the carbon terminals. Each element of the set is provided with an automatic tripping coil which acts independently of the others.

As already indicated, this piece of apparatus is closed by means of compressed air and it is held in the closed position by a toggle lock. The valves which are located on the cylinders are operated electrically from the controlling station. The valves automatically exhaust the cylinders after the breaker is fully closed. In addition to the automatic tripping device mentioned, the breaker can be opened from the controlling platform, an electromagnet acting on the tripping mechanism being provided for this purpose.

Fig. 2 illustrates a three-pole, double-break automatic oil circuit breaker operated by means of electromagnets. This switch has all live metal parts completely immersed in oil, of which only a relatively small amount is required. The switch is held open by gravity. Provision is made for easily removing the oil tanks for repairs and inspection.

The switch is erected in a masonry structure, with each pole of the switch and the oil tank in which it is immersed in a separate fire-proof compartment. There are two stationary contacts per pole, one connected to the incoming

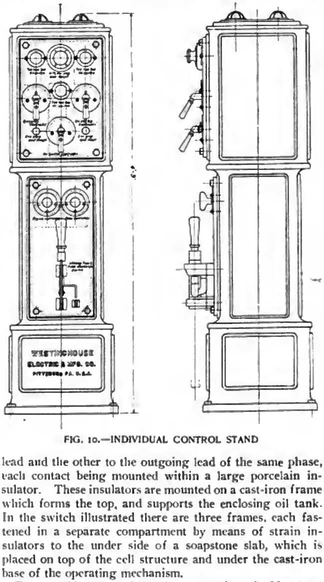


FIG. 10.—INDIVIDUAL CONTROL STAND

lead and the other to the outgoing lead of the same phase, each contact being mounted within a large porcelain insulator. These insulators are mounted on a cast-iron frame which forms the top, and supports the enclosing oil tank. In the switch illustrated there are three frames, each fastened in a separate compartment by means of strain insulators to the under side of a soapstone slab, which is placed on top of the cell structure and under the cast-iron base of the operating mechanism.

The movable contact for each pole consists of a U-shaped copper piece fastened to the end of a stout wooden rod. In the closed position of the switch this U-shaped piece electrically connects the the two stationary contacts of each pole. The wooden rods are fastened at their upper ends to a common cross bar, which, through a system of levers giving a straight line motion, is raised by means of the closing magnets, assisted at the beginning of its motion by a pair of balance springs. This system of levers is locked by a toggle joint when the switch is closed. At opening a tripping magnet strikes a blow on the toggle causing the same to pass beyond the center. Gravity then, assisted by a

powerful spring, causes the cross-bar with the wooden rods and contacts to drop to the open position. There are two breaks in series for each pole of the switch, each break in a separate compartment. The stationary contacts are each fitted with a removable plug which enters a hole in the movable contact. Contact between this plug and the movable contact is broken after the main contacts are broken, hence all arcing occurs on the plug, which can be removed and replaced when worn out. Current for the closing and tripping magnets is derived from the exciters, a storage battery, or other convenient source of low voltage direct-current supply. In case of failure of the operating circuit the switch can be easily operated by hand, without in any way disturbing the mechanism.

The oil tank is constructed of a top and bottom casting and heavy sheet metal sides. This tank is held in place to the under side of the frame casting, carrying the terminal by means of clamps. The interior of the oil tank is lined with insulating cement which is moulded in such a form as to fit closely about the terminals and moving contact piece, leaving just room enough for free movement of the parts and the oil. By this means the amount of oil is reduced to a minimum, thereby reducing the fire risk. The wooden rod interposes an effective barrier between the two terminals of each pole when the switch is open. Suitable levers are provided for moving the tanks so that they can be readily lowered away from the contacts and removed without dismantling the switch.

The construction is such that the entire switch may be set in place and lined up before the oil tanks are placed in position, with the contacts exposed to view so that they can be accurately adjusted. All sediment formed in the oil settles at the bottom of the tank, leaving the oil clear about the contacts. The oil level is readily determined by means of a small sight gage. When necessary the tank is readily drained or filled in position. The tanks themselves are insulated from the circuit and all the live metal parts are inside and in the oil, so that there are absolutely no live high-tension parts exposed.

Mounted on each oil-break switch is a small, double-pole, double-throw, knife-switch. This switch is operated by the motion of the levers of the oil switch and is used for the indicating and tripping circuits.

The controlling and indicating devices for an automatic, electrically-operated, oil-break switch consist of a controlling switch, an electro-mechanical tell-tale indicator and a lamp. These are suitably mounted at the operating station. A polyphase overload relay, connected to series transformers in the main circuits, is provided for automatic opening. The connections are shown in diagram Fig. 3.

The controlling switch, which is of the drum type, has three positions, namely, "closed," "off" and "open," but it will remain of itself in only the "off" position and the "open" position. In other words, if it is thrown to the "open" position it will remain at that position when the hand is removed, but if it is thrown to the "closed" position the switch will return of itself to the "off" position as soon as the handle is free. In this position it connects the control circuit so that, if the oil switch opens through the action of any of the automatic devices, a lamp will be lighted on the operating stand to attract the operator's attention. If the oil switch is opened by the operator by throwing the controlling switch to "open," the lamp does not light.

The mechanism of the electromechanical tell-tale indicator consists of an electromagnet which attracts a pivoted armature through an angle of about 90 degs. Attached to the armature is a disk with a pointer which indicates to the eye the "open" position or "closed" position of the oil switch.

Fig 4 illustrates the overload relay which is electrically connected to the tripping magnet of the oil switches. It is constructed on the induction principle. There are two electromagnets made of laminated iron, and projecting between the poles of each of these magnets is an aluminum sector carrying the movable element of the contact. Surrounding part of each pole of the magnet is a short-circuited turn of copper which produces a lag in the magnetic field passing through this turn and thus produces a shifting of the field across the face of the magnetic poles. This shifting field tends so to move the aluminum sector as to close the movable contacts against the stationary one. The motion of the sector is opposed by an adjustable weight, by means of which the amount of current necessary to close the relay contacts may be varied. The mechanisms of the two sectors are entirely separate, with the exception that the contacts themselves are connected in parallel, so that should either one be operated it will energize the tripping coil of the oil switch and thus open the latter. When used on a two-phase circuit the relay has one of the movements connected to one phase and the other to the other phase, through the medium of two series transformers. When used on a three-phase circuit, a series transformer is connected in each phase and these three transformers are so connected to the relays that when an overload in one or all of the main wires exceeds that for which the relay is adjusted, it will operate and open the switch.

FIG. 9.—CONTROLLING BENCH BOARD

The cycle of operation of an automatic oil switch with all its necessary controlling and indicating devices is as follows: Referring to diagram, Fig. 3, and assuming the oil switch to be closed, the double-pole knife-switch will be closed in position B. In this position the oil switch may be opened automatically by the polyphase overload relay, or by hand by throwing the controlling switch handle to the left or "open" position. In either case current flows from one side of the line through the tripping coil and the knife switch to other side of line. When the oil switch is opened it throws the knife switch from position B, cutting off the tripping coil current, and closes it to position A. If the oil switch is tripped automatically the controlling switch handle will be in the "off" position and as soon as it is open the control current will flow from one side of the line through the indicator and the knife switch to the other side of the line, causing the instrument to indicate open. The current will also flow from one side of the line through the controlling switch, the lamp and the knife switch to the other side of line. This causes the lamp to light up calling attention of the switchboard attendant to the fact

that the oil-break switch has opened automatically.

If the oil switch is opened by hand, the handle of the controlling switch will be thrown to the "open" position on the left. As soon as the oil switch is open the current will flow from one side of the line, through the indicator and the knife switch to the other side of the line. The indicator will then show the "open" position. To close the oil switch the handle of the controlling switch is thrown to the extreme right position. Current will flow from one side of the line through the controlling switch contacts and the closing coils of the oil switch to the other side of the line. The oil switch closes and in so doing moves the knife switch from position A to position B, cutting off the current from the lamp and the indicator, and causing the latter to indicate "closed." As soon as the indicator shows the oil switch closed, the hand is removed from the handle of the controlling switch, which then snaps back to the off position, breaking the current to the operating electro-magnets on the oil switch.

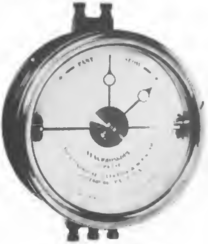


FIG. 11.—SYNCHRONIZER

FIG. 12.—POWER FACTOR INDICATOR

FIG. 13.—FREQUENCY INDICATOR

FIELD RHEOSTATS AND SWITCHES

The field rheostats and field discharge switches for a large installation can be operated by hand, if space and location permit, but usually it is found necessary to employ auxiliary control; the rheostat face plates and the field switches being arranged in a switchboard of the panel form located near the rheostats themselves, which are separate from the face plates and the wires connecting them being made into a large cable. Fig. 5 illustrates a form of rheostat face-plate designed to be operated by a motor which is controlled from a point distant from the rheostat. A cut-out switch is provided on the face-plate to open the motor circuit when the contact arm assumes either of the limiting positions. The face-plate is also provided with a device which indicates to the operator whether the brush or the contact arm is between or fully on the stationary contacts of the face-plate.

The generator field-discharge switch illustrated in Fig. 6 is electrically controlled by means of a magnet, and can be closed or opened at the will of the operator. This switch is provided with carbon tips to prevent damage to the main contacts due to arcing. The act of opening the switch closes a small auxiliary switch, which in turn shunts a resistance across the field winding. This allows the discharge of the field winding to die out gradually and prevents any undue strain on the field insulation. Fig. 7 illustrates a rheostat and field switchboard for the control of the fields of a battery of six alternators. With apparatus of this nature, manipulation becomes a simple matter and the operating devices and indicating instruments can be so located and centralized as to make the control of the circuits an easy matter for a single operator.

THE CONTROLLING PLATFORM

The controlling platform is usually, though not essentially, located so as to give the operator a comprehensive survey of the entire station. The generator instruments are located at the front of the platform, and in some cases have been worked into ornamental stands, as illustrated in Fig. 8, these stands forming the supports for the platform railing. At the back of the platform are placed the instruments for the feeders and auxiliary circuits, generally. These instruments are mounted on marble panels and combined into a switchboard. The controlling switches and other operating appliances are located in the central space of the platform. These controlling switches may be combined in a single bench board, an illustration of one being shown in Fig. 9, or they may be arranged on separate stands, as shown in Fig. 10, each stand containing the control appliances for a single circuit. The writer prefers the latter arrangement, as it is simpler and less confusing to the operator. There is not the possibility of a mistake in the selection of the proper control apparatus as there is in the case on the bench board, where there is greater concentration of apparatus. Both methods are common, however, and with proper attention and care on the part of the operator there is but slight opportunity for a serious mistake.

The apparatus for the exciter and station auxiliaries is usually hand operated and is arranged on panel switchboards. It is best located in close proximity to the apparatus controlled.

SPECIAL INSTRUMENTS AND APPARATUS

The conditions of operation in these large installations have brought many problems to the designer of details, and, without attempting to indicate their nature, it is sufficient to say that the solutions arrived at have added many new devices to the station's equipment. A modern electrical installation with large units and several transmission lines would not be complete without synchronizers, power factor indicators, frequency indicators, time limit relays, reversal relays, etc.

The methods generally used for synchronizing rotary converters or generators by means of lamps, permits the possibility of throwing a machine in multiple with others, while there is considerable difference of phase between their circuits. Lamps merely indicate a difference in voltage across

the switch, and not a difference in phase between the machines, except when the difference in phase produces a diffrence in voltage sufficient to affect the lamp. Moreover, a 100-volt incandescent lamp does not light up below 30 volts to 40 volts, and therefore is a very crude and sometimes unreliable method of synchronizing the machines. Again, it is of much greater importance to have the machines approximately at the same phase than at the same voltage at the moment of synchronizing. Thus, with the average generator, it takes a difference in voltage of 25 per cent to produce a rush of current equal to full load between the machines being synchronized, while a difference in phase of only 15 degs. is sufficient to produce this result.

The synchronizer illustrated in Fig. 11 indicates difference in phase directly, and it is not affected by a difference in voltage. In this instrument the angle between the machine being synchronized is always equal to the angle between the pointer and the vertical position. Thus, if the incoming machine is faster in speed, this angle will vary, causing the pointer to rotate to the right, and if the incoming machine is slower in speed the pointer will rotate in the same manner, but to the left. When the machine reaches the synchronous speed the pointer stops at a definite fixed position on the scale. When the movable pointer coincides with the dummy pointer, the machines are in phase and the main switch may be closed, thus synchronizing the machines in the shortest possible time, and with the least possible current flowing between them at the moment of closing the switch.

It is often essential in railway plants to know the power factor of the circuits, operating, as they do, a large number of rotary converters. The instrument illustrated in Fig. 12 is designed for this purpose and will indicate directly the power factor of any circuit into which it is connected. The range of indication of the instrument covers an entire circle and will indicate the power factor of the circuit with leading or lagging current, or when power is being delivered, in either the forward or reverse direction. When used with generators it serves both as a reverse current indicator and a power factor indicator. When used with rotary converters it will serve as the only indicator necessary on the alternating-current side, for by its indications the field current may be correctly adjusted, and when used in connection with the ammeters and voltmeters in the direct-current side of the converter, it will give a means of determining readily the volt-ampere input to the alternating side.

The instrument illustrated in Fig. 13 is for use where it is required to have an indicator that will continuously indicate the frequency of a circuit. In construction it consists of two voltmeter movements, which tend to rotate the shaft carrying the pointer in opposite directions. These movements are so arranged that when the shaft rotates in any direction, the torque of the movement which tends to rotate it in this direction decreases, and the torque of the other movement increases. It is thus evident that the two movements will take up a position where their torque is equal, there being no spring or other controlling force acting on them. Should the torque of one of the movements be raised by an outside influence the shaft would take up a new position, and the forces acting on it would again be balanced. In order that the instrument may indicate the frequency of the circuits, to which it is connected, the resistance in series with one of the voltmeter movements is made inductive and the other non-inductive. It thus follows that any change in the frequency of the circuit will unbalance the forces acting on the shaft of the instrument and cause it to take up a new position, when the forces would again be balanced. By a proper calibration of the instrument it can thus be made to indicate the frequency of any circuit to which it may be connected.

When the main transmission circuits from a station have branches feeding separate sub-stations or networks, it is very necessary that some selective device be provided to operate the automatic circuit breakers so that they will localize and confine trouble to the branch or network on which it occurs and leave the main circuit undisturbed. It is also necessary to have the circuits in the distributing system so protected that they will not be opened by temporary overloads or by ordinary short circuits, that will easily clear themselves, but will only be opened when the disturbance assumes dangerous proportions. A device designed to meet this condition is illustrated in Fig. 14, and it is called a time limit relay. It consists essentially of a dash pot, the plunger of which is connected to a moving arm carrying contacts which move through an adjustable distance to close

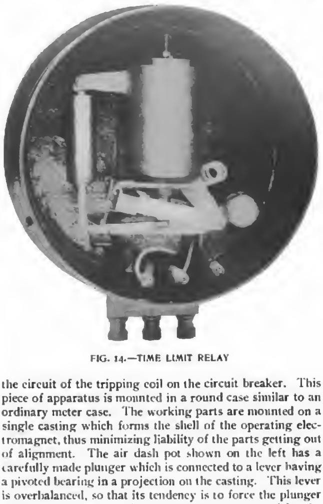


FIG. 14.—TIME LIMIT RELAY

the circuit of the tripping coil on the circuit breaker. This piece of apparatus is mounted in a round case similar to an ordinary meter case. The working parts are mounted on a single casting which forms the shell of the operating electromagnet, thus minimizing liability of the parts getting out of alignment. The air dash pot shown on the left has a carefully made plunger which is connected to a lever having a pivoted bearing in a projection on the casting. This lever is overbalanced, so that its tendency is to force the plunger into the cylinder. This tendency is counteracted by the weight of the core of the electromagnet, which normally rests upon the lever arm, keeping it in the lower position. Upon this lever is fastened the moving element of the contact. The stationary element consists of flat spring pieces fastened to, but insulated from a bent metallic strap pivoted about the center of the lever arm. By varying the position of the bent strap, the arc through which the lever moves is varied and the time is changed. This variation is obtained by a thumb-screw on the end of a movable lever on the outside of the cover, not shown in Fig. 14. The piston of the dash pot being normally down, dust is prevented from accumulating upon its sides, thus obviating from this cause any variation of time required for the travel of piston.

The operation of the relay is as follows: An overload or short circuit in the main circuit sends current by means of a relay through the electromagnet, causing it to lift the core from the lever. The lever now being overbalanced causes the graphite plunger to move upward in the dash pot cylinder until the movable element makes contact with the stationary element. As soon as this contact is made the circuit through the tripping coil on the circuit breaker is completed and it is tripped. Current through the electromagnet is then automatically cut off and the core drops until it rests on the lower arm, causing the plunger to descend and the contacts to separate. The relay is then ready to repeat the cycle when necessary.

The time elapsing between the closing of the circuit and closing of the contacts in the relay can be varied from one to eight seconds. Thus it can be seen that if one of the relays installed in the main feeder is set, say for the maximum time of eight seconds, and similar relays connected into the branch circuits are set for a shorter time, if an overload or short circuit should occur in one of the branch circuits and continue a sufficient length of time, to allow the relay to work, it would only open the branch circuit without disturbing the main circuit. If the trouble does not continue a sufficient length of time to cause the relay to act, it resets itself when the core of the solenoid adds its weight to the contact arm. With a system so protected the main circuit relays would only be operated by an overload or short circuit occurring between the protective devices in the branch circuits and the power station. Time limit relays have several other applications, but the foregoing is the most important one.

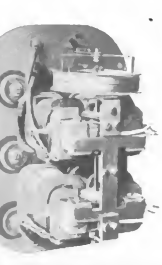


FIG. 15.—POLYPHASE REVERSE CURRENT RELAY

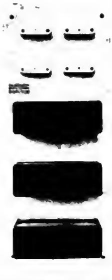


FIG. 16.—LOW EQUIVALENT LIGHTNING ARRESTER

Another form of relay largely made use of on transmission lines is the type illustrated in Fig. 15, and it is called a reverse current relay. This device is automatic in its action, and is required at the sub-station, when it is fed by two or more transmission lines operating in parallel. A short circuit or ground occurring on either line would affect all similarly, and open the overload breakers at the station, thus cutting off the entire supply of current. To prevent this occurring the lines are protected at the station, with time limit overload relays, and with reverse current relays at the sub-station ends. A short circuit or ground occurring on one line, the station ends of the lines are held in by virtue of the time relay, while the line on which trouble has occurred will open at the sub-station end by the current coming into it in a reverse direction from the other line or lines. Being thus disconnected from the other lines the point of trouble can receive current only through its own connection to the main station from which it is disconnected as soon as the trouble has lasted long enough to cause the time relay to open the circuit breakers. Thus it will be seen that trouble on a line operated in parallel with others, causes it to open up automatically at both ends, without seriously disturbing the supply of current. Another application of the reverse current relay is on machine circuits, where it is used to prevent one machine being operated as a motor by others which are running in parallel with it. The form of relay most commonly used is shown in the illustration and is adapted for either single or polyphase circuits. It works on a principle similar to the induction wattmeter, retaining the same sensitiveness and reliability in operation. By means of movable scales it may be adjusted to operate for any predetermined load.

LIGHTNING PROTECTION

In nearly every electrical installation the matter of adequate lightning protective apparatus is of prime importance, and it becomes greater with increased size of the system, for not only do the possibilities of trouble increase, but also the amount of damage resulting from a breakdown. The location of this apparatus in the station and the means furnished for fireproofing and insulating should receive the same careful consideration as the other elements of the installation.

In general the complete protection of electrical apparatus from injury by lightning and related causes requires devices for two distinct purposes; first, to prevent an abnormal rise of potential of the line above the earth. Such strains, which manifest themselves by the grounding of apparatus, may be avoided by the use of lightning arresters. Second, to prevent the local concentration of potential upon a few turns or layers of a coil, which may be produced by lightning discharges and in high tension circuits by other causes of static waves, the use is made either of choke coils or static interrupters, the former for low voltage and the latter for high voltage circuits, where especially good protection is required.

The simplest form of effective lightning arrester is a single spark gap connected between line and ground. It has been found, however, with alternating-current circuits that if the single gap is replaced by its equivalent in several small gaps, and if these gaps are of non-arcing metal the tendency to maintain an arc is successfully resisted. The low equivalent arrester illustrated in Fig. 16 is mounted in such a manner as to give the very best insulation, a fact of especial importance in apparatus exposed to the full force of lightning disturbances. The best quality of marble is used for the panels, and, for the higher voltages, porcelain is used as an additional safeguard. The low equivalent arrester consists of the following parts: A number of small air gaps connected to the line (series gaps); a second similar series of air-gaps (shunted gaps) shunted by a resistance (shunt resistance); and a low resistance in series (series resistance). These parts are connected between line and ground in the order named.

A lightning discharge passes the series gaps and meets opposition in the shunt resistance, and, therefore, jumps the shunted gaps passing freely to earth through the small non-inductive series resistance. When the line is discharged the generator current which follows is withdrawn from the shunted gaps by the shunt resistance which has the same effect as reducing the power of the generator and cuts down the current following the discharge so that the series gaps can readily suppress the arc.

On high voltages an auxiliary adjustable gap gives a

means of adjusting the arresters to the special conditions of the circuit; moreover, by placing in this gap a plate of marble or heavy glass the arresters can be inspected while connected to a live line. The shunt and series gaps consist of one or more "gap units" connected in series. A "gap unit" includes seven cylinders of non-arcing metal, forming six gaps, the cylinders being held in position by porcelain end pieces. The resistances are made from material of high specific resistance wound and assembled on asbestos spools and thoroughly insulated with mica to render them fireproof. The resistances are so mounted as to be thoroughly ventilated.

The properties and advantages of choke coils are well known, and a reference to the illustration, Fig. 17, will show a form which represents the very latest practice, and has for its special features unexcelled qualities of insulation and ventilation attended with an exceptional high choking power.

FIG. 17.—CHOKE COIL

During the last year there has been introduced a device called the static interrupter, Fig. 18, which may be considered as a choke coil with magnified power. It has been devised for cases requiring special protection, such as apparatus connected to high-tension circuits. Like a choke coil it serves to prevent the local concentration of potential which results from abrupt static waves. The power of the interrupter to reduce the abrupt waves of static electricity is very much greater than that of a plain choke coil.

When static interrupters are installed, they are usually placed in the leads from the transformers, or machines, and inside the switches, so that protection is secured from switching which, though causing only slight strains in low-tension circuits, may become dangerous on high-voltage circuits, such as require static interrupters. The static interrupter is then substantially a part of the apparatus to be protected, not of the line.

The interrupter consists of a choke coil, which is connected in series with the line and a condenser, which is connected between line and ground on the apparatus side of the choke coil. The function of the condenser is to absorb as much as possible of the static wave which succeeds in passing the choke coil. The static interrupter is usually constructed single pole, and each interrupter is placed in a self-cooling fluted oil tank. Leads are brought out at the top for connection to the circuit and ground. The choke coil is wound without an iron core, and is very heavily insulated. The condenser is made of thin metal plates separated by sheets of carefully treated fibrous material. The insulating material is provided with ducts which give a circulation of oil through all parts, thus maintaining a uniform temperature. The oil also serves as an insulator.

Lightning or static protection includes either choke coils or static interrupters, as well as lightning arresters. Whether choke coils or static interrupters should be used depends on the apparatus to be used, as well as upon other conditions.

SUB-STATION

Although the power may be generated in one large station, it is not available for use until it has passed through the sub-stations, located at points where they can most economically feed the service mains, which, in railway practice, are direct-current circuits, operating at 500-650 volts.

In the construction and design of the sub-station the consideration of making the building fit the apparatus, and closely conform with the necessities of the switchboard requirements, is of too great importance to be ignored in even the slighest degree. For, in the sub-station, no compromises are required with other types of apparatus, as its equipment is entirely electrical. The switchboard circuits should be laid out to follow each other in successive steps in the direct course of the power through the station.

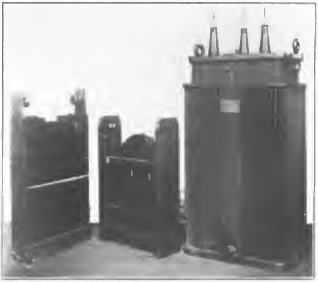


FIG. 18.—SINGLE POLE STATIC INTERRUPTER WITH CHOKE COIL AND CONDENSER REMOVED FROM CASE

The power from the incoming high-tension cables should lead at once, after passing through the lightning arrester circuits, to the high-tension switching devices, then to the high-tension bus-bars, from which the power divides to the separate rotary converters circuits, passing successively through the high-tension switches and the stationary transformers to the low-tension switchboard, from which the alternating-current sides of the rotaries are controlled, and also from which the high-tension switches are controlled, when they are power operated. The current on being delivered from the direct-current sides of the rotary converters passes on to the direct-current switchboard, and from it is distributed to the feeder circuits. This arrangement of the switchboards and apparatus is safe, simple and non-confusing. It is safe, because the high-tension apparatus is separate and isolated from the low-tension switchboards, and so located as to allow plenty of space for insulation and fireproofing; simple because all the wiring can be straight or direct without bunches and crosses, and non-confusing because there will be no mixing of apparatus and circuits which might perplex an operator.

Of course, it is not always possible to provide sufficient space to arrange a layout and build a station in this manner, and it then becomes necessary to resort to gallery construction to provide room for the switchboards and apparatus, but the same thought should not be lost sight of, and, whatever the construction adopted, every precaution should be

taken to make the layout simple and direct and to segregate and separate the low-tension and high-tension switchboards and circuits.

Large units and consequent heavy capacity of the low-tension circuits necessitate special construction and location of the apparatus, and in some instances require auxiliary control, with the circuit breakers each in fireproof and cellular masonry structures. To consider these features in detail would be beyond the limits of this article.

In the selection of protective switching apparatus for the incoming high-tension lines, especially if fed from a large station, the breaking capacity rather than the carrying capacity of the apparatus should be considered, since a large station can supply a heavy flow of power on short circuit, with consequent destructive results, should the switch not prove equal to the occasion.

To provide proper protection it is then often necessary to install switch or circuit breakers like those previously described for the power station, which means that to be operated to the best advantage some form of auxiliary control is required. This can be supplied from the direct-current bus-bars. In the case of starting a sub-station, when no direct current is available, one of the high-tension switches can be closed by hand, thus throwing current on the high-tension bus-bars. Then any high-tension switch connected to a set of transformers may also be closed by hand. This gives low-tension alternating current, which may be used in starting a motor generator set, if one is provided, or else for starting the rotary converter itself by its starting motor. In either cases, direct current will be immediately available and all high-tension electrically operated apparatus can be controlled at will by power.

In the sub-station, for the same reasons as in the main station, the high-tension apparatus, if it is of large size, should be installed in masonry structures with all conductors, bus-bars, carefully insulated and in separate and fireproof compartments, yet so arranged that they are easily gotten at for inspection. In small sub-stations the masonry structures are not necessary, but plenty of room should be provided for the insulation of the apparatus and conductors, and each piece of apparatus should be carefully insulated, and the framework upon which the apparatus is mounted should be of wood, so carefully dried and treated as to be as free from the effects of moisture as possible.

Trolley Lines for the Philippines

On Oct. 21 the Philippine Commission at Manila passed a bill providing for the construction of a standard gage electric railway and for a lighting and power plant. The bill provides that advertisements for tenders shall be inserted in two New York papers, one in Chicago, one in Washington, one in Manila, and in an engineering journal. Maps and specifications will be exhibited in Manila and in Washington at the Bureau of Insular Affairs. The bids will be opened at Manila on March 5.

The line will be 35 miles long, and will cover all the important streets of the city.

The life of the franchise is not to exceed fifty years, and the fares will be 7½ cents gold for first-class passengers, and 5 cents for second-class passengers.

Compensation is to be paid the city for the franchise at the rate of not less than 1½ per cent on the gross earnings of the street railway. After twenty-five years the rates of fare are to be readjusted by arbitration and the city will then have the privilege of purchasing the entire plant at a price to be fixed by arbitration based on the net earnings.

Novelties on the Grand Rapids Street Railway System

The Grand Rapids Street Railway Company has introduced a great many interesting devices for the reduction of labor and the improvement of the economy of the operation. Most of these wrinkles are due to W. W. Annable, electrical engineer and master mechanic of the road, and some particulars of the directions in which the practice of the company differs from that usually followed may be of interest.

FIG. 1.—SAND MIXER AND SAND BLAST FOR CAST WELDING

Considering first the special applications to track work, Mr. Annable has developed a complete cast-welding outfit, including a sand blast for cleaning the joint. This equipment is mounted on a truck, as shown in Fig. 1, using an old Edison 14-motor belted to an air compressor, and on the same truck is mounted Clingman's sand mixer. The apparatus can then be easily hauled to the point of use. The joint is first cleaned by means of the sand blast until the bright metal shows for some 12 ins. on each side of the joint, then it is also sanded just before the moulds for the cast weld are placed around it, so as to eliminate entirely any oxide film which may interfere with an integral contact between the cast metal surrounding the rail and the steel of the rail itself. The novelty of this cast-weld joint lies in the fact that the weight of molten metal surrounding the joint yields up enough specific heat to reduce the rail surfaces in contact to a temperature which approximates that requisite for melting. In order to produce this

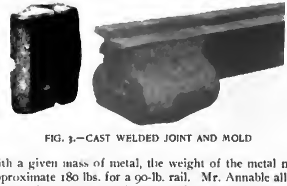


FIG. 3.—CAST WELDED JOINT AND MOLD

with a given mass of metal, the weight of the metal must approximate 180 lbs. for a 90-lb. rail. Mr. Annable allows the metal to pass through the cast-iron mould which surrounds the joint, and in this way adds to the temperature of the joint sufficient heat to produce the metallic union required between the cast joint and the rail. He then reduces the amount of metal required to stay around the joint

so only enough is left to make it mechanically as strong as the rail. One hundred and forty pounds is found ample for this result. It is found that the passage of this extra metal through the mold does not change the chemical composition at the head of the rail, which is subject to the attrition from the blow of the rolling car wheel. The tests on a rail joined in this way show that it requires 60 tons hydraulic pressure on 18-in. centers to fracture the rail, and the fracture occurs at points not adjacent to the joint of the rail itself; practical operation also conclusively proves that the strength of the joint is greater than the rail; the permanent flecture point is reached at about 20 tons for an 80-lb. rail, and the joint shows no sign of weakening until after the elastic limit of the rail has been reached.

FIG. 10.—ADJUSTABLE TROLLEY POLE

FIG. 2.—HOME-MADE CAST WELDING CUPOLA CAR

The cupola in which the iron is melted is shown in Fig. 2. The iron used is scrap, consisting of brake-shoes, broken frames and miscellaneous castings, and the tests cited above were made from iron produced from this mixture of scrap. The cupola shown in Fig. 2 will handle about 14,000 lbs. in one heat, or enough to pour the required amount for joint and spill, for from seventy-five to one hundred joints. The cupola as shown is mounted on a double truck frame made by Mr. Annable, the coke and iron being on separate platforms. A tuyere is provided on each side of the cupola, so that joints can be poured on either track with the least possible movement of the molten iron. The regular form of ladle is used for pouring the metal into the joint, and the matrix or mold for forming this joint is shown in Fig. 3. The blower for the cupola is 30 ins. in diameter, and is driven by an old type of railway motor with the fields connected in series. The speed is 3800 r. p. m., and is maintained constantly during the heat, more or less iron being introduced into the furnace to give the proper temperature to the molten metal.

The joints of about 8 miles of track have been cast-welded in this way in Grand Rapids, and examination indicates that the joints answer every purpose as mechanical and electrical connections. It is well known by those experienced in measuring the electrical conductivity of cast-welded joints that the higher the temperature at which the metal is poured into the mold, the lower the resistance of the joint. As these joints show under test a conductivity greater than that of the rail, nothing more could be desired in the way of ground return conductor.

Before leaving the subject of track work, reference should be made to the use by the Grand Rapids Company of a corrugated cast-iron surface plate, adjacent to the rail at crossing and street in sections. The plate, which is shown in Fig. 4, is employed on the grooved side of the rail and is designed to prevent heavy traffic from damaging the toothing blocks at the points, where they are subject to excessive street traffic wear. Some of these plates have been down five years and do not yet show any wear from vehicle abrasion.

In other departments of its system the company has also introduced novelties in construction which are of considerable interest. For instance, Fig. 5 shows a form of trolley wheel for which Mr. Annable has just secured a patent, and which has been in use for some time. The end of the harp, which otherwise is of the ordinary kind, terminates in two hubs projecting inwardly, while the trolley wheel has extended hubs which project into the annular recesses in the hub of the trolley head. The wheel rotates around a hollow shaft which has inside oil holes. Oil is injected into this hollow shaft through a hole in the end, and flows along the inside of the axle of the trolley wheel, and then along the outside of the axle, giving a large oiling and bearing surface, both for conductivity between the trolley wheel and harp, and also for the pressure of the trolley wheel. The bearing has a long life without chattering or side play to the trolley and avoids the use of side springs for the purpose of conducting a current from the trolley wheel to the

FIG 4.—CAST IRON WEAR PLATE FOR GIRDER RAILS

pole. The sand box used is also novel, as well as ingenious. It consists of a rectangular box, 10 ins. x 10 ins. x 7 ins., shown in Fig. 6, provided with a spout through which the sand is introduced into the box, and also distributed on the track. The box can be rotated on an axle 120 degs., by the motorman, who presses his foot on a button located

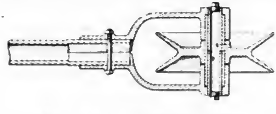


FIG. 5.—NEW TYPE OF TROLLEY WHEEL

at a convenient point near the controller. A pair of sand boxes is used at each end of the truck.

Mr. Annable has also designed his own track drill, which consists of a 1-hp motor mounted in a box, one end of the motor being provided with a flexible shafting running the full speed of the motor, see Fig. 7. The reduction for the drill speed takes place in the head of the drill device, where there is a worm gear which reduces the revolutons in the ratio of 27 to 1. This brings the speed down to 40 r. p. m., which is about right for a 1-in. drill. The drill head clamps the rail and the drill is pushed forward in its feed by an automatic or hand feed as desired.

The bonds for the Grand Rapids road are also made in the company's shop. Scrap copper wire, which is usually old field wire, from which the insulation has been removed, is used for the flexible portion of the bond. The head is a copper thimble, as shown in Fig. 8. The outside of the thimble is tapered and is inserted in an inch hole in the web of the rail, where it is riveted over and in this way securely fastened to the rail. The current density on the contact surface between the rail and the thimble does not exceed 60 amps. per sq. in., which is certainly well within the limits of good practice. The bonds are 160,000 circ. mils. capacity, and two of them are used at every joint which is not cast-welded.

The Grand Rapids Company builds its own trucks, and has adopted a wheel base for single trucks of from 8 ft. to 9 ft. The car body, as shown in Fig. 9, is supported by

FIG. 7.—PORTABLE ELECTRIC RAIL DRILL

elliptic springs at the ends of the truck frames. The side-bar is formed of two pieces of flat iron $\frac{5}{8}$ in. x 7 ins., riveted together so as to make a truss completely around both wheels and extending to the car bolster. The distance between the wheel center and bolster is 4 ft. on an 8-ft. wheel base. The brake rigging is secured on the outside of this frame, and the brakes are applied by a single compound lever, equalized by rods connecting both compound levers together. In this way the brake pressure is distributed equally on all four wheels, as is shown by the uniform wear on all brake-shoes under one equipment. On some of the

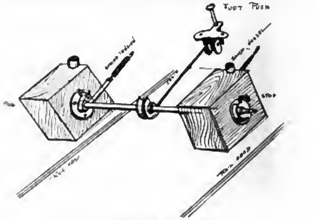


FIG. 6.—REVOLVING SAND BOX

cars the Westinghouse standard electric brake is used as an emergency and traffic brake.

The convertible car made by this company has the follow-

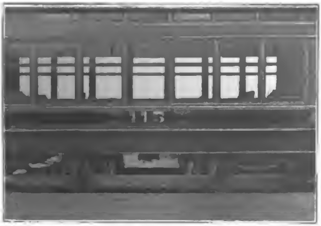
FIG. 8.—RAIL BONDS

ing features. A curtain is provided for the summer car and slides inside of the curtain groove, making the car rain-proof in times of wet weather. As the window-sill is 30 ins. from the floor of the car, and the window is 36 ins. high, all the effect of an open car is obtained. When used as a winter car, the sash frames are placed on the outside of the car under a furring strip, which is permanently screwed over them. Before leaving the car, attention must be called to the arrangement of the seats in the new cars that are now being built. Brownell & Wright reversible seats are used. There are also four permanent seats located in the corners of the car. The turnover seats are located opposite the middle of the windows, which give an aisle room of 25 ins. instead of 18 ins. if the seats were located opposite the side posts of the car. This arrangement increases the seating capacity from thirty-two to thirty-six.

The trolley pole, with its stand, is a novel construction, and is arranged so the trolley can be pulled to the ground for the replacement of trolley wheels, as shown in Fig. 10. This gives a great range of flexibility of the pole, and does not make it necessary for the motorman or conductor to climb to the top of the car, except in the case of a broken trolley rope.

Mr. Annable has found that breakage of pinions is largely due either to an inherently weak gear, or else that the bolts

that clamp the two halves of the gear together become loose, which puts the split gear out of mesh with the pinion, and consequently sooner or later the split gear and pinion, or both, will be wrenched from this cause. In the Grand Rapids shops the gear is made whole, and is forced on a car axle by a hydraulic press before the wheel on that side



GRAND RAPIDS CAR AND TRUCK

is pressed in place. This gives much longer life to gears and pinions and reduces trouble from this part of the equipment.

The Grand Rapids Railway Company also manufactures its own car wiring cables. To make connections the company uses a cast copper trough. The stranded ends of the wire are first turned, and are then introduced into the T trough. The lips of the latter are then bent over by a hammer, and the joint is soldered. When tapped the joint is the same size as the insulation of the original insulated cable.

The Nashville & Columbia Electric Railway and the Nashville & Gallatin Electric Railway have been consolidated as the Tennessee Interurban Electric Railway, and the capital stock of the companies has been increased to $3,000,000. The road that the company proposes to build has been surveyed. It will extend through Nashville as a center, from Gallatin to Mount Pleasant, touching Brentwood, Franklin, Spring Hill and Columbia to the southward, and Goodlettsville, Edgefield Junction, Hygeia Springs, Ridgetop and Eldorado Springs on the north. The road will be 119 miles long, and will pass through a densely populated country, known as one of the most magnificent agricultural and stock-raising sections of the United States. It will constitute a strong factor among the railway interests of Nashville and the tributary country. The traffic in passengers, freight and express, it is estimated, will be very heavy. The incorporators of the company are: C. W. Ruth and Frank Haskell, of Pittsburgh, Pa.; J. H. Connor, J. P. Fulcher and John H. McMillin, of Nashville; Van Leer Polk, of Paris, France; D. D. Spillers, of Gallatin, Tenn.; J. M. Dedman and Major W. J. Whitthorne, of Columbia, Tenn. The officers of the company are: Frank Haskell, president; C. W. Ruth, vice-president and treasurer; Frank P. Bond, secretary; J. H. Connor, general manager.

It is said that a bill to give electric railway companies operating in Pennsylvania the right to carry freight and express matter, and in many other ways to allow them the privileges similar to those now held by steam roads, is being prepared by eminent corporation lawyers of Philadelphia. The granting of the right of eminent domain to street railways will be another clause in the bill.

Comments on the Proceedings of the Accountants' Meeting at Detroit

BY A MEMBER OF THE ASSOCIATION

The saying, "you can't keep a good man down," applies as well to a body of men as to an individual.

The association is fast becoming of great value. While, perhaps, it is putting it too strong to say it is a recognized authority on matters which pertain to it, it at least may be proud of the fact that its assistance is welcomed, not only by the National Association of Railroad Commissioners, but by the Census Department of the United States. We think the association richly deserves the success with which it is meeting. Certainly no association could have executive officers who would devote more time or thought to the work than have those who have had charge of the affairs of this one, and we doubt if any body of men could attend more strictly to business while in session.

Commencing with the address of welcome we shall try and give our impressions of the papers read and the discussion that followed. The association is to be congratulated at being privileged to listen to the able address of Hon. F. A. Blades, Comptroller of the city of Detroit. The facts of his having excused himself from a previous business engagement, and of writing his address, distinctly show that he fully appreciated our calling, but did he not attach greater importance to us than is as yet recognized by those who employ us? True, we "handle the money and account for it," but will not the man who earns the money and economically expends it always be considered the most important factor, and rightfully so? We may be a link in the chain, which should be strong, but it's the executive officer who pulls the chain. "Pride goeth before a fall." We don't give our show in the big tent yet awhile, and care must be taken that some of the tribe of Brutus do not arise and say "upon what meat does this our Cæsar feed that he has grown so great," and cut us off in our youth.

The above is not designed to belittle our calling, for it is no doubt an undisputed fact that the president or general manager who gives his accountant the greatest opportunity to become thoroughly familiar with all the details of operation, and requires from him such statistics as will enable him, as the head of the organization, to get in as concise a statement as possible the cream of the information, and requires the heads of departments under him to consult with the accountant as to details, is the one who is getting the greatest amount of income from his property, and expending that income the most economically. Still we are part of the chain, possibly the hook, but we don't do the pulling. With this idea in mind we will take up that part of the president's address which deals with the subject of the paper he stated he had intended to have had "prepared and presented to the convention on 'Correct Accounting Methods for Electric Railways,' being a treatise on the broad underlying principles of accounting, including depreciation, injuries and damages, sinking fund, etc., with the object of instilling into the minds of those who have the guidance or direction of street railway affairs, the vital necessity of making adequate provision for depreciation."

While Mr. Mackay would have been perfectly justified in having had such a paper prepared and read, after it had received the approval of so many of the members and the disapproval of but one, still we cannot help feeling that the one who advised against the discussion of the subject by our association may have helped steer it away from a rock which might have wrecked it. That the writer is not alone in his views is shown by the following communication from

a gentleman who has been for a long time very prominent in the financial affairs of the country, and whose advice is eagerly sought on all matters of public interest. Being a large investor in street railway securities, he is particularly qualified to speak on the subject. He says:

"I think your association will be of great advantage to those who attend the meetings and are thus enabled to interchange ideas, and that it will result in much good to the companies you represent, but I do not think it would be wise for you to discuss in your convention matters which pertain to the policies of your companies; those matters concern the stockholders, who choose boards of directors to represent them, and either elect executive officers themselves or delegate that power to the directors, and it is these representatives who dictate the policies. The accountants are one part of the machine that carries out the policy. The matter of reserves is one of policy, and it occurs to me that you would be overstepping the bounds of propriety if you were to discuss it."

There has been for a number of years a bankers' association whose meetings are attended by the presidents and directors of some, if not all, of the large banks of the country. They discuss matters of policy. Let us suppose, for instance, that an auxiliary association should be formed, composed of the cashiers or tellers of these institutions. The purpose for which they were formed was to secure uniform and economical methods of transacting the routine of office work. Would it be proper for this last-named association to discuss the amount of reserve the banks should carry? Among the numerous charts of the organization of the various companies we have seen published, are there any which place the accountant's circle above that of the president or the general manager? They have an association. Let it be granted that the subject is one which should be discussed; are they not fully competent to decide when and where they will take it up, without suggestions from us?

"Little boats must keep the shore,
Larger ships may venture more."

It was fortunate for the president that his address came near the opening of the convention, instead of at the close, otherwise he would have had to alter his remarks regarding the "Standard Classification" to read something like this: "Although it 'has met the requirements of the various interests represented from all parts of this great country, and has stood for several years the test of actual practice without the necessity of amendment,' this convention has recommended many changes of vital importance." These changes will be taken up later in this article. The remarks of the president regarding the necessity of a standard classification of construction and operating accounts, covering the lighting department of those companies which have absorbed lighting systems, brings to mind the fact that there was presented at the New York meeting in 1901 a report of a committee on a standard system for electric lighting companies, which was a copy of a report made to the National Electric Light Association at Niagara Falls in May of that year. No action was taken on the report by our association at that time, nor has any been taken since. The recommendation of the president would seem to be apropos, and it may be a topic that will merit discussion at future conventions.

The discussion of the paper prepared by Mr. Sampson, treasurer of the Union Traction Company of Anderson, Indiana, on the "Collection and Reporting of Fares on City and Interurban Lines" was interesting, and showed plainly that the members are continually seeking the most up-to-date methods of conducting their department, and brought out very forcibly the benefit to members from the interchange of ideas. It also brought out the fact that roads are very generally abandoning the old plan on through lines of making numerous collections. In connection with the reading of this paper discussion followed on various matters, one of which was the length of time that trip-sheets or day-cards should be preserved. There seemed to be no unformity in the matter, but in the writer's opinion they should be kept until the legal time has elapsed in which a suit for damages could be brought that might require the use of the day-cards.

The discussion on the paper of J. R. Shurtz, auditor of the South Jersey Gas, Electric & Traction Company, of Camden, N. J., on "The Stationery Storeroom," brought out the different methods employed in the arrangement of stationery.

The report of the committee on "Standard Blanks and Accounting for Material and Supplies" brought out a discussion which bid fair to take up all the time of the convention, until brought to a close by the timely remarks of a member who suggested that no matter how much we might discuss the subject, local conditions are such that no committee would be able to prepare a system which all could adopt; that the best plan was to accept the report and get each for himself such points as he could make use of. This seemed to be the opinion of the majority and it was so decided.

The association has reason to feel highly flattered by the attendance at their meetings of two representatives from the Census Department, W. M. Steuart and T. C. Martin, as well as A. L. Judson, the accountant of the Board of Railroad Commissioners of the State of New York, each of whom addressed the convention and took part in the discussion of such subjects as interested them.

It is unfortunate that Mr. Tripp was unavoidably prevented from attending the convention, otherwise the discussion of a chart of forms he had prepared would have undoubtedly brought out ideas that would have been highly beneficial.

The form of income account as presented by the committee appointed to prepare a standard form of report for electric railways, was such a radical departure from that which had been adopted by our association and approved by the National Association of Railroad Commissioners, that it is most unfortunate that it was not printed and in the hands of members a sufficient length of time before the convention to enable them to digest it thoroughly and realize the significance of the changes. Had they had this opportunity they would have been in a position to present arguments against some of the changes proposed by the committee who had had these matter under consideration for months and were ably prepared to sustain their position. There is no intention on the part of the writer to intimate that the committee was not as capable as any which could have been selected, nor that they did not give the matter the careful consideration the subject deserved, and that they handed in their report as soon as they could possibly finish it. Still I think the association was too hasty in adopting it.

When the subject of "revision" is broached, it is possible the admonition to "stand pat" will be found sound advice.

Of what advantage is it to the companies we represent to have made the changes from "income" to "earnings"? Some of us put the classification, including the forms recommended for monthly and annual report, into effect even before the same were formally adopted by the association, having good reason to believe that the same would be adopted since it had been endorsed by the Railroad Commissioners at their Denver meeting. It upset comparisons for a year, but we thought we were getting something

that would be generally adopted, and something that would be a fixture for a long time, so were willing to make the change. At the end of three years we are told it was radically wrong and great changes are recommended. It will probably be said that we don't have to change our system unless we wish, but is that a very good argument among those who are striving for uniformity?

We are an organization of street railway companies; what are the real earnings of those companies? Are they not the receipts obtained through its franchises? We obtain the rights to operate cars in the public ways and to transport passengers, possibly mail, express and freight also. Do not these items really constitute all our earnings? Is not advertising a side issue, a perquisite, if you will, and more properly an income than an earning? Would it not be much better to deduct rent of land and buildings from expense account number 36, than to show it as an earning? Suppose you hire a building for a passenger station and sublet a corner for a newsstand, is there any doubt that the net rent should be shown in account 36? Is it not equally proper if you rent a part of a building you own, to deduct any rent you may receive from expense account number 3? Are not rents of tracks and terminals based on a proportion of the interest on the investment, added to a fixed rate for maintenance and depreciation? Should not that portion based on the capital go to income and the balance credited to expense? If a company is in a position to rent cars, does it not mean that there has been an extra outlay of capital, and is not the return from that outlay an income? Suppose the same company, in order to accommodate its business at certain seasons of the year, temporarily hired equipment, would it not be perfectly fair to include in income the balance, if there had been more income received than hire paid out? or, if the reverse were true, deduct the income received from the expense account? Is not the above also the case if a company has surplus power to sell? Presumably the rate received is based on the cost, including depreciation plus profit; should not the profit be counted as an income and the balance be deducted from expense?

Why should we deduct taxes paid on real estate purchased or conducted as an outside investment from income from same and show the net as income? Have we not decided that taxes are not expenses, and would it not be just as appropriate to deduct the interest on capital invested in this real estate? Is not the public interested in knowing the total amount of taxes we pay and are we not anxious that they should? Why then bury any part of them in this item? We think the balance sheet and the various schedules presented are very concise and cover the ground in good shape, except that possibly under "track" (page 21 of the report) it might be well to define by notes if under "length of road" is to be included tracks in yards, car houses and shops, or whether those tracks should go under sidings and turnouts; also when a siding ceased to be such and became second main track. Both of these points the writer has had to take up with the commissioners. Under "cars," is it not going to be a little confusing to define which have or have not electric equipment? Most companies shift their motors and controllers from open to closed cars and back again, as the seasons require, but with this exception the cars remain electrically equipped. Would not more explicit directions help us out? I think the thanks of the association are due to the committee for their work, and feel certain it will receive the commendation of the joint committee from the Railroad Commissioners. It is a thankless job, as a rule, and the writer is very glad, indeed, that after having adopted the report as presented, with but slight amendments, the association showed its willingness to trust the matter of making such slight changes as the Railroad Commissioners may require to them. We can't go before that body as a committee of the whole, but they have very generously allowed us to have three representatives, to be chosen by our president. It would be folly to make dummies of them. We think President Mackay has every reason to feel proud of his meeting, and the association certainly has occasion to feel pleased at the manner in which he conducted it. He certainly kept the discussion going on every subject that was brought up. If no one volunteered to speak, enough were invited to be heard to make it interesting.

The writer regrets that other pressing duties have prevented his giving this article all the thought it deserved, but possibly if it had been more extended, readers might have decided with Ray that "he that uses many words for the explaining any subject, doth, like the cuttle-fish, hide himself for the most part in his own ink."

Cincinnati Traction Interests

It is reported from Cincinnati that the papers in the alliance between the Pomeroy-Mandelbaum syndicate, of Cleveland, and the Widener-Elkins syndicate, of Philadelphia, controlling the Cincinnati Traction Company, were signed Oct. 22. The causes which led up to this alliance may briefly be stated as follows: The Pomeroy-Mandelbaum syndicate controls the Cincinnati, Dayton & Toledo Traction Company, formerly the Southern Ohio Traction Company, which has operated to College Hill, 7 miles from the heart of Cincinnati. Here it has been blocked for years by the Cincinnati Traction Company. Some time ago the syndicate purchased a steam road operating to within 3 miles of the heart of the city, but up to very recently its plans to operate cars over the steam road have been successfully blocked. The syndicate is also back of the Miami & Erie Canal Transportation Company, which has a franchise for the use of the canal banks from Cincinnati to Toledo.

To accomplish this the Traction Terminal Company has been incorporated with $100,000 capital to build traction depots and street railways. The incorporators will be J. B. Foraker, Jr., Randolph Matthews, Frank Wilcox, George H. Warrington and Dana Stevens. Mr. Foraker is the vice-president of the Cincinnati Traction Company, and Mr. Wilcox is the vice-president of the Miami & Erie Canal Transportation Company and also the legal representative of the Cincinnati, Dayton & Toledo Traction Company and the Mandelbaum-Pomeroy syndicate; Mr. Stevens is the assistant general manager of the Cincinnati Traction Company, and Mr. Warrington and Mr. Matthews are legal representatives of the company.

The company will organize at once, and contracts will be made by it with the Cincinnati Traction Company and the Cincinnati, Dayton & Toledo Traction Company for entrance into the city of the cars of the latter company. This Traction Terminal Company will also build a traction terminal station for the accommodation of these cars and other interurban cars that come into the city. The question as to the route of entrance of the Cincinnati, Dayton & Toledo cars is to be decided by this terminal company, although it is merely a legal formality to carry out the decision and agreements arrived at between the officials of the Cincinnati Traction Company and those of the Cincinnati, Dayton & Toledo Traction Company. It is stated that the entrance agreement with the Cincinnati, Dayton & Toledo Traction Company is practically the same as those of other interurban roads that have recently secured such contracts, and that the Cincinnati Traction Company will get a percentage of all fares collected and on passengers hauled inside the city limits.

Appropriate Car Decoration

BY H. ARNOLD FRENCH

A street car, with absolutely no ornamentation to relieve its appearance, would be an object of deservedly adverse criticism. Its extreme plainness would not only make it unattractive but actually unsightly and offensive to all public-spirited persons who take an interest in the beauty and tasteful appearance of the streets of the city in which they live. At the same time many of these people, certainly those whose artistic principles have been farthest developed, would, no doubt, prefer the appearance of cars of this description to some which may be seen—though in fewer numbers than formerly. Cars which, instead of being devoid of all decoration, are covered with a copious intermingling of stripes, united with a convolution of broad and fine lines, distributed in every available space on the body, and which have incorporated into this medley of design a mixture of fantastic lettering, which has evidently no value except that of filling a vacuity to which the fertile mind of the designer failed to respond when called upon to furnish more material for design.

But a sensible medium can always be found if diligently sought between the two extremes. Simplicity and artistic taste is much more essential to a master painter in the arrangement of his ornamental work than ostentatious display. Simplicity, in fact, is demanded by most managers, though often more from economical rather than artistic grounds. This has, nevertheless, had a good effect, and has often prevented the master painter from employing a multiplicity of motifs in his designs, for which extravagant waste of time and material there is no possible apology.

Questionable taste in car decoration cannot always be attributed to the master painter, however. This imputation in many cases would be erroneous, for admitting that the painter draws the designs and supervises the application of the colors, the fact must not be forgotten that in many cases, being conversant with the ideas and fancies of those in higher authority, he selects what he knows will be pleasing to them. He is seldom allowed to exercise his own taste exclusively. It is true, that his views are often solicited by his superiors, but for obvious reasons he usually advocates those ideas that experience has taught him will be most acceptable, regardless of his own ideas, which are often compelled to lie dormant for the want of artistic appreciation.

As has been stated, simplicity should be the predominating element in the construction of all ornamental designs used on street cars. This in no sense implies that simplicity is advocated to secure cheapness or that simplicity is in all cases synonymous with beauty. A simple design, painted with color alone, might present a most unsightly appearance, but if executed with gold leaf the same design might be transformed into a very pleasing ornament.

Gold leaf cannot be improved upon by any material used in decoration, whether on a street car or any other vehicle. Its known "sociability," which allows it to intermingle with all colors, shades and tints, without the least danger of violating any of the laws of harmony or disturbing any color scheme, however delicately arranged, proclaims it to be the most valuable of all decorative material in existence. Furthermore, the fact which makes it still more desirable, is, that if necessary, it can be used alone upon any color, without fear of its presenting that incomplete appearance that often accompanies any other leaf or color when similarly employed. Let it be added, in passing, that where gold leaf is used alone for the decorative painting of street cars it denotes, in a most emphatic manner, a vast degree, a keen conception of the propriety of things, combined with much appreciation of artistic results; for the appearance of a car decorated after this manner—with a touch of asphaltum shade here and there, if you please—is very neat and attractive.

The appearance of aluminum leaf ornaments on cars convey to the mind of a stranger, when they are first seen, that the company operating the cars are not absolutely prosperous, especially if gold is used upon cars in the city where he resides. Still, it is extensively used by many companies, chiefly on account of its low cost, when compared with gold leaf. While it cannot by any means be said to give the rich effect produced by gold leaf, yet it is possible to make it quite attractive by a clever combination of harmonious colors with it. In all cases where it is embraced with color in one design, it is very important that it should predominate, as color in this arrangement should not be too much in evidence, for if the color stands out so prominently as to be conspicuous, then its appearance is similar to an "all-paint" decoration.

The persistent use of paint alone for car decoration is evidence, in many cases, that it is preferred to leaf ornamenting or the leaf and color combinations. This preference, which, to the true lover of art, seems a perversion of opportunities, is evidently not always chosen on account of economy alone, for it is seen in many instances where elaborate panel scrolls were "worked out" with color entirely—all of the detail executed with many blends and lines, all of which makes the expense excessive. Again, where light colors are used over dark ground work it requires two and frequently three coats to "cover," so as to give the ornamental colors their full value. This necessitates so much time in the final completion that the cost of this method in time alone would overbalance the expense of even gold leaf. So it is fair to presume that in many cases where the use of "all-paint" ornamentation is in vogue it must be a matter of past ideas, confounded with up-to-date practice on the part of those who are responsible for these costly and antiquated displays. If I should wish to pose as a reminiscent I could relate how, way back in the seventies, it was the fashion to ornament street cars in a similar manner.

The more simple method of ornamenting cars with color exclusively, such as straight striping, or even turning these stripes on the ends into flat scrolls, is hardly worth discussing. Cars painted after this style are very unsightly. Certainly the presence of this kind of decoration on cars fails to conceal the fact that it is only tolerated by its apparent cheapness, and would be far more preferable if it was dispensed with entirely and the cars used in service without any ornamentation whatever. It is more refreshing to note that street car decoration is slowly but surely nearing that point where rich simplicity is the predominating feature, a characteristic also which is noticeable in the high-grade coaches of large steam roads during late years.

Meeting of New York Railroad Club

At the meeting of the New York Railroad Club, held on Oct. 16, President Vreeland, as chairman of the special committee on new quarters, reported the very thorough search his committee had made for a suitable meeting place; the only location recommended was in Carnegie Hall, which, however, was not obtainable on the club's regular meeting night. Having thoroughly considered the matter in all its phases, the executive committee of the club recommended to the membership that the regular meeting night be changed in order to secure permanent and adequate facilities. This recommendation was approved by unanimous vote, and the club will hereafter meet on the third Friday of each month, except June, July and August, at Carnegie Hall, 154 West Fifty-Seventh Street, New York city.

At the meeting of the club, held Sept. 18, there was an interesting discussion on the subject of track construction, which, owing to the pressure on these columns, due to the publication of the proceedings of the Detroit convention, has not been presented in an earlier issue. The principal speakers were J. C. Brackenridge, chief engineer of the Brooklyn Heights Railroad Company; R. Trimble, principal assistant engineer of the Pennsylvania lines west of Pittsburgh, and W. Boardman Reed, engineer of track of the Metropolitan Street Railway Company, of New York. Mr. Trimble confined his remarks to steam railway practice, the others to electric railway practice. An abstract of the remarks follows:

Mr. Brackenridge.—In preparing the roadbed to receive the ties care should be taken to excavate as little as possible below the finished grade line of the bottom of the tie. When the holes are dug carelessly, some being deeper than others, it is impossible to tamp up the track in such a manner that it will retain a perfect surface and line. After the tie holes have been dug and ties laid, the rail should be distributed, then driven up tight to the abutting rail and spiked (no allowance being made for expansion). The ends of the rails being in close contact, the friction between the faces of the ends will help support the joint, prevent working, and the consequent loosening of the electric bonds. Before tightening up the joints, the rail ends should be in surface and line. This latter is a matter that track foremen are very apt to be careless about, and when this is the case a kink will result which it is difficult to get out. The rail is then buried within the pavement which restrains movement of the rail laterally and protects it from sudden temperature variations.

When the track is laid with "T"-rail without paving, surfaced and lined, it should be filled in to within about 1½ ins. of the top of head of rail and to a distance of about 30 ins. outside the gage line. This method of covering the ties prolongs their life, and furnishes lateral support for the tracks. Should the rail buckle or get out of line, due to expansion, it can be remedied by taking off a joint at the place affected, and putting in a trailing-point split-switch; this, however, we find is rarely necessary if the track is

properly lined and surfaced in the first place. Apropos of this, just a suggestion for steam railroad work—when the rails and ties are left exposed, the rails are apt to creep, especially on grades, thus making it difficult to keep crossings with other tracks in line, particularly so if the crossing be at right angles. This difficulty can be overcome and the crossing maintained in perfect line by putting in switch points on either side to take care of the movement of abutting rails. This is a simple method and will double the life of a crossing at points where there is much movement of the connecting track.

The most expensive as well as vexatious question in track work is that of maintaining joints, especially in paved streets; this is due to the poor design of nearly all makes of joints or fish-plates. In designing a fish-plate, advantage should be taken of every square inch of bearing area that a rail affords for a distance of 10 ins. from its end. This all-important fact is overlooked in the design of most of our standard fish-plates used on railroads today. The only satisfactory joint that has come under my observation takes advantage of the horizontal area offered by the base of the rail. It stands to reason that a rail can be better supported by using the 50 sq. ins. or 60 sq. ins. of bearing area offered by the base of the rail than by the angular bearing obtained by most fish-plates under the rail head and on the flange of the rail.

In street railroad construction, where the best pavements are used, such as granite block, brick or asphalt on a concrete foundation, as I said before, the paving costs more than the actual track work. It is, therefore, of first importance that the track, once laid and paved up, should not be disturbed until such time as the rail is worn out. This would not be difficult were it not for the joints, which, with the ordinary fish-plates, give way long before the rail is half worn. I have found that by using a sole-plate similar to the old stringer joint-plate in connection with the regular fish-plates or above-mentioned joints, placing ties 5 ins. between faces at the joints (making a suspended joint), and driving the rails up tight together, tightening the joints, then paving the street with as tight longitudinal joints between the stones as possible from the head of the rail toward the curb, being careful to see that the stone next the rail is fitted up close to it in order to prevent the rail from getting out of line (due to expansion)—on such track there will be no necessity for repairs until the head of the rail is worn out. I am a believer in wooden tie construction, having used the longitudinal concrete beam with steel tie-rods and found that the rigid foundation shortened the life of the rail more than 25 per cent.

One of the difficulties I have found with the 9-in. girder-rail track under heavy traffic was that it always became wide gage, no matter how carefully the track was laid. After giving this subject considerable thought, I came to the conclusion that this was due to the fact of the web being in a perpendicular line with the gage, which threw the weight outside the center of gravity, resulting in the tipping out of the rail, and the consequent widening of the gage of the track. This difficulty I overcame by designing two rail sections, known as the standard Brooklyn Heights Railroad section, which is a tram rail, and a grooved rail on the same principle. In these sections the web was moved back from the gage line about ½ in., and no more difficulty was experienced. The design of the groove rail is such that the flange of the wheel forces the dirt over the lip of the rail and insures a good contact between the head of the rail and tread of the wheel. In other types of grooved rail there is a tendency for the flange to pack the dirt in the bottom of the groove, thereby lifting the tread of the wheel off the head of the rail, making poor contact and causing a greatly increased power consumption.

In closing, I realize that the discussion may deal largely with the wisdom of laying the track with tight joints but my experience has been that, even where the joints are left open, it was found that the friction between the plate and the rail was great enough to prevent the expansion from closing up the joint.

Mr. Trimble.—Assuming that we have a perfectly constructed roadbed, the following points in their natural order of construction are mentioned:

First, Ballast.—This should be of good quality, its purpose being (*a*) to secure solid bearing for the cross ties; (*b*) to hold them in position; (*c*) to provide a uniform support for the track as far as possible; (*d*) to distribute the train load over a large surface, and (*e*) to give good drainage.

In order to provide solid bearing for the cross-ties and to secure uniform support for the track, the ballast should be of some hard, durable material. As a general rule, the writer believes that stone is better than gravel. In order to distribute the train load over as much surface as possible, it is necessary to have a deep bed of ballast under the ties. This bed varies on different railroads from 6 ins. to 10 ins. Owing to the very heavy rolling stock now in use on steam railroads, the writer believes that the time has come when the bed of ballast should be very much increased, and advocates that 14 ins. under the bottom of the ties is not too much. Some engines now in use concentrate on a wheel base of 16 ft., about 225,000 lbs. Considering that this load is distributed over an area of about 200 sq. ft., we have an average load on the supporting roadbed of 1100 lbs. per sq. ft. These are not quiescent loads, but on account of the high speed at which these loads travel over the track, the effect toward depressing and distorting the supporting roadbed must be largely increased over the figures above given. These figures certainly show the necessity of having a good bed of ballast to distribute the loads over as much area as possible, and it has been demonstrated that 6 ins. or 8 ins. of ballast under the bottom of ties is not sufficient to make a perfect distribution.

Second, Ties.—No satisfactory substitute has yet been found for the wooden tie. In order to provide for the loads, the ties should be placed as close together as practicable to allow sufficient room for tamping. The writer believes that with a good sized tie, say not less than 10-in. face, eighteen ties to a 33-ft. rail should be used for standard construction. A treated tie with tie-plates should give very good results.

Third, Rail.—100-lb. rail should be used for perfect track under existing conditions. It should be well manufactured. One of the greatest difficulties encountered by the railroads is the securing of good rail. Our rails are wearing badly, and this is believed by people who have given the subject serious consideration, to be caused by the mills not giving proper attention to the process of manufacture. The writer believes that best results have been obtained from rails laid with broken joints and suspended angle-bars.

Fourth, Joints.—Perfect track, of course, should have a perfect joint. A great many people claim to have a perfect joint, but the writer has not yet seen it. On account of the ease of application and general utility, although the angle-bar is not a perfect joint, yet it is probably as good as any joint we have in use. Better results would probably be obtained were a better quality of material used in the angle-bars. Some experiments with better material have been very satisfactory. In laying rail very particular attention should be paid to the joint spacing, and at the present time many railroads are giving this matter close consideration. Formerly these joints were guessed at, but it is now the practice in laying rail, in order to provide for spacing, that the temperature be taken and the opening be allowed for the degree of temperature of the rail at the time it is laid.

Fifth, Track Fastenings.—Track fastenings are an important feature in a perfect track, and the writer believes for a long time to come rails will be secured to cross ties by means of spikes as at present. These seem to answer the purpose very well, and it looks as if they are fully as good as lag screws.

Mr. Reed.—I must differ with the first speaker as to the best track construction for electric railways, especially for paved streets. As the power applied to the wheels emanates from a revolving armature, there is, or should be, an even application at all points of the circumference, and there is nothing to cause a pound or hammer blow, therefore, I believe, no necessity for a flexible roadbed: I consider a perfectly rigid roadbed by far the best. Especially is this true on paved streets, for every movement of the rail is imparted to the pavement and tends to raise it off its bed. It is impossible to maintain asphalt in even a safe condition unless the track is as nearly rigid as possible and the repairs to any first-class pavement alongside of a flexible track will exceed the extra expense of rail renewals, if there is any such extra expense, which I doubt.

In Manhattan all electric tracks built since 1898 by the Metropolitan Street Railway Company are constructed on a perfectly rigid foundation. In lieu of ties, cast-iron yokes, bedded in concrete, 5 ft. between centers, are used, so that with a 9-in. 107-lb. rail, and twelve-hole 36-in. joint plates there is but little or no give to the structure even with the heaviest cars. This same result can be obtained on the ordinary trolley roads by laying a good concrete foundation under and around the ties or laying the rails on a concrete beam of sufficient cross-section. To be sure, at crossings, switches and frogs there is always a pound, and consequently excessive wear, but that this is increased by having a solid foundation I doubt.

On steam railroads, where the power applied to the locomotive drivers is conveyed by reciprocating parts, no matter how much care is used in balancing there is always a hammer blow struck with each revolution of each driving wheel. The experiment of laying a copper wire on the head of a rail is old, but it illustrates the effect of these hammer blows perfectly. With a solid foundation, therefore, for steam railroads there would not only be excessive wear on the track structure but upon the locomotives as well, so that a flexible track is desirable; I believe for this reason

joint plates should not be too long and should be supported and fitted as well as possible to the rail, so as to prevent any lateral motion, and to prevent the drop of the drop rail. Track for steam railroad has been laid experimentally on concrete foundation, but did not prove a success, for the concrete was not sufficiently elastic to withstand the pounding of locomotives.

The joint has always been the weakest part of any track, whether on a steam or electric road; the 36-in, twelve-hole joint so generally used on 9-in. girder rails for electric railways is strong enough and should never break, yet it will not hold up the rails during their life. The theory of supporting the rail at the base as well as the head by the joint plate is, like many others, better than the practice owing to the variation, slight as it may be, in the height of adjacent rails. Welding, whether cast-iron or electric, makes as nearly a perfect joint as can be had, but it is not suitable for rails exposed to great changes of temperature, and even on rails buried by pavement it has its drawback. The necessary heating of the rail-ends makes them brittle, so that either rails or joints will break in cold weather or track will get out of either line or surface, and is likely to play havoc with intersecting lines. Could ends of rails be machined and joint plates of almost any of the existing types be machined to fit them, a perfect joint could perhaps be obtained and joints would hold up during the life of the rails, thus lessening materially the worry and labors of all track masters.

Christensen Air Compressors for Shop Work

As stated in a recent issue, N. A. Christensen, who has been superintendent of the Christensen Engineering Company, of Milwaukee, since its organization, has personally undertaken the manufacture and sale of Christensen air compressors for miscellaneous work. This will not interrupt in any way Mr. Christensen's connection with the Christensen Engineering Company, with whom he is still engaged as consulting engineer, and with his other interests remain undisturbed. The air compressors furnished by Mr. Christensen will be manufactured by the Christensen Engineering Company under his own designs, specifications and inspection, insuring the same excellency in design, detail and workmanship which the products of this company have always possessed. The new arrangement, however, leaves him free individually to extend the introduction of his system of air compressors in a rapidly extending field. There are now in use over 7000 of these compressors, of all sizes and capacities, construeted under his patents and used for various purposes, such as sand blasts for cleaning rails, air blasts for cleaning cars, motors, generators, etc.

Mr. Christensen's engineering and sales offices are located in the Herman Building, corner of Wisconsin Street and Broadway, Milwaukee.

Tramways in France

The accompanying two tables give statistics for the year ending Dec. 31, 1901, of the light railways and tramways in France. and are taken from the official list of the French Government published Aug. 21, 1902. Properly to understand the tables, it should be stated that the classification of railways and tramways by the French Government differs considerably from that followed in this country. A distinction is made in France between main trunk steam railroads and those which are not part of the main trunk systems. The latter are called "lines of local interest" or "light railways," and all of the roads given in Table I., with the exception of the mountain railways, are operated by steam.

Under the heading of "Tramways," the French classification includes a number of short interurban lines, which carry freight. Most, if not all of these roads, which are referred to in the first three lines of Table II., are operated by steam. Tramways for passenger business only—that is, city and suburban lines—are given in the two final sub-divisions in the tramway table. The totals given under the heading "number" apply to operating companies, and not to roads.

A brief character sketch of Alfred Beit, a member of the firm of Wernher, Beit & Co., of London, Eng., who, besides their other interests, control street railways in South Africa, Mexieo, Chili and Portugal, appears in "Everybody's Magazine" for October. Mr. Beit is only about forty-five years old, and a bachelor. People say he is worth $375,000,000. He came of a Hebrew family in Hamburg, went to college and served an apprenticeship in a Hamburg bank. After his apprenticeship he went to Kimberly and rapidly built up a fortune in the diamond fields. From the time that Cecil Rhodes consummated his great consolidation of the Kimberly diamond mines in 1889, he and Beit were in close business assoeiation. Mr. Beit is very small in stature, and when he was seen, as it often happened, in company with Mr. Rhodes, the contrast was almost ludicrous. He is as thorough and precise as Mr. Rhodes was general and heedless of details. He is very blonde, with prominent eyes of steel blue, and is almost dandyish in his dress. The actual figures of Mr. Beit's wealth are probably known to no man; but it is certain that he is one of the richest men in the world, and almost the only man to whom the Rothschilds are willing to play second fiddle, as in the great De Beers Company, where his holdings much exceed their own. Those who do come to know him find him personally a very sunny-tempered man, well read, well traveled, well groomed, by no means the typical millionaire of fiction or the stage.

The recent wreck on the Lake Shore Electric Railway at the crossing of the Nickel Plate steam road is said to have been one of the most expensive in the history of electric operation, and, if the electric company is obliged to pay for the damages, it will make a sorry hole in the earnings of the company. Brakes on the electric car failed to work and it plunged into a freight train, demolishing eight Armour refrigerator cars, said to be worth $10,000 each. The cars were loaded with hams and bacon for export shipment, and the total loss is said to aggregate $200,000.

TABLE I.—LIGHT RAILWAYS

	Total	Length		Cost of Installation	Gross Receipts		Expenses		Profits	
		Built	In Operation		Total	Per km. of Track	Total	Per km. of Track	Total	Per km. of Track
		km.	km.	fr.	fr.	fr.	fr.	fr.	fr.	fr.
With State guarantee	37	4,179	3,934	273,729,551	14,391,022	3,797	13,006,461	3,432	1,384,561	365
Without State guarantee	31	1,316	1,217	230,257,462	19,285,377	15,886	14,290,165	11,771	4,995,212	4,115
Totals	68	5,395	5,051	503,987,013	33,676,399	6,739	27,296,626	5,455	6,379,773	1,275
Mountain railways	12	30	30	22,568,636	1,234,407	12,566	772,673	26,644	461 734	15,922
In Tunis and Algiers	1	43	43	2,667,830	182,517	4,245	....	......	....	....

TABLE II.—TRAMWAYS

	Number			Length		Cost of Installation	Gross Receipts		Expenses		Profit	
	Total	Partly or Entirely Electric	Entirely Elec	Built	In Operation		Total	Per km. of Track	Total	Per km. of Track	Total	Per km. of Track
				km	km	fr	fr.	fr.	fr.	fr.	fr.	fr.
For passengers and freight with State guarantee	31	0	0	2,578	2,437	132,068,337	7,679,503	3,151	7,196,846	2,953	482,747	198
For passengers and freight without State guarantee	25	4	4	416	411	38,530,296	3,977,403	9,677	2,938,683	7,150	1,038,720	2,527
For passengers, baggage and parcel business	22	8	8	252	251	33,002,833	4,117,813	16,212	3,329,240	13,895	588,573	2,317
For passengers only, in Department of Seine	11	10	6	479	613	240,125,758	42,639,866	69,559	37,398,411	61,009	5,241,455	8,550
For passengers only, outside Department of Seine	56	53	47	1,178	1,194	317,982,061	41,133,133	34,479	30,635,417	25,679	10,497,7,6	8,800
In Tunis and Algiers	..	..	..	230	214	22,192,394	3 016,770	14,097	2,424,609	11,330	592,161	2,767

Convertible Interurban Cars

The accompanying engraving shows one of four convertible cars for interurban service recently built for the Manitowoc & Northern Traction Company, by the St. Louis Car Company.

CAR FOR MANITOWOC & NORTHERN TRACTION COMPANY

The cars have a steel channel bottom frame work, and are mounted on St. Louis Car Company's No. 23 truck. The car bodies are 34 ft., and the length of the cars over all is 45 ft. The roof is of the steam coach pattern. The interior finish is mahogany throughout, and the cars are fitted with the St. Louis Car Company's latest style of walkover seats. The cars are also equipped with the St. Louis Car Company's arc headlight and interior arc lamps.

These cars are also provided with smoking compartments in the rear end, and are in great favor for trolley parties. They are lettered "Manitowoc & Two Rivers Railway."

The Morehead Return Trap

The Morehead return trap, which has given good results in a number of electric railway plants, is constructed of steel, the heads and longitudinal seams being closely riveted and calked, to withstand any pressure carried on the boiler without breaking, which is impossible with cast-iron traps. It is the embodiment of simplicity, there being no rubber joints to blow out or leak, and and only one valve, which is on the outside. All working parts are on the outside, in plain sight and easily accessible. There is no ball or globe float inside the receiver to collapse, leak, rust or stick.

This trap is usually located 6 ft. or more above the water line of boiler. The water from the condensing surfaces is forced by the pressure of steam from behind, through a pipe leading to the trap, with a swing check valve close to the latter. As soon as sufficient water has entered the receiver to overcome the weight on the arm, the receiver tilts down, allowing the water to pass through the discharge pipe, at the same time opening the steam valve, which has a pipe connected with the dome of the boiler. As soon as the receiver is empty it tilts back, as before, and again refills. The trap is prompt in opening and closing, its action being due entirely to gravity, and when once set up it requires no further attention. It takes water from the condensing surfaces, whether they are above or below the water level in the boiler. It also supplies all the water needed in the boiler from the main water pipe, providing there is enough pressure on the main to lift the water to the trap, thus performing the duties of a pump or an injector. It operates equally well with high or low pressure coils, or coils using exhaust steam, allowing no condensation to collect in them.

Where a return trap is not employed the usual way of handling condensation is by means of a pump. The advantages in favor of the use of a trap can be enumerated briefly as follows: A pump will not lift water at a temperature exceeding 212 degs., a return trap will. A pump consumes a considerable amount of steam. For example, an ordinary duplex boiler-feed pump requires from 90 lbs. to 120 lbs. of steam per horse-power hour. A common slide valve engine seldom consumes less than 40 lbs. per horse-power. The Morehead return trap consumes less than 10 lbs. per horse-power. The pressure is admitted to the surface of the water and is automatically shut off before the tank is empty. The steam used is only such as is condensed by the latent heat passing from it into the water in the tank, which is all put back into the boiler.

The Morehead return trap requires practically no attention; needs no lubrication; will not race or run away; never sticks; is noiseless; requires little room and no foundation. The trap is manufactured by the American Blower Company, of Detroit, Mich.

The Montgomery (Ala.) Traction Company is laying its track on Dexter Avenue, the principal street of this city. The line is practically completed to Pickett Springs, 4 miles north of Montgomery. This company has five new first-class cars, and will start running regularly within ten days. W. H. Ragland is the president, and John G. White & Co., of New York, are the contractors. The company is having difficulty in crossing the tracks of the Montgomery Street Railway; but it is presumed that all matters of difference between the two railways will be satisfactorily settled within a few days

RETURN TRAP

Johnson's Trolley Retractor

This device is intended to furnish protection to the overhead construction, trolley poles and wheels by instantly retracting the trolley about 15 ins. below the wire whenever it gets off the line. It has operated successfully through severe storms and 10 degs. below zero without being out of service a minute.

It is made entirely of steel, is simple of construction, and every adjustment can be made from the outside of the car.

Fig. 1 shows the retractor in position on the dash of a car, connection being made with the regular trolley rope by means of the clamp I, Fig. 2, the latter cut showing the position when the trolley is retracted.

The machine consists of rotatable casing, mounted in a suitable frame and containing a tension reel provided with an automatic adjustable locking device and a retractor arm of suitable length, receiving the power of the springs E through the medium of the arm F and yoke G. In Fig. 1 there is a maximum of spring power and a minimum of leverage. In Fig. 2 the order is reversed, the minimum of spring power and maximum of leverage at H, which in this machine gives 75 per cent more power in the last position. As the retractor springs can be wound up by the ratchets D to agree with the trolley-pole tension, the vicious action of unnecessary power on the start is obviated in case the harp should be pressed against the wire.

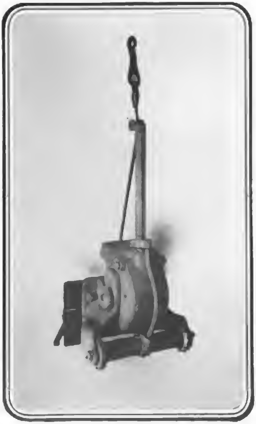


FIG. 1.—RETRACTOR READY FOR SERVICE

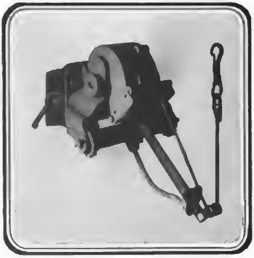


FIG. 2.—TROLLEY RETRACTED

The spring power at E is divided, and should one of the springs break it still leaves energy enough in the remaining one to get the trolley out of danger. It is claimed that the breaking of both springs would merely change the machine into a trolley catcher, and that a broken spring can be replaced in three minutes without removing the device from the car.

The action may be briefly described as follows: When the car is running and the trolley is on the wire the tension-reel accommodates the variations in heights of line, but when the trolley jumps from the wire, a sudden upward movement of 3 ins. or 4 ins. locks the reel and raises the latch C. The arm then swings down like a movement of the human arm, and carries the trolley with it, the reel remaining securely locked while in that position. But when a small lever, which is raised to an upright position behind the button B, so that it can be readily found in the dark, is moved to the left about three-fourths of an inch, and a downward pull of an inch or two is given on the trolley, the locking device is thrown out of gear and the trolley can be manipulated with the utmost freedom. After the trolley is replaced on the wire the arm is raised to an upright position, and the locking device set in action, the small lever being locked so that it cannot be tampered with. Fig. 3 illustrates the locking device, which permits the conductor to manipulate the trolley with freedom.

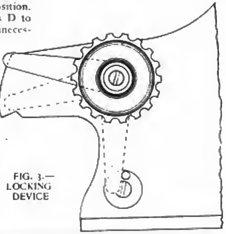


FIG. 3.—LOCKING DEVICE

Plans of the American Car Company

The purchase of the plant of the American Car Company, of St. Louis, by the J. G. Brill Company, of Philadelphia, was reported in September in the STREET RAILWAY JOURNAL. The reorganization recently effected included the election of an official board, composed as follows: President, John A. Brill; vice-president, Samuel M. Curwen; secretary and treasurer, James Rawle.

It is the purpose of the new company to build the cars and trucks of the Philadelphia house. The companies will work conjointly, the St. Louis concern taking care of the Western and Mexican business, which of late has so far exceeded even the large capacity of the Philadelphia plant that some such move as this was imperative. The Brill Company is particularly fortunate at this juncture to secure the affiliation of a plant so admirably situated and well equipped. The heavy special machinery for the manufacture of the solid forged truck frames has been increased in the Philadelphia shops to provide for the extension of business, and for the present all the truck frames will be made there. The difficulties attending the process necessitates a force of men of long experience in handling these large and intricate forgings.

The high quality of material and workmanship and the minute attention to every detail of manufacture which has always characterized the product of the Brill Company will be duplicated in the output of the American Car Company by the adoption of the same methods of employment of expert workmen, supervision by foremen of long experience in special lines, and by the intimate association in all matters on the part of the officials, themselves inventors and practically versed in everything connected with car and truck building. The American Car Company has commenced under the most favorable circumstances, and will undoubtedly be successful and prove a valuable extension of the parent concern.

Electric Railway In Corea

The electric railway in Corea, which was partly wrecked in 1898, owing to the superstition of the inhabitants, has been re-equipped by Messrs. Collbran & Bostwick, the owners, and a power station for the supply of current for the line as well as for lighting purposes, has been installed. The station is equipped with Babcock & Wilcox boilers, and engines made by the Ball & Wood Company, of Erie. The road is about 9 miles in length, with a 3-ft. 6-in. gage.

Systematic Protection of Fare Collections

The development of interurban and suburban traffic in conjunction with street railways for city service, taken together with other modern conditions which make it necessary for city lines to issue transfers, tickets, etc., calls for a larger classification of collections from passengers carried than is now generally the practice. The Ohmer Fare Register Company, of Dayton, Ohio, has recently perfected its new No. 3 machine, which is intended to meet these requirements.

With this register no trip cards are necessary, and no receipts of any kind are punched or passed from one conductor to another. When not in service the register is always locked, and it cannot be operated until the individual key of one conductor is inserted in the register. After inserting the key the printing device is unlocked, and with the first printed statement taken, which will include the conductor's number, the register can then be operated. The conductor's individual key must remain in the register as long as he has the car, and his number will be printed with the statement taken every half trip. At the finish of his run he removes the key, and by so doing locks the register. The key cannot be removed until the registration is complete and the mechanism returns ready for the registration of another fare. The succeeding conductor follows the same operation.

For ease and understanding of the operation of the register a duplicate of the record given by this machine is shown in Fig. 1, in which fares are recorded as indicated by the headings at the top of the respective columns. From this it is very easy to determine the total collections in detail for each conductor, thus, conductor 34 is shown to have collected 175 5-cent fares, 58 3-cent fares and 37 2-cent fares, making a total of $14.19, in addition to 102 tickets,

	5¢	Tickets	Transfers	3¢	10¢	Passes	
•	6625	6156	5981	5837	5733	5736	MAR 4 NS
9	6625	6156	5981	5837	5733	5736	MAR 4 25
8	6566	6124	5954	5819	5722	5733	MAR 4 25
7	6485	6077	5920	5795	5701	5731	MAR 4 25
6	6422	6040	5894	5776	5685	5729	MAR 4 25
	203	116	87	61	48	7	
6	6422	6040	5894	5776	5685	5729	MAR 4 19
5	6372	6013	5871	5762	5675	5726	MAR 4 19
4	6317	5981	5848	5744	5663	5724	MAR 4 19
	105	59	46	32	22	5	
4	6317	5981	5848	5744	5663	5724	MAR 4 34
3	6252	5942	5822	5720	5650	5722	MAR 4 34
2	6202	5912	5802	5704	5639	5719	MAR 4 34
1	6142	5879	5775	5686	5626	5717	MAR 4 34
•	6142	5879	5775	5686	5626	5717	MAR 4 NS
	175	102	73	58	37	7	

	5¢	Tickets	Transfers	3¢	10¢	Passes	
•	6625	6156	5981	5837	5733	5736	MAR 4 IS2
•	6142	5879	5775	5686	5626	5717	MAR 4 IS
	483	277	206	151	107	19	

RECORD GIVEN BY REGISTER

73 transfers and 7 passes. Conductor No. 19 has collected 105 5-cent fares, 32 3-cent fares, and 22 10-cent fares, making a total of $8.41 in addition to 59 tickets, 46 transfers and 5 passes.

The printed figures at the bottom are simply duplicates of the first and last impressions shown on the record, and it may be optional with the management to have two or more copies for distribution. It will be observed that the first statement was taken by the inspector March 4. A duplicate of this statement must be taken by the conductor entering the car on his first trip. In this case conductor No. 34 took the car at trip No. 1 and left it at beginning of trip No. 4. Conductor No. 19 succeeded No. 34 at trip No. 4 and finished at the beginning of trip No. 6. Conductor No. 25 succeeded No. 19 and finished at trip No. 9, when the car was run into the barn and inspector No. 2 took the last statement.

The Ohmer register is considered by some to be designed particularly for interurban roads, but is claimed by the manufacturers to be equally well adapted for large city lines. With one copy of the register record sent to the general office the work of each conductor can be computed and entered without waiting for the report of the local cashier or receiver. It gives the company a complete statement of all transactions on each car and makes a most positive check over cashier as well as conductor. As the register contains duplicate reports of the day's receipts, and as the cashier has only one, the other report can be referred to by the managing office to ascertain if the cashier is faithful in his duty. With this system the cashier can be eliminated, the conductor making reports directly to the company by depositing his collections in a safe at the local station provided for the purpose. The register will keep a complete record of all the fares in the denominations in which they have been received from passengers.

A Large Electric Truck for Italy

What are said to be the largest and most powerful trucks ever built for electric service are those of an order recently completed by the J. G. Brill Company, of Philadelphia, for the Mediterranean Thomson-Houston Electric Company, of Paris, for use on the Milan-Gallarte Third-Rail Electric Railway, Italy. These trucks are considerably larger than the standard four-wheel steam railroad trucks, and because of their solid forged frames and the strength and disposition of the springs, have a carrying capacity equal to the large six-wheelers used under the heaviest steam

HEAVY ELECTRIC TRUCK FOR MILAN

coaches. It is interesting to note that enormous strength is obtained without bulk. The type is the Brill No. 27-E.

The frames are 12 ft. ½ in. long, and are composed of solid forged sides—that is, the side-bar, yokes and extensions are a single solid forging, angle-iron transoms, end pieces and tie-bars. The transoms, besides having ends bent at right angles, each secured with two bolts to the side-bars, are further strengthened by brackets bolted to the side-bars with and to the insides of the transoms. The end pieces are bent around the side-bar extensions and bolted thereto. The side-bars are 1¾ ins. thick and 7 ins. wide at the center, tapering to 6 ins. at the yokes. The pedestals are 4 ins. thick and the extensions 1½ ins.

The system of equalization combines a swing bolster and a cushioned connection with the frame by means of spring-link suspended equalizing bars. These spring links are supported by the frame at points near the yokes, relieving the strain upon the frame and giving a wide suspension to the centrally borne load, theoretically and practically the correct method of equalization. Not only is the load distributed equally upon each wheel, but a leverage is obtained in favor of the frame against the wheels and brakes, preventing tilting or kicking up, no matter how violently the brakes are set. Another advantage of the cushioned side swing is the softness of contact of the wheel flanges with the rail heads. The equalizing bars are 2½ ins. thick and 5½ ins. wide at the center. Equalizer and box springs are heavy double coil, and triple elliptic springs carry the bolster.

Outside brakes are connected with the upright levers by brake-rods placed outside the wheel treads, allowing the entire width between the wheels for the motors. Extra large journal boxes have a strong lip for the bar holding the third-rail contact apparatus. The total weight without wheels and axles is 7400 lbs.; wheel base, 7 ft.; gage, 4 ft. 5⅜ ins. between flanges; diameter of wheels, 41 ins.; length of axles, 7 ft. 3 13-16 ins.; journals, 5⅛ x 9 1-16. G-E 55-H, 160-hp motors will be used, and the maximum speed will be about 62 miles per hour. Weight of empty car bodies 44,000 lbs.

The practice of operating funeral cars has become quite common, both on steam and electric roads, and especially in the larger cities, where it is inconvenient and expensive to use carriages. It remained for an enterprising electric railway manager, however, to suggest that the trolley roads should go a step farther and lay out a burial ground or graveyard, thus ensuring a source of revenue to the company and affording the people an opportunity of visiting the last resting place of their dead friends and relatives as well as an inexpensive and convenient method of attending the funeral Daily newspaper paragraphers, no doubt, will find this a very attractive subject, but when they have exhausted it others will doubtless recognize in it a very sensible movement. Many of the discomforts that attend the burial of the dead will be eliminated by the adoption of this plan

Pure Copper Trolley Wheel

The accompanying illustration shows the 1902 model of the 6 in. pure copper trolley wheel manufactured by the Process Copper & Brass Company, of Boston, of which T. Raymond Pierce is sales agent. This wheel can be used in connection with all types of overhead wires, but is designed especially for high speed roads, and it is stated will take all frogs and switches and do the work accomplished by a 4½-in. wheel with less than half the wear.

This wheel, as well as the Process Copper & Brass 4½-in. wheel, is made by a special process, which toughens the copper,

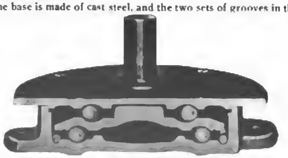
PURE COPPER TROLLEY WHEEL

and the company guarantees that it will outwear by 50 per cent the ordinary composition wheel, while the cost is only 25 per cent more. The wheel is of a special design, such as has been found to be most desirable, and is in use on about fifty roads throughout the country

Ball-Bearing Trolley Base

The accompanying illustration shows a new type of trolley base, designed to give the maximum amount of horizontal flexibility so as to enable the trolley wheel to follow easily any variations in the alignment of the trolley wire. As will be seen, this is accomplished by the use of ball bearings, and it is claimed that the friction on the pole and on the trolley wire are much reduced, that the strain on each is greatly relieved, especially at the curves, and hence the principal cause of the trolley wheel leaving the wire is eliminated.

The base is made of cast steel, and the two sets of grooves in the



BALL-BEARING TROLLEY BASE

base are case hardened. The arrangement of the base is compact, so that there is no increase in height in the base illustrated over the standard trolley base. The weight of the base is in the neighborhood of 75 lbs. The base was exhibited at the Detroit convention by the Detroit Trolley & Manufacturing Company, which is manufacturing the device. The Eastern selling agency for the base has been secured by the General Supply Company, of 40 John Street, New York.

A Quick Repair Job

The Massachusetts Chemical Company recently received the following story of rapid repair work from a young factory electrician located in Western New York.

The proposition was a 60-hp 500-volt direct-current motor, which had given a good deal of trouble, as it had been insulated with supreme indifference to common sense. The armature coils had been dipped once in shellac, baked, dipped in linseed oil varnish, baked again, assembled and painted with some black varnish. The fields had been dipped in black paint, baked, taped with strips of duck, shellacked and finally painted black.

The persistent leakages in the armature had been taken care of by frequently heating it with the current and then dipping it in armalac. On several occasions short circuits, which had been caused by chafing of the crossed windings, had been temporarily stopped by lifting the wire slightly and jamming in a bit of cotton waste which had just been saturated with armalac. In the present instance, under the expansion of a heavy overload one of the binding bands burst, and before the machine could be stopped the armature and four fields were badly smashed. Export orders were behind, transatlantic cables were demanding immediate deliveries, and the cessation of work by that machine meant idleness for $75,000 capital and fifty operatives.

The smash occurred at 2 p. m., and by a hasty consultation the factory committee decided that as the sending of the repair job to a repair shop would entail a delay of at least a week, at an expense of $200 and a net loss of at least $1,000, it would take a chance and try to patch up the machine as it stood. Armature and fields were quickly removed, two men detailed on each piece, and the work of stripping the fields begun. The armature abrasions were mended by prying out the coils and covering the denuded wires with the very thinnest of armalac tape, cut on the bias. It was "puttering" work, but at 1 o'clock the next morning all the breaks were covered and tested out O. K. with the current. The armature was then set back on its bearings and the new bands put in place, turning the armature by hand.

A pail of water resistance had been got ready long before, and the current was admitted into the armature until it was hot. The armature was then put on wooden horses and turned over slowly with one-third of its diameter in a soap-box (made temporarily tight with shellac and sand) and full of armalac. The old windings soaked up the insulating material, and the operation was continued until the armature was nearly cool. The soap-box was then taken away and the slow turning was continued, to make the compound dry in an evenly distributed state, until the fields had been put in position.

The work on the fields had been of an especially exasperating character. They were of small wire, and at least a dozen wires on each field had been smashed. The work of soldering them and putting each one into a little trough of fine armalac tape was a long one. They were then heated with the current and sent into the dipping tank, then wound with thin bias armalac tape painted with armalac, wound with thin bias armalac duck, 1¼ ins. wide, and again painted. Before morning the motor was left running under the eye of the night man. The motor is running yet, though there is a swelling on all four fields. The rush orders are filled, a heavy expense bill was avoided and the motor will not be disturbed until January, when it will get another baptism in the soap-box.

A Take-Up Device for Steam Engine Indicators

The great trouble experienced when using the detent on the steam engine indicator is that of the slack given up by the cord between the paper drum and reducing bushing on wheel. This slack, if not properly guided when throwing on the detent, is liable to get foul, and a device has been brought out by James L. Robertson & Sons, of New York, to take up this slack.

It consists of a short horizontal arm, at one end of which is a vertical bearing, in which sets a steel pillar on the upper end of which there is a frame holding a double set of loose steel rollers, between these the cord from paper drum passes. On the lower end of vertical pillar there is a light spiral spring enclosed. This spring causes upper frame to revolve when cord becomes slack, and is so arranged that cord winds on frame, to be given up again when tension is applied. The object of the device is to permit the operator to take as many cards as desired without unhooking from the crosshead or stopping the engine, no matter what speed. This, of course, pertains to indicators that are fitted with a detent and using a direct-connected reducing motion, the latter being the most popular in modern engineering practice.

Where an indicator is used in connection with pendulum, lazy tongs or reducing motion attached to engine frame, not so much trouble arises, and generally a rubber band is employed to take care of slack cord, which works fairly well. In this case the take-up device is in the shape of a regular guide pulley to connect direct to indicator. The guide pulley is removed and this put in its place, wound up, and it is ready for use, and immediately the detent is engaged it picks up instantly what slack cord occurs.

London Letter

(From Our Regular Correspondent.)

The tramway system of the city of Leeds may be taken as a very typical one of the best conditions which exist in Great Britain. There are over 20,000 acres within the city boundaries, and up to the present the policy of the Corporation has been not to go outside the various boundaries. Gradual increases in the number and length of lines within these boundaries are being carried forward as fast as street improvements, which are also in active progress, will permit. At present there are now 77 miles of track, or 40½ miles of street open for public traffic. The Corporation has 245 cars in stock, and from 183 to 230 are in operation as required.

Seven miles of track were granted in the last session of Parliament, and proposals for extensions of routes and for new routes which, if adopted, will amount to 9 miles additional, are presently being considered by the tramways committee. These additions, with those already sanctioned, will enable the lines to come into immediate contact at the various boundaries with lines already sanctioned in other townships, such as Bradford, Halifax, etc., as well as with the lines of the British Electric Traction Company from Dewsbury, etc.

Unfortunately, in Bradford and Halifax the gage is different from that of Leeds, which is 4 ft. 8½ ins.; consequently running powers cannot be arranged, but common waiting rooms and timing cars to meet are arranged by the various corporations. The routes are arranged to pass from one extreme of the city right through the center to the other, so there is very little switching on to other lines in the center, and thus congestion is avoided. The fares are graded on distance and average about 2 miles for 1d. At present the box system of collection is in operation, but under the new management this and other obsolete, or practically obsolete, methods will no doubt be dispensed with and more up-to-date practice adopted.

The tramways department is just on the point of vacating the old premises in Bow Lane, which have been the location of the tramways department since taking over the lines in 1894, and previously of the company for about twenty years, to very large and handsome offices in City Square. This change, which has been necessitated by the rapid growth of the departent, will no doubt enable the staff to carry out its duties better and further the reorganization of the department.

All the current is at present being furnished from one power station, which is very centrally situated on the banks of the River Aire. The equipment at the power station consists of two engines from J. Fowler & Co. of 1300 hp each, three engines from Hick, Hargreaves & Co. of 1450 hp each, two generators from Greenwood & Batley of 750 kw each, three generators from Electric Construction Company of 850 kw each, twelve boilers from Clayton, Son & Co., of Lancashire type, of 400 hp each, stokers by Bennis & Co., two coal elevators by Graham, Morton & Co., a switchboard by J. Fowler & Co., three boosters from Greenwood & Batley of 300 amps. each, two boosters from Mather & Platt of 600 amps. each, and one turbine from Parsons of 250 kw.

The cost of power per unit during the last year was .38d. This sum includes all the station operation and maintenance expenses.

As showing the development of traffic, it may be noted that the increase from March 25 to Sept 6 is £20,773-3-10 on a total income of £124,682-0-3, or equal to a weekly increase of £883-19-3.

As is now well known, the whole system of the Leeds tramways is under the management of J. B. Hamilton, who was appointed general manager early in this year and took over the management the first of April. Mr. Hamilton has already inaugurated many improvements in the traffic problem, and better results in car mile receipts are already in clear evidence, and everything so far shows that his appointment has been a good one for the tramway department.

The Harrogate Corporation having decided to introduce tramways into the borough, the committee appointed to consider the matter has now drawn up a scheme as to the routes. The proposed routes include from Oatlands Mount, on the south of the borough, to Little Wonder and Bilton, on the north, and to Starbeck, on the east. Electricity from the corporation's own works will be the motive power, and each of the routes will enable the cars to run through the center of the town.

At a meeting of the Liverpool tramway committee it was stated that the general manager of the tramways (Mr. Bellamy) had designed and produced a car with the upper deck covered in. The roof of the cover was 6 ft. 2 ins. from the deck, and consisted of a light frame, principally of steel work and canvas at the side and the top, to be moved easily in sections. The whole could be adjusted in half a minute. It has the additional advantage of removing the trolley standard to the outside of the cover. So far from losing seating accommodation, the new car would give some ten additional seats for passengers. While abolishing overcrowding outside and limiting it inside, the cars would carry seventy-three passengers. It was proposed to apply the system to thirty cars that were now on order and to twelve that were approaching completion in the works of the committee, which would test the practical value of the new arrangement. No part of the invention was to be patented, and it would be available for the whole tramway world without anything in the way of royalties.

Hampstead is well in the throes of work in connection with the construction of the Hampstead & Charing Cross Electric Railway. The junction of Adelaide Road and Haverstock Hill presents a busy scene, and this point will be one of the chief centers of the excavating work. The work at present being done is that authorized under the old acts, which will be available for the new scheme. For the upper part of Hampstead, where deeper levels and slight deviations are being sought for the tunnels and the extension to Golder's Green, a delay is necessitated till the new bills are passed. The contractors for the work are Messrs. Price & Reeves, who constructed a portion of the Central London Railway.

Satisfactory progress has been made since the recommencement of operations upon the new subway that is to connect Waterloo Station and Baker Street. At the present time only about one and a half miles of single tunnel remain to be constructed, so that three-fourths of the subway between the points named are now finished. Lift shafts are already completed at Waterloo, Piccadilly Circus and Baker Street, and a similar shaft at Oxford Circus is now started. Staircase shafts at Waterloo and Oxford Circus are sunk, and the booking hall at Waterloo is covered in, ready for internal fittings. Land for all the station sites is in the possession of the company, with the sole exception of that in Trafalgar Square, and as financial difficulties are now removed there is reason for hoping that the works will be pushed to a speedy conclusion.

The linking up of a score of mining and manufacturing towns and villages in South Lancashire by the South Lancashire Electrical Tramways Company is proceeding apace. The entire system, with its various junctions and branches, will cover nearly 80 miles, and, inclusive of equipment, will entail an outlay of nearly £1,500,000. The lines will run from Parr, near St. Helens, to Swinton and Eccles, where connections will be made with the Salford Corporation's system. Among other places which will be tapped by the South Lancashire Company are Newton-le-Willows, Haydock, Lowton, Leigh, Tyldersley, Atherton, Little Hullton, Astley, Boothtown, Worsley and Walkden.

On the invitation of the assistant secretary of the Board of Trade, representatives of corporations and companies operating tramways had a meeting recently with representatives of the Board of Trade and of the home office at Whitehall Gardens, Westminster. The subject of conference was the proposed Board of Trade regulations, especially with regard to carrying a red light on the rear of all cars. Mr. Young, Glasgow, made the opening statement, and was followed by the representatives of Manchester, Newcastle, Liverpool, Cardiff, Hull, Leeds, etc., and also by Mr. Sellon for the operating companies. It was pointed out that at night electric tramway cars of the present day present such a blaze of light that a red rear light was quite unnecessary, and, further, that on account of the adoption on all large systems of distinctive route colors, with lights at night colored to correspond, a regulation requiring a red light on the rear of every car would be so confusing as practically to do away with the system of distinguishing route colors, which have been found so popular and convenient wherever adopted. Sir Herbert Jeykil, for the Board of Trade, explained at the outset that since the suggestion had come from the home office, and his department had no special views on the matter, he would allow Mr. Cunninghame, as representing the home office, to deal with it. Mr. Cunninghame, after hearing the various speakers, said, in effect, that his department had no desire whatever to fetter or harass electric tramways, but quite the opposite. Their idea, if it could be carried out, was to have all road and street vehicles carrying a red light on the rear. He saw, however, from what had been put forward by the deputation, that there might be a difficulty in making such a rule quite general, and, in any case, they would now consider whether electric tramway cars should be excepted in the event of such a rule as proposed being adopted. He mentioned that in any case the home office would not deal with the rules applicable to Scotland, so that his friends from the North might have any lights which suited them so far as they were concerned.

Mr. Challenger, the traffic manager of the Bristol Tramways Company, has adopted a new means of safely ventilating the cars during hot weather. When the cars are traveling at full speed, to have the front doors wide open causes a strong current of air to rush through the car. Mr. Challenger has had the whole of the

cars which are provided with double doors fitted with brass rods, which hang from the handles of the doors, and which are provided with slots at intervals, and these are so arranged that the driver can secure the doors a little way open, the opening varying within several inches, according to passengers' requirements. It is found that a very small opening on the hottest day allows ample fresh air to enter and obviates the excessive and dangerous current inevitable when the ventilation was not so easily regulated.

The Mayor, aldermen and burgesses of the county borough of Croydon intend, subject to the approval of the Board of Trade, to lease to the British Electric Traction Company, Ltd., or their approved nominees, the existing tramways running from the Red Deer to the borough boundary at Purley, from the Thornton Heath Pond to the borough boundary at Norbury, and from Station Road, West Croydon, at its junction with North End, along Station Road and Wellesley Road to its junction with Whitehorse Road, for the term of eighteen years and seven calendar months from June 1, 1902.

It is now possible to go to Twickenham Bridge by the London United Electric Tramways. Then there are the authorized extensions of the electrical tramways to Hampton Court, Thames Ditton, Surbiton, Hook, Maiden, Cromford and as far as Uxbridge. The fares from Hammersmith to Hounslow, a distance of 8½ miles, are 4d.; to Twickenham, 4d.; Shepherd's Bush to Southall, 3d. In each of these cases workmen's tickets are issued by certain trains at 1d. the journey. It is possible for a workman to travel from Southall to the Bank, a distance of 14½ miles, for 2d. The opening of the new Twinkenham route has proved intensely popular, as the route passes through most interesting and picturesque country and was a famous drive in the old coaching days.

C. M. Atkinson, stipendiary magistrate for the city of Leeds, yesterday delivered judgment in the case in which a Leeds tram car conductor was summoned by the police for overloading his car on the occasion of the recent lifeboat procession. The town clerk, W. J. Reeves, prosecuted on behalf of the police, and the defendant was represented by W. Wright, instructed by the Gas Workers and General Laborers' Union. At the outset the town clerk stated that when the case was last before the court it was adjourned in order that he might ascertain what position the corporation was going to take under the tramways act of 1870. After fully discussing the matter the corporation had decided that they would not for the purpose in question—the prevention of overcrowding—make any by-laws under section 48 of the act, but would deal with the matter only as undertakers under section 46, as they would thus be able to exercise greater powers in this way than would otherwise be the case. The learned stipendiary magistrate expressed his indebtedness to the town clerk for his information, which, however, did not affect the present case, as he had only to deal with the statutes and by-laws in force when the case was before the court. In the course of a lengthy judgment Mr. Atkinson alluded to the powers possessed by the corporation for licensing and regulating hackney carriages, omnibuses, etc., and said the same powers extended also to tramways. In 1875, when the trams were in the hands of a private company, a by-law was in force prohibiting the conductor from allowing any person beyond the licensed number "to enter or mount or remain in or upon any part of a carriage." The corporation subsequently purchased the undertaking and become invested with all the rights, powers and authorities of the original promoters, and if the by-law was enforceable against a conductor in the service of the company it would be enforceable against the present defendant. It was now suggested that, as the corporation had not enacted a by-law in relation to tramways similar to that relating to hackney carriages and omnibuses, consequently they did not possess, and never had possessed, the right to impose a limitation on the number of passengers carried, and therefore that the by-law under which the information was laid was useless and unenforceable. He was glad he was not constrained to adopt this view, and he would therefore convict the defendant, subject to its being proved that he did allow more than the licensed number to remain on the car; but as the man acted under express instructions, and this was only a test case, he should only impose a nominal penalty of 5s.

A. C. S.

The Columbus, Buckeye Lake & Newark Traction Company, the Columbus, London & Springfield, the Dayton, Springfield & Urbana, the Columbus, Grove City & Southwestern, the Springfield & Western, and the Cincinnati, Lebanon & Dayton Railways, all of which are controlled by Tucker, Anthony & Co., and A. E. Appleyard, of Boston, have placed on sale at their several offices mileage books for 500 and 1000 miles, good on any road of the system. The books are sold at the rate of 1¼ cents per mile, and can be used by any member of the family purchasing the book.

Letter from Italy

(From Our Regular Correspondent.)

The Italian government has at last granted permission to begin electric operation on the Valtellina Railway lines from Colico to Sondrio and Colico to Chiavenna, which have already been described in the columns of the STREET RAILWAY JOURNAL as equipped by Ganz & Company, of Budapest, on their high-tension three-phase system. Tests and experiments on these lines have been made for several months, and the last tests were so satisfactory that the Italian government decided to grant permission to start electric operation. Among other experiments one of the most interesting was the fire test, which consisted in cutting off one of the trolley's wires and letting it fall on top of the car. It was expected that the car would burn at once, but the safety devices operated so satisfactorily that nothing of the kind happened. The line from Lecco to Colico has not yet been completed, but in a few weeks it will be ready for electric operation.

The Milan-Gallarate Railway has been equipped with an automatic block system as a result of the collision which took place a few weeks ago.

The Edison Electric Company, of Milan, which is operating the street car system of the city, is gradually substituting brass hand wheels for the ordinary handles of the mechanical brakes of its cars. These hand wheels, about 12 ins. in diameter, are placed vertically, connected through gearing to the vertical rod of the brake, and are operated by the motorman with the aid of a brass handle. This new system seems to be more satisfactory than the old one, and motormen are satisfied with it, as it permits them to utilize the weight of the body in applying the braking power. The wheel is removed with the controller handle when the car is at the end of its run.

The sum collected for the sufferers of Martinique amounts to 22,000 lire ($4,400). Through the initiative of the local press on the Sunday following the terrible accident of the Antilles the cars were smartly arranged with Italian and French flags and the words "oggi-tutti in tram" (to-day everybody is to ride in the tramways) were displayed in large letters on both sides of the car. Besides the usual 2-cent tickets, passengers were invited to buy an additional 2-cent ticket for the benefit of the sufferers. Upon these extraordinary tickets was printed, "Pro Ankle."

The new experiment of using post office boxes, for letters only, secured to the street cars in Milan is giving very good results, and the boxes prove so useful to the public that Mr. Galimberti, the Italian minister of post and telegraph, has decided to adopt the new system all over the peninsula wherever street cars are installed.

The proposal of Messrs. Cook to construct a light electric railway connecting the Naples street railway system to the lower station of the existing cable road, is assuming practical shape, and work has commenced. The line, which is intended to afford facilities to the 50,000 tourists visiting the crater annually, starts from Pugliano, at the foot of the mountain. The power station contains two gas engines of 90 hp. each, coupled to two direct-current generators feeding the line at 550 volts. The design of the plant is due to Mr. Strub; the contract for the electrical equipment has been secured by the Brown & Boveri Electric Company. The gas engines were furnished by the Winterthur Maschinenbau Company. The faculty of science in the University of Naples forwarded to the Italian government a protest against the construction of this railway, which is running in close proximity to the Royal Observatory, and, therefore, would seriously interfere with seismic observation and records.

The employees of the Florence Street Railway Company joined the general strike of the working classes of the city numbering 15,000 people, and which lasted over a week.

The Spezia Electric Railway, in spite of the critical financial situation of the Helios Company, of Cologne, has at last been completed and begun operation. A number of years ago the Helios Company, of Cologne (Germany), secured the concession for constructing and operating an electric tramway in Catania (Sicily) and one in Como (Lombardy). On account of the critical situation referred to, the construction work on both has been suspended. A very heavy fine is to be charged to the Helios Company by the Catania municipality, as the time limit stipulated for completion of the work has expired.

Electric locomotives do not seem to be favored for hauling trains through the Gotthard tunnel between Italy and Switzerland. During the last trip of the Italian King to Germany the steam locomotives of the royal train were fitted with the new Langer's smoke destroyer, which is giving satisfactory results. This apparatus has now been working for some time in several Swiss mountain railways, viz., on the Thun-See, Viege-Zermatt, Righi and Central Bahn lines.

NEWS OF THE WEEK

The Ever Exacting Public

In Birmingham there is a striking example of the inconsistency of the general public. When the Birmingham Railway, Light & Power Company put into operation its transfer system last month the sale of books of 100 tickets for $4 was stopped. The suburbanites have been greatly distressed because of this, and at a meeting held a few days ago protested and passed a set of resolutions calling on the company to return to the sale of books, if possible. President Jemison, of the company, heard them patiently, and told them the company could not possibly sell tickets at the reduced rate and grant transfers also. He said the company would take off the transfers and begin again to sell tickets at the reduced rate, if the people so desired. There will be no profit in the street railway service of the company, Mr. Jemison declares, if transfers are granted and tickets are sold at the reduced rate.

Indianapolis as an Interurban Railway Center

Indianapolis is rapidly coming to the fore as an interurban railway center, and will, before long, compare favorably with Detroit and Cleveland, if it does not actually outstrip them. Already six lines enter the city, and within one year this number will be increased to eleven, which will all enter one great terminal station. The lines now entering the city are the Union Traction Company, the Indianapolis, Shelbyville & Southeastern Railway, which will later connect with Cincinnati; the Indianapolis & Greenfield Railway, which will be extended to Richmond and thence to Cincinnati; the Indianapolis & Plainfield Railway, which will, when completed, tap the coal fields of Sullivan and adjoining counties; the Indianapolis & Martinsville Railway, which may be extended to Bloomington; the Indianapolis, Greenwood & Franklin Railroad, which will be extended to Columbus next year. Of the projected electric lines already being built the Indianapolis Northern Traction Company is probably the most important. This is a branch of the Union Traction Company, and will invade the Lake Erie territory. This will come to Indianapolis by way of Kokomo, Tipton and Noblesville. Another important line will connect Indianapolis, by way of Lebanon, with Lafayette. In addition to this there are now coming into the Union Station sixteen steam railroad lines.

The Hudson Valley Strike

A meeting of the directors of the Hudson Valley Railway Company was held in New York city on Oct. 3, at which the action taken by the officials of the road in the strike was indorsed. The directors present were John W. Herbert, Addison B. Colvin, George B. Wilson, G. Tracy Rogers, Lewis W. Emerson, Watson N. Sprague, Charles E. Brisban, Peter McCarthy, George E. Green and John McNamara. John W. Herbert, who is Mayor of Helmetta, N. J., was elected vice-president of the company to succeed J. A. Powers, resigned; J. A. Kellogg, of Glens Falls, was chosen secretary and counsel to the company, and George H. Helms, president of the American Snuff Company, of New York, was elected a director to succeed Thomas O'Connor, resigned. The following resolution was passed: "Resolved, That the action heretofore taken by the president and general manager in relation to the matters growing out of the difficulties with our late employees be and it is hereby approved, and they are hereby authorized to operate cars on the several divisions of the road by the employment of competent operators on such terms as they may deem proper and just."

The strikers, having rejected all offers to settle by arbitration all questions in dispute, and having undertaken to dictate their own terms for reinstatement, the contention is likely to continue for some time to come, and may lead to further acts of violence on the part of the lawless element. There are no visible prospects for a settlement, as neither side is making any move toward arbitration, and the citizens' movement for an adjustment of the differences has fallen through.

Improvements at Nashville—The Defeat of the City

The plans of the Nashville Street Railway Company for the improvements that are to be made in the system, now that an agreement has been reached with the city, call for the complete reconstruction of the system. It is planned to relay nearly 40 miles of old track and to extend practically all the old lines. The Buena Vista line will be extended beyond the city limits out the Hydes Ferry Pike for some distance, opening up a large new territory, and the Jefferson Street line will be extended to the city limits, and on to West Nashville, a distance of about 2 miles, giving car service to the Clifton and Mt. Nebo.

In the West End the West Nashville line will be double tracked, and the Church Street line will be extended out the Richland Pike to the Continental Park. The Overton Street line will be entirely abandoned, and the Kayne Avenue line extended for more than a mile beyond its present terminus. The improvements in South Nashville will be the most sweeping of any division of the city. The Wharf Avenue line will be straightened so as to run directly out Wharf Avenue and Fillmore Street to Mt. Olivet and Mt. Calvary Cemeteries. The Fairfield line will be extended for a little more than a mile out the Murfreesboro Pike to Jim Town. All the other South Nashville lines will be straightened and improved, and a new line will be built in this section. In East Nashville the Lischey Avenue line will be extended to the city limits, and probably beyond, and the tracks of all the lines will be greatly improved. Fatherland Street will be double-tracked to the city limits, as will also the ends of the Woodland Street line. A new line may be built to serve the section southwest of Vanderbilt University and the Hillsboro Pike neighborhood, but it has not yet been mapped out. A new power house is now being constructed.

In the settlement of the controversy between the city of Nashville and the Nashville Street Railway Company, mention of which was made in the STREET RAILWAY JOURNAL for Oct. 18, there is furnished an example of the almost disastrous results that followed a war of extermination by the city on the company operating the street railways of the city. Both sides to the controversy, of necessity, made concessions before the settlement was effected. It would seem, however, that the company marched out of the fray triumphant, for the main contention of the city—the fight on the charter rights of the company—was waived by the city. In fact, it would seem that the ultra-conservative guardians of the public rights, after inflicting on the innocent population untold misery because of the inadequate railway service, emerged from the fray with the main contention waived in favor of the company.

An Important Ruling in Massachusetts

The Railroad Commissioners of Massachusetts have recently handed down their decision on the petition of the Greenfield, Deerfield & Northampton Street Railway Company for a grant of location in Whately. It is the first case of its character to emanate from them, being rendered under recently enacted provisions of the law, and is considered an important ruling.

The petition of the company for a location was brought under Section 11, Chapter 112, Revised Laws, and at the hearing, given after due notice to the Selectmen and to all persons owning real estate abutting upon the way in which the location was asked, two of the Selectmen and other residents appeared as remonstrants. Now, the statute, in certain cases, empowers the Railroad Commissioners to grant a location in a city or town in order to connect existing locations in adjoining towns, and the petitioner claimed that the statute applied in this case for the reason that its petition to the Selectmen of Whately for an original location was neither granted nor refused within three months after the filing thereof, and also for the reason that the location which was finally granted by the Selectmen was declined by the company. The remonstrants insisted that the Selectmen acted within the required time, and that a location having been granted the Railroad Commissioners have no jurisdiction. The company filed its petition

with the Selectmen of Whately March 13, 1902, and on May 31 the Selectmen notified the company in writing that they would grant a location provided the company would build a certain branch track. On June 5 the attorneys of the company submitted to the Selectmen a form for order or location, and on June 7 the Selectmen held a meeting at which the chairman said that he was ready to sign the order of location in the form submitted. The other two members said that before they signed the order they would like to inquire further in reference to conditions and restrictions. Inquiries were subsequently made by them, as a result of which certain additional conditions were embodied in the order of location. This order bears date June 7, but was not signed until June 26. No vote was passed or action taken or meeting held by the Selectmen after June 7 until June 26. In their decision the Railroad Commissioners say:

We find, therefore, as a matter of fact, that the Selectmen did not either grant or refuse the location within three months after the filing of the petition. We are also of the opinion that the board would have jurisdiction had the grant of location been made within the statutory time. The literal wording of the statute supports this construction, and it is easily conceivable that the Legislature may have had in mind cases where a grant of location is accompanied by conditions which make it equivalent to a refusal of location, and this without bad faith or improper conduct on the part of anybody. The promoters of this enterprise contemplated a railway between the town of Greenfield and City of Northampton, through the intervening towns of Deerfield, Whately and Hatfield. In planning it, it was necessary for the company to study economy in construction, safety in operation, and the accommodation of the largest number of probable patrons. The route selected calls for the smallest capitalization, avoids railroad crossings, and affords on the whole the largest accommodation to the different communities in the towns through which the railway is to pass. The necessary locations have been secured with the single exception of the one asked in Whately. Giving due weight to the natural and proper wish of the Selectmen of Whately to secure all possible advantages for their townspeople, we do not believe it consistent with the public welfare to now bind the company to the construction two years hence of 2½ miles of railway with so little assurance that conditions will then justify an expenditure which is admittedly unwarranted at the present time. It is enough to require the company to build the extension as soon as circumstances warrant the outlay. To secure the best service for the largest traveling public we feel that public necessity and convenience demand that the location asked be granted to this petitioner to connect the locations which it has in the adjoining towns, and we so find. It is accordingly ordered, that there be hereby granted to the Greenfield, Deerfield & Northampton Street Railway Company a location for the track of a railway with turnouts, poles, wires and other appliances necessary for operating the same by the overhead electric system, upon the easterly side of the so-called "River Road" in Whately from Deerfield to Hatfield as shown on a plan upon file with this petition and made a part of this order.

Yerkes Scores Against Morgan

There is reported from London a dramatic development in the fight for the control of London's "tube" railroads. It has transpired that Speyer Brothers, who are financing Charles T. Yerkes' plans, have bought control of a large company hitherto allied with the Morgan scheme of transportation, thereby not only reducing the scope of the Morgans' projected line by many miles, but actually threatening it with legal obliteration. This latest move in the Morgan-Yerkes controversy was announced on Oct. 21, at the session of the House of Commons' "tubes" committee, by Sir Edward Clarke, who, as counsel for the London United Electric Railways, withdrew the bill providing for the construction of the road. This road had always been part of the Morgans' line, and covered the district westward between Hammersmith and Piccadilly, and southward between Clapham and the city. The Morgans had originally intended to cover these points, but as the London United already had certain powers from the amalgamation effected a year ago, and as the Morgans' project had passed through Parliament under the title of the London United & Piccadilly & City Railroad, Balfour Browne, who is counsel for the joint bills, expressed surprise in behalf of the Morgan interests at Sir Edward Clarke's announcement, which left him scarcely half the length of the road over which he had been arguing for nearly a year. Mr. Browne at once requested time to consult his principals, and amid a sensation the committee adjourned. Mr. Browne then announced that the Morgan interests were ready to go on with such road as they had left, namely between Piccadilly and the city, and that they would take the earliest opportunity to introduce a new bill asking for the powers which they had so unexpectedly been deprived of by the defection of the London United, owing to the Speyers securing control of it.

A continuous chapter of misunderstandings led up to what Mr. Yerkes terms his "coup." The promoters of the London United say that though they were willing to pool their interests with the Morgans, they believed they were better fitted to control the traffic management of an English line than the American firm. Sir Clinton Dawkins, a partner in the house of J. S. Morgan & Co., through whom the negotiations were conducted, refused to agree to this, and the United officials then demanded control of the arrangements of their own section of the line, which was also denied in a way, it is hinted, that people took to be slighting, and Sir Clinton went to the United. It is intimated that the promoters were indignant at what they considered to be their ill treatment, and cabled to Mr. Yerkes offering him the road. Mr. Yerkes thereupon cabled them to go to the Speyers, and shortly after Mr. Yerkes' return the Speyers bought up the road, thus blocking the Morgans' scheme.

A report from London, dated Oct. 23, says that the committee upheld the contention made by the counsel for Charles T. Yerkes before the House of Commons' railroad committee, that the bill providing for the construction of a Piccadilly and City road must be withdrawn, as the Morgans' "tube" scheme had no legal status through having been presented to Parliament as part of the London United plan, which became non-existent that day through the withdrawal of its bill.

It is learned that the Morgans do not propose to abandon their underground projects. In spite of the decision of the committee, they will have a bill introduced in 1903 giving facilities similar to those of the scheme just quashed by the defection of the London United, control of which was purchased by Speyer Brothers, who are financing Charles T. Yerkes' plan.

PERSONAL MENTION

MR. F. C. BANGS, assistant treasurer of the Cleveland Electric Railway, of Cleveland, Ohio, has been appointed general manager of the Cleveland Clearing House. Mr. Bangs will retain his position with the Cleveland Electric Railway Company.

MR. RICHARD STOCKTON has resigned as purchasing agent of the South Jersey Gas, Electric & Traction Company, of Camden, N. J. Mr. Stockton, it is announced, will become connected with a prominent manufacturing company in New York.

MR. D. CLARENCE DURLAND, who has been elected second vice-president of the Sprague Electric Company, has, for the past three years, been assistant general manager of the Sprague Company, and his promotion is evidence of his engineering and executive abilities, which he has combined to a marked degree.

MR. F. D. RIDGE has resigned as superintendent of the Clarksville Electric Street Railway Company, of Clarksville, Tenn., to accept a position with the Jackson Electric Railway, Light & Power Company, of Jackson, Miss. Mr. Lee Orrel, who has been in the service of the Clarksville Company for a number of years, will succeed Mr. Ridge.

MR. C. R. HAYES, assistant to Mr. William Pestell, superintendent of motive power and machinery of the Worcester Consolidated Street Railway Company, of Worcester, Mass., has resigned that position to become electrical engineer with the Ludlow Manufacturing Company, of Ludlow, Mass. Mr. Hayes is a graduate of the Worcester Polytechnic Institute.

MR. W. G. WAGENHALS, who recently retired as general manager of the Mill Creek Valley Street Railway Company, of Cincinnati, Ohio, was surprised at his home a few evenings ago by a large number of his former employees, who presented him a handsome gold watch and chain, appropriately engraved. Mr. Wagenhals, as has been stated, is general manager of the New York & Philadelphia Traction Company.

COLONEL ALLAN C. BAKEWELL, who was recently elected president of the Sprague Electric Company, has long been identified with the electrical industry, and has won many friends through his executive ability and honorable business methods. He was vice-president and general manager of the old Interior Conduit & Insulation Company, which was absorbed by the Sprague Electric Company some years ago. Previous to his present office he was for three years second vice-president and general manager of the Sprague Company.

MR. HENRY S. PARMELEE, president of the Fair Haven & Westville Railroad, of New Haven, Conn., who died a few days ago in New York, was one of the most influential business men in New Haven. He was born in Ohio fifty-eight years ago, and spent most of his early years in New Haven, New York and Edinburgh, Scotland. His father, Spencer T. Parmelee, who died in 1875, was prominently identified with the street railway companies in New Haven, being a director of the Fair Haven & Westville Railroad. It was in 1884, following the death of Hoadley B. Ives, president of the company, that Mr. Pamelee was elected to the presidency of the company. Under the direct supervision of Mr. Parmelee the road was equipped with electricity.

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Advertising Interurbans

Advertising of electric railway lines has come to be accepted so much a matter of course by the more progressive companies that it would almost seem unnecessary to call attention to its importance. Whether it is because the summer tourist season has recently closed or whether there are still a number of roads that do not appreciate the importance of publicity we do not know, but for some reason there has been a remarkable laxity among some of the companies engaged in this traffic. The writer, arriving one day recently in a city of nearly 100,000, from which several interurbans radiate, sought by inquiry at the principal hotel and also at the place where tickets were advertised as on sale, to secure a timetable and map which would enable him intelligently to plan his day's work. At neither of these places nor anywhere else along the road, as far as could be ascertained, were any such timetables obtainable. Earlier in the season, when the roads were new, and the tourists more numerous, it was within the writer's knowledge that advertising timetables were plentiful, but the management seemed to have made the incorrect assumption that because the tourist season had closed and the road had been in operation for some time all possible patrons of the road were familiar with it, and that there was nothing more to do but stop hustling and complain of the poor traffic until spring. No steam road assumes that it is too generally known to need at least timetables for the information of the public. A certain proportion of the travel over every interurban road each day comes from people who are strangers in the locality, and who have no means, save by hit or miss inquiry, of knowing where a road can take them or at what time, or how long a certain trip will take, if timetables are not to be found at the places where they have a right to expect to find them. Some one about the office of an interurban line should be required to see that hotel racks, railroad depots and other public places, where one might expect a timetable, be kept constantly supplied, and should be held strictly responsible for the continuity of this service.

Safety Devices for Massachusetts Railways

Although the Massachusetts Railroad Commissioners have not yet finished the task assigned by the Legislature of investigating the necessity for improved safety appliances on street cars, their attitude toward the employment of power brakes is plainly indicated by their recent rulings. So far as the present investigation is concerned it is proposed to determine whether the power brake is superior to the hand brake as a safety device for street railways, what expense would be entailed by the operating companies in the equipment of their rolling stock with power brakes, and how much time would be required to equip the electric railways of the entire State with power brakes, should it be deemed necessary to enact a law making it obligatory upon the companies to do so.

Other subjects upon which the Commissioners are seeking information are the advisability and necessity of having all street railway cars equipped with jackscrews or other implements sufficient to raise the cars to such a height as will permit the extrication of injured persons held beneath them; and the efficiency of the fenders available for use on the street railway cars of the State. No expression of opinion has thus far been volunteered upon the proposal to make jackscrews a part of the car equipment, but there have been many advocates of fenders present at the meetings.

The Commissioners have already ordered several companies to place power brakes upon high-speed, double-truck cars, intended for use over single-track lines, and there are indications that they favor a general application of this rule. At the public hearings very little interest has been shown in this feature of the investigation; in fact, it may be said that throughout the proceedings the only persons who have shown a desire to be heard are those advocating some form of apparatus which they desire to have adopted. It is promised that the street railway companies will be

permitted to present their views, and offer such suggestions as their experience may indicate to be desirable. The Commission will prepare a report upon this subject, which must be presented to the Legislature by June 15. This will form a comprehensive review of the development and application of safety devices to the operation of electric roads in Massachusetts, it is promised, and the operating companies are consequently interested in the present proceedings. In the first place it is desirable that the Commissioners be fully informed on the subject from the operating companies' view point, and, moreover, it is very important that the matter should be presented in the right light to the Legislature and the public.

Chicago Franchise Ruling

The Supreme Court of Illinois has handed down two very important decisions affecting the street railway companies of Chicago, the first of which affirms the city's right to regulate fares and upholds the transfer ordinance, while the second establishes the right of the city to compel the companies to clean the roadway between the tracks and remove snow from the streets through which their lines pass. The first of these decisions is the result of litigation instituted by the city on behalf of suburbanites, who objected to paying two fares to reach their places of business. The second was the outcome of an attempt on the part of the city to recover the cost of removing snow which had been piled up along the tracks of the street railway in the companies' efforts to keep their lines open during severe snow storms.

On the question of the right to regulate fares, the decision says that an examination of the city charters of 1851, 1863 and 1872 reveals the fact that this power has been granted to the city. It is further declared to be the general doctrine that the Legislature has the right to regulate fares and charges of common carriers, and that the municipality may exercise that power by delegation from the State. On the question of a contract existing between the city and the street railway companies, the court holds that the corporations exercise their powers subject to municipal regulations, and that the enforcement of the transfer ordinance is not a violation of such a contract. This transfer ordinance calls for the conveyance of passengers any distance within the city limits for one fare, provided the line of cars is owned, leased or operated by the same firm, company or corporation, and this applied whether the lines are continuous, intersecting or come within 200 ft. of each other. It is not seriously contended by any one that this construction reveals the spirit of the law or is in harmony with the views of the legislators who enacted it. It must be admitted that when the lines extending into the present suburban districts were built, it was not understood by the companies or the property owners of these districts that the new railways were to be operated as a part of the old system or that a single fare would entitle a passenger to ride over both lines. Consequently, it will not be admitted by any unprejudiced observer that such a policy as that now proposed can be enforced in good faith against the wishes of the companies, yet the effect of the decision will be to make the Union Traction Company furnish transportation for one fare between all points in the immense territory which its lines serve. It will enable a passenger, for instance, to ride from the city limits on the North Side to the city limits on the West Side, or vice versa, for one fare, and he may go from Jefferson, Bowmanville or High Ridge to Lawndale or Austin for 5 cents. This, of course, introduces many complications into the operating problem of the Chicago railway properties, and adds an entirely new element to the franchise controversy. It would seem that the constitutional provision which assures corporations, as well as individuals, against confiscation of property without due process of law and fair compensation, would be flagrantly violated by the proposed policy of those who have conducted the litigation against the transportation interests.

The plea of the railroad companies that these long hauls and transfers would make operation unprofitable is met with the statement that "a railroad company is not entitled to exact such charges for transportation as will enable it at all times not only to pay operating expenses, but to meet the interest regularly accruing upon all its outstanding obligations and justify a dividend upon all its stock." This ruling is based upon a decision of the Supreme Court of the United States (San Diego Land & Town Company vs. National City), where it was held that "if a railroad corporation has bonded its property to an extent that exceeds its fair value, or if its capitalization is largely fictitious, it may not impose upon the public the burden of such increased rates as may be required for the purpose of realizing profits upon such excessive valuation or fictitious capitalization." By taking this attitude the Illinois Supreme Court holds in effect that the traction companies must show that the securities upon which they have guaranteed interest charges, represent the actual value of the properties, and that if a fictitious valuation has been given these properties, the operating company is not warranted in charging a fare sufficiently large to pay the interest on these securities. We do not believe that this decision will be accepted outside the jurisdiction of the court which rendered it, or that it will be taken as a precedent by courts of equal jurisdiction; but it is, nevertheless, unfortunate that it should come at a time when a serious effort is being made to solve the transportation problem. It is feared that it will encourage Mayor Harrison and his followers, who will welcome this decision as political capital, and will now renew their efforts to prevent the operating companies and the transportation committee from reaching an agreement.

Regarding the question of cleaning the streets through which the companies' lines extend, it was held that the city could require the companies to keep that portion of the roadway between the tracks in proper condition at all times; moreover, in the winter, when the companies clear their tracks of snow, it was held that the city could compel them to remove the snow from the streets and dispose of it instead of piling it up along the sides of the track, and thus obstructing ordinary vehicular traffic.

Promoters and Their Methods

The interest which has been manifested in the development of interurban railway properties and the willingness of farmers and merchants in small towns to lend financial assistance to these enterprises seems to have attracted to this field many irresponsible promoters and others who are entirely incompetent to carry out undertakings of this character. Accordingly, all sorts of schemes are being exploited, the localities selected for this work generally being in the neighborhood of some line that has already been established upon recognized standards by men of sufficient means to build and operate it properly, thus enabling the newcomers to profit by the good reputation of the original installation.

It is questionable whether many of the undertakings complained of are started in good faith and with the intention of completing them. On their face most of them seem to be merely pretenses for unloading worthless securities upon a gullible public, but some of the projects have merit, and if supported by competent men with sufficient capital to put them through, would doubtless develop into profitable investments, but the trouble is that they are promoted merely to be sold out or to be utilized by sharpers for issuing stock. This is evident from the tone and character of certain advertisements that have appeared lately in the newspapers throughout Ohio, especially those published in the smaller cities. An example is furnished by a construction company, which offers for sale securities of a proposed interurban road, to the amount of $25,000, at $10 a share, and as an inducement to purchasers announces that it "will give away on Jan. 1, 1903, $1,000 worth of 6 per cent gold coupon bonds." With each share of stock the purchaser is promised a coupon that will entitle the holder to one chance in the drawing.

Of course, this is a very reprehensible method, and in many

States the promoters could be reached under the lottery law. Evidently they feel the necessity of offering some sort of an explanation of their course, for they say that they are "doing the construction work, and that they have taken a large block of stock in payment and desire to realize on a portion of it." It would seem, however, that they have no confidence in the project themselves or that they realize their inability to carry it through. Otherwise, they would not resort to such unusual methods in financing it. This, however, is not the first unusual procedure in connection with this property. Some time ago an effort was made to secure stock subscriptions along the route of the proposed line by holding out as an inducement an offer of employment on the road. It is greatly to be feared that such practice will bring trouble upon legitimate enterprises, as these operations are bonnd to reflect upon the industry and bring the interurban electric railway into disrepute wherever the people have suffered from the visitation of this class of promoters.

Ill-Advised Activity

Several prominent labor unions in Boston have set on foot a movement to defeat the new Washington Street Subway bill, when it comes before the voters of that city at the next municipal election, on the gronnd that it contains no clause or section providing for the exclusive employment of union labor in the construction of the tunnel. This agitation is an evidence of such gross selfishness and utter want of public spirit that it is earnestly to be hoped that every sane and intelligent voter of the New England metropolis will vigorously repudiate the bold-faced attack upon individual liberty which is threatened, and declare, by no weak majority, that the right of any American citizen to work at terms agreed npon by himself and his employer shall be maintained inviolate.

The transportation facilities of Boston are in crying need of this snbway in the heart of the business district, and if the construction is delayed another year, through the ill-advised activity of certain labor organizations, the public will indeed suffer great inconvenience. The subway bill, as now drawn, has passed both Houses of the Massachusetts Legislature, received the governor's signature, has been approved by the representatives of the city of Boston, its commercial organizations and the Boston Elevated Railway Company, and simply awaits the consent of the voters in referendum enactment to become law. Preliminary studies and surveys have already been made by the Boston Transit Commission, and it is the general consensus of opinion in that city that the bill, as it now stands, represents the most generally equitable and harmonious compromise of the heretofore conflicting interests that can readily be made.

If the bill should be defeated, the first result would undoubtedly be a loss to the labor unions in general prestige that can scarcely be measured. Few communities in the East are in any intellectual temper to stand, without vigorous protest, any further inconvenience and loss resulting from either labor union tyranny or overbearing corporate greed, after the experience drawn from the recent anthracite coal strike. Personal liberty is no where in the United States held dearer than in Boston, and the history of the overthrow of tyranny in the past in New England ought to be warning that the public spirit of 1902 contains enongh of the old fire and indomitable energy to make Boston an inhospitable home for any sort of anarchy. Public sentiment is a factor which neither labor union nor corporation can hereafter safely overlook or defy, with the inference of the coal strike of 1902 behind it. Without popular sympathy a lahor nnion or any combination of unions is bound ultimately to writhe in its death throes, for this country is still in the hands of its voters, who never will yield the individual freedom to work in their own time and way as long as the spirit which founded this republic is to be found alive.

The second result of the failure of the bill's passage would nndoubtedly be a continuance and aggravation of the already burdensome and congested conditions of transportation which to-day exist in the main business thoroughfares of the city. For several years there has been a growing necessity of a further avenue of rapid transit travel in the business heart of Boston, from north to south, and in the reverse direction. Boylston Street, in the Back Bay, is already presenting still further problems of severe congestion in busy hours, and awaits further action by those in authority, as soon as the Washington Street subway can be well started, if not even before its completion. No keen observer of modern methods of transportation can fail to see the immediate necessity of relief in the present congested districts, and the attempt of irresponsible labor unions to block the progress of this great public work, and necessity must be met with an avalanehe of opposition if a great public wrong is to be averted.

The third result may easily be a bill of far less satisfaction to labor than the present one. It is impossible to foresee the character of legislation which would be enacted next year, in view of the possible changes in political outlook and legislative personnel whieh this week's elections may bring. For the labor uuions to iuterfere successfully to prevent the passage of the Washington Street Subway bill of 1902 would be for them to strike a blow which would react hardest upon their own heads, and it is inconceivable that the intelligent thinking citizens of Boston, whether union or non-union sympathizers, will commit an act of such monumental and mischief-making folly as to oppose the passage of a bill, which if made law will result in a general good beyond the power of these brief comments to tell.

Reckless Automobile Driving

Conviction and pnnishment are being meted out to reckless automobile operators nowadays in a manner that is liable to strike terror into the hearts of some of the young scalawags who have been scorching through crowded city thoroughfares and quiet residence districts with no more compunction than if they were on a race course. Six months' imprisonment in the Kings County Penitentiary was the sentence pronounced last week by City Judge Kellogg, at White Plains, upon W. Byrd Raymond, the driver who was arrested in connection with the collision between a trolley car and an automobile in Warbnrton Avenue, Yonkers, on Oct. 26. The accident cansed injury to twenty-two persons who were in the car.

In announcing his decision the court took oecasion to point out the reprehensible character of the prisoner's conduct in pntting the lives of others in needless peril. The judge said that he had no prejudice against automobiles or bicycles in general, but the owners of these machines must understand that the general public had rights which they were bound to respect. There is no inelination on the part of the public to hamper or restrict the proper enjoyment of the automobile or its ntilization in commercial service, but there is a well-defined antipathy to the shallow-pated youngster who delights in doing "stunts" similar to those performed by Raymond at Yonkers in darting across the railway tracks in front of a trolley car.

The eourts of other States have been equally severe in dealing with cases of this kind, whenever it was apparent that the aecidents under investigation were the result of criminal negligence or carelessness. Last week one eonviction of an operator, on the charge of manslaughter, was secured, and a sentence of one year imposed. This should prove a salutary lesson to those who find a peculiar satisfaction in "taking chances" in scorching through city streets. In the rural districts there have been many arrests during the last year, and in some localities farmers have organized societies to enforce the speed limitations imposed by local ordinances. On several occasions these committees have been on the verge of becoming vigilance societies for the time being, especially at resorts frequented by the fashionable set, who simply ignored the loeal regulations and turned the country roads into racing courses. The elimination of this class of operators will do much toward advancing the interests of legitimate sport and the development of the automobile industry.

Opening of the American Soo Water Power Plant and Electric Railway

A water power plant, second only to that of Niagara in capacity, has been under construction for four years at Sault Ste. Marie, Mich., and on Oct. 25 formal ceremonies were held, celebrating the completion of the hydraulic part of the work. Little of the electrical machinery of the plant has, as yet, been put in, but the entire output will be in the form of electrical energy, which will be utilized for various purposes in the immediate vicinity. This development is surpassed in this country only by that at Niagara. The rapids of Ste. Marie River, however, are farther from the market for power and in a sparsely populated portion of the country, but it is believed that the utilization of the great water power available here will go far toward attracting industries to this locality and will assist materially in the development of the region. Unlike the Niagara plant, which already had a market for its product, the Soo plant will be obliged to develop industries for that section and offer such inducements in the way of cheap power as will attract manufacturing establishments to that point.

POWER HOUSE AT SAULT STE. MARIE, MICH.

The capacity of the plant is 32,000 kw, in 80 units of 400 kw each. One of the uses to be made of this electric power is the operation of an electric railway in Sault Ste. Marie, Mich. The water power development has been carried on by the Michigan Lake Superior Power Company. The electric railway has been built by the Trans-St. Mary's Traction Company. Both of these enterprises are carried on by the Consolidated Lake Superior Company at the Soo, on both American and Canadian sides. The active spirit in all of these enterprises is Francis H. Clergue, who is backed by Philadelphia capitalists.

CONTROLLING GATES AT HEAD OF CANAL

The Trans-St. Mary's Traction Company has built a line along the principal street, near the river front, extending from the Country Club, east of town, to Fort Brady and the railroad terminal yards, west of the town, passing the Union Depot and all the main points of interest about the place. The construction work has been done by the Falk Company, of Milwaukee, which built the entire track and overhead line. The rails are 80-lb. standard T, and were rolled just across the river in Sault Ste. Marie, Ont., by the Algoma Steel Company, which is one of the industries controlled by the Consolidated Lake Superior Company. The overhead fittings were supplied by the Ohio Brass Company. Six semi-convertible cars have been ordered from the St. Louis Car Company, which are to be equipped with Westinghouse No. 49 motors, Providence style C fenders and electric heaters, made by the Consolidated Car Heating Company. As there is a large amount of snow at the "Soo" an ample snow equipment has been ordered, consisting of a plow, made by the Taunton Locomotive Manufacturing Company, and a McGuire sweeper.

A feature of the celebration was the operation of a special car over the line, very handsomely decorated for the occasion. The railway company had been unable to secure any of its own cars for this event, owing to the pressure of business at the works at which its rolling stock was being built, and it had been unable to borrow or rent a car from any other builder, as all the shops were behind in their orders. Finally an appeal was made by G. W. Chance, chief engineer of the company, to Thomas Lowry, president of the Twin City Rapid Transit Company, of Minneapolis, who is also president of the Minneapolis, St. Paul & Sault Ste. Marie Railway, and he at once came to the relief of the "Soo" company. Very careful preparations were required, however, to ensure delivery in time. The cars of the Twin City Company are 42 ft. long, and as the flat cars are only 34 ft. long, it was found necessary to utilize two of them for the car body and another for the trucks. Arrangements were made and orders were at once given by Mr. Lowry to load the car, and railroad officials were notified all along the line to rush this train through. It went through on a special mixed passenger and freight train, running on passenger time most of the way, and arrived at the Soo at 4:40 the next afternoon. The same night the train was switched over to the Algoma Iron Works on the Canadian Soo, and unloaded. The car was mounted on its trucks, the electric connections made, and the car returned to the American Soo on its own trucks across the International Bridge and transferred to the Traction Company's tracks early next morning. Decorators were immediately put to work on the car, and it was ready for running before noon.

The Twin City Rapid Transit Company also sent two experienced men, Mr. Lamb and Mr. Blanchard, along with the car from Minneapolis, who, together with the forces of the railway company, arranged all the details as to mounting the car and getting it in service and operating it.

The Trans-St. Mary's Traction Company was thus enabled to present to the citizens of the Soo, for their inspection and use, one of the finest cars built in the United States. The car is 42 ft. long, will seat fifty-one people, has four General Electric 67-motors, K-6 controller, hot-water heating, and is thoroughly modern in all its fittings, having just been turned out by the Twin

City Rapid Transit Company at its shops in Minneapolis, and never having been in service—except on its trial trip—before being sent to the Soo.

The car was very handsomely decorated on the outside and inside with red and orange bunting, in addition to the stars and stripes festooned on the inside of the car. The interior was also decorated with handsome photographs, showing the several stages of development of the canal and power house, in addition to a beautiful brochure gotten up by the Consolidated Lake Superior Power Company, showing views of the industrial establishments around the Soo, and the magnificent scenery along the Algoma Central & Hudson Bay Railway.

The first trip that the electric car made on Oct. 25 was to take a party of the directors of the Consolidated Lake Superior Power Company and invited guests from the power house to the Country Club, at a little after 4 o'clock. F. H. Clergue, president of the Trans-St. Mary's Traction Company, made a very appropriate address at the end of the line, calling attention to the vast resources of the Soo, and also to some local improvements contemplated. On the return of the directors and invited guests to the power house, the public was given a general invitation to ride, and the car made a number of trips and carried many people.

Some idea of the magnitude of the present undertaking will be gained from an examination of the accompanying cuts and consideration of the fact that the length of the canal from Lake Superior to the power house on the Ste. Marie River is over 1300 ft., and that the width is 200 ft. There is an average depth of water in this canal of 23 ft., and the bed is through solid rock. Views of the forebay, showing the ice racks, and of the canal head-gates are also presented.

The length of the dam and power house combined, shown in the cut of the latter, is 1368 ft. In this power house, as already mentioned, provision is made for eighty generating units of 400 kw capacity each, to be operated by turbines under a head of 17 ft. to 21 ft. Right of way, 400 ft. wide, was purchased through the town for the canal, and the lower end of the canal, fronting on the river is the power house, which also serves the purpose of a dam. This arrangement enables the turbines in the station to discharge directly into the river. Water-wheels have been installed in half of the wheel pits, and four electric generators have already been furnished. The Stanley Electric Manufacturing company is furnishing the electrical apparatus, and the water-wheels are made by the Webster, Camp & Lane Company, of Akron, Ohio.

The hydraulic equipment forms one of the most interesting and important features of the plant. The turbine used is of special design. Each unit consists of four water-wheels, placed on a horizontal shaft, which extends through a water-tight joint in the bulkhead into the generating room, which is on the down-stream side of the power house. The turbine ordinarily lies submerged in water, and when in operation the four wheels discharge into one short central draft tube. The gates for starting and stopping the wheels and for governing are located around the periphery of each turbine wheel. The specifications called for a unit that would develop 568 hp from 391 cu. ft. of water per second, under 16 ft. head, with a turbine speed of 180 r. p. m., and show an efficiency of 80 per cent from three-quarter to full gate. The turbines installed were tested in pairs on a horizontal shaft in the flume of the Holyoke Water Power Company before being installed at the Soo plant, and the maximum readings shown were 292 hp and 84 per cent efficiency at a speed of 180 r. p. m. under 16-ft. head, aggregating 584 hp at a minimum of 82 per cent efficiency from three-quarters to full gate for the penstock unit. Lombard water-wheel governors will be used, and to obtain synchronism, electric motors controlled at the switchboard will be employed. The electrical equipment will be supplied by the Stanley Electric Manufacturing Company, and will consist of three-phase 2300-volt 30-cycle alternators, three of which have already been installed. One 60-cycle Westinghouse alternator is also employed. The output for the use of the electric railway will be stepped down to 365 volts, by means of Stanley transformers into 600-volt direct-current by Stanley rotary converters. The line has been built under the supervision of G. W. Chance, chief engineer of the Trans-St. Mary's Traction Company.

ICE RACKS FROM BOTTOM OF FOREBAY

Tunnel Franchise Accepted

The formal acceptance of the revised franchise for the Pennsylvania Tunnel, granted by the Rapid Transit Commission three weeks ago, was received on Wednesday, Nov. 5, by the Commission from the directors of the Pennsylvania Railroad. The company's delay in returning the franchise was due to the fact that the Aldermen announced some time ago that they would not act upon it until after election. The franchise will now be forwarded to the Aldermen, but nearly a month will pass before a vote is taken on it. The Merchants' Association, of New York, has sent to merchants and manufacturers in Manhattan a circular urging them to petition the Board of Aldermen, according to blanks inclosed, to pass the Pennsylvania Tunnel franchise.

A 10,000-Volt Railway Motor

In anticipation of the renewal of the tests in high-speed high-pressure electric railway work, near Berlin, Siemens & Halske have been conducting some independent experimental work and car by omitting the intermediary transformers and utilizing a smaller motor. The old car weighed 96 tons, and the new equipment on a similar car carrying the same number of passengers, will not exceed 76 tons, while the power required will be cut down from 1000 hp to 920 hp.

FIG. 1.—ELECTRIC LOCOMOTIVE EQUIPPED WITH MOTORS TAKING CURRENT AT 10,000 VOLTS

have built for this purpose an electric locomotive, which is illustrated in Fig. 1. In the original Zossen tests the line pressure of 10,000 volts was reduced by transformers before it reached the motors, but in the new equipment provision is made for taking current directly from the line at this voltage. One advantage in this arrangement will be the reduction effected in the weight of the

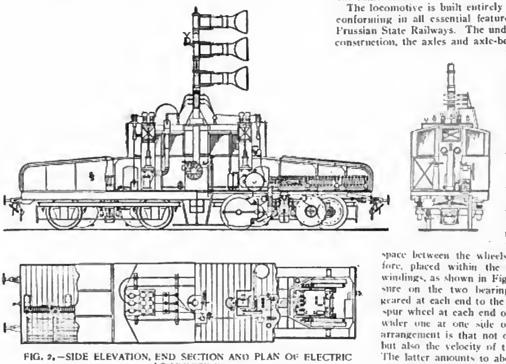


FIG. 2.—SIDE ELEVATION, END SECTION AND PLAN OF ELECTRIC LOCOMOTIVE

The following description of this equipment is taken from a translation published in the London Electrician of a paper on the subject by Walter Reichel, and the cuts are reproduced from the same source.

The locomotive is built entirely of iron, of standard gage and conforming in all essential features to the requirements of the Prussian State Railways. The underframe is of the double-truck construction, the axles and axle-boxes being similar to those of the previous experimental car. The wheels have a diameter of 1250 mm, and the wheel base of each bogey is 3¼ m. Although only fitted with one motor each at present, there is room on each bogey for two. Fig. 2 shows the general arrangement of the locomotive with a pair of motors on each bogey.

The details of the motor, which was designed by Herr Reichel, chief engineer for Siemens & Halske, are closely similar to those of motors for narrow gage. It is necessary to make the utmost use of the space between the wheels, and the bearings are, therefore, placed within the space enclosed by the motor windings, as shown in Fig. 3. In order to keep the pressure on the two bearings equal, the motor shaft is geared at each end to the car axle, there being a narrow spur wheel at each end of the motor shaft instead of a wider one at one side only. Another reason for this arrangement is that not only the pressure on the teeth, but also the velocity of the teeth is exceptionally great. The latter amounts to about 18 m per second, with 147 teeth in the larger wheel and 69 teeth in the smaller wheel.

Before adopting a system of lubrication, a number of experiments were tried with tooth velocities of 25 m per second, and it was found that it was not sufficient to fill the gear box with oil or consistent grease and let the gear run in it. For this reason

the system of forced lubrication with compressed air, shown in Fig. 4, was then adopted. By means of a pump a pressure of air corresponding to 5 cm of mercury is produced in the oil reservoir. This drives the oil out of the reservoir to a distributing cock, which must be turned to the right or left, depending on whether the locomotive is to be run forward or backward. The oil flows through one of two sets of pipes to the nozzles above or below the toothed wheel, as shown in Fig. 5, and after it has been used it collects at the bottom of the gear case, and is then pumped back to the oil reservoir. This system of lubrication is only necessary with a gear ratio of 2.1. If a ratio of from 1.35 to 1.4 is used, the velocities of the teeth are smaller, and the ordinary lubrication with consistent grease is sufficient, otherwise the construction of the gear box is not different from the ordinary, nor is the suspension of the motor.

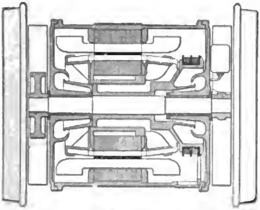


FIG. 3.—SECTIONAL VIEW OF MOTOR

The motor case is of cast steel, and is made in two parts, carefully turned inside so that there is a firm bearing surface for the active iron and a good conduction of heat through it. The bushes of the bearing are in one part. They are of bronze, lined with white metal, 300 mm long and 100 mm internal diameter. This makes it possible to reduce the air-gap of the motor to 1.5 mm or 2 mm. The active iron which carries the primary winding is fastened with screws into the motor case, which is shown in Fig. 6. The rotor of the motor is fastened to the motor shaft by means of a special sleeve, so that the motor can subsequently be arranged on the car axle for direct driving. The active iron of the rotor is held together by screws and pressure discs, and carries the secondary winding. On the rotor sleeve two slip rings are held by a second sleeve, and the current is collected from the slip rings by means of carbon brushes. There are three apertures in the upper casting of the motor case on the slip-ring side, to facilitate inspection. The motor itself is lubricated by means of oil and wicks, the oil being contained in vessels screwed on to the motor and communicating with the bearings by copper tubes, which are shown in Fig. 5. This arrangement was found to be necessary because of the small space available.

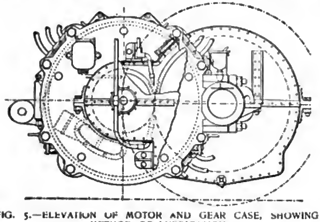


FIG. 5.—ELEVATION OF MOTOR AND GEAR CASE, SHOWING METHOD OF LUBRICATION

To obtain a better casting the axle bearings are screwed on to the motor casing, Fig. 6. On the other hand, the lugs which, with the assistance of the springs, transfer the weight of the motors and the turning movement it occasions to the underframe, are cast directly on to the motor casing.

In the first experimental fast-speed car, it will be remembered, the primary winding of the motor was on the rotor, but this is only feasible with bar winding, which is not applicable in this case owing to the high pressure. It was not necessary to construct the present motor for a very high turning moment, as, in consequence of the smaller weight of the car, smaller starting torque was necessary. The rotor may, therefore, be of smaller diameter, and the primary winding can be placed on the stator. In order to afford as large a cooling surface as possible, the slots are made fairly deep, so that the coils are thin and wide. A calculation of the conditions of saturation of the active iron gave a radius of about 34 cm for a width of 30 cm. The cores of both stator and rotor consist of laminations, those for the rotor being stamped in one piece, and those for the stator being made up of segments. The calculation for the winding gave 72 open slots, and 72 wires per slot of the primary. Star connection is employed, and the wires are placed in mica tubes. To save space and to secure certainty of insulation the coils are placed alternately in longer and shorter tubes, so that the longer ends always lap over the shorter. By this means the possibility of sparking from one phase to another is considerably reduced. The method of insulating the high-pressure winding was determined upon after several trials. In the final test the winding withstood a pressure of 22,000 volts without cracking and without disclosing any weakness.

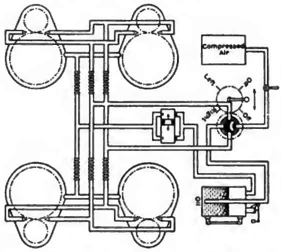


FIG. 4.—SYSTEM OF LUBRICATION

The winding of the rotor is placed in ninety half-closed slots, and consists of a number of single flat copper bars arranged in series and four in each slot. It is a wave winding connected in star. The three free ends are connected to two slip rings and the frame of the rotor respectively. At starting the pressure in the rotor winding is 700 volts. The employment of bars for the rotor winding facilitates the addition of bronze binding wires, and also permits of a very effective ventilation. The air enters the neighborhood of the shaft and is directed outward through the openings in the rotor casting by vanes, which are cast on to the latter. This current of air also cools the stator coils. The velocity of the air was about 6 m per second, and about 120 litres of air was forced through per second. To prevent the high pressure sparking over when the motor gets warm, the inside of the frame is covered with a thick layer of mica wherever it is adjacent to the

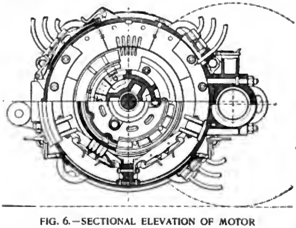


FIG. 6.—SECTIONAL ELEVATION OF MOTOR

primary winding, and the distance of this winding from the frame is always kept as large as possible.

The three high-pressure cables, which are insulated to stand 15,000 volts, are led through three soft rubber brushes, which are placed inside hard rubber brushes. They end in three terminals, which are mounted on corrugated porcelain insulators attached to saddles supported on mica-insulated iron tubes fixed to the casing of the motor. The weight of the motor and gear is 4090 kg.

Fig. 7 shows the connections of the motor and controller. With the exception of the resistances, nearly all the apparatus employed are similar to those used in the previous experimental car. The speed at starting is regulated by varying the resistance in the rotor

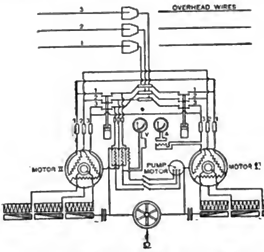


FIG. 7.—GENERAL DIAGRAM OF CONNECTIONS

or secondary circuit. This is insulated from earth, as the third secondary phase of the motor is connected to earth through the motor shaft. The current to the stator coils passes from the main switch through fuses. The switch is driven by an air piston, and serves as a reversing switch by changing the phases.

The rotor resistance has twenty-four steps, and the resistance coils are spirals of Kruppin wire, held by porcelain insulators on an iron frame. The hand-wheel is on a vertical spindle which controls this resistance. The switches for the primary high-pressure circuit are of the tubular type, and are worked by air pressure. Both the high-pressure switches and fuses are placed in the cable ways behind the motors, and are visible through glass windows.

When the locomotive was completed tests were made at a gradually increasing pressure, starting at 6000 volts and about 50 alternations. The final test was made at 11000 volts and 95 alternations, and with a trailer weighing 31 tons, a speed of 105 km per hour was attained. The toothed gear ran quietly, and the motor stood the high pressure. About 260 kw were required. This corresponds to a load of about 280 hp on the driving wheels, which agrees with experience already obtained at 100 kw per hour. Tests were also made to determine the tractive effort of the locomotive, and for this purpose the old experimental car was used as trailer, so that a total weight of about 130 tons was drawn.

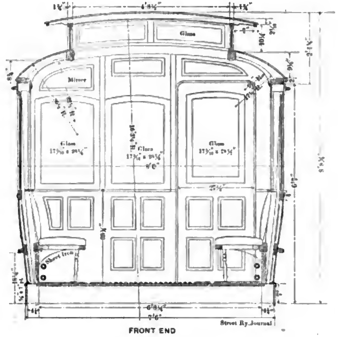
Brownell Plant Acquired by the Brill Company for the American Car Company

It was announced in St. Louis this week that the Brownell Car Works had recently been acquired by the American Car & Truck Company. This latter company was formerly the American Car Company, which has been reorganized and reincorporated under the new name, and at a recent meeting John A. Brill was elected president of the new company. This deal will give the Brill Company control of two large and complete car building plants west of the Mississippi River.

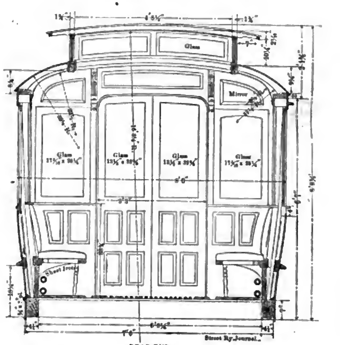
The Brownell car works, of which the late F. B. Brownell was the head, are in North St. Louis. When, some years ago, the firm became financially involved to such an extent that the appointment of a trustee was necessary, W. B. Thompson, a director of the company, was appointed to that position, and has handled the property ever since. At the time it came into his hands, it is stated, there was $190,000 of indebtedness against it. Mr. Thompson has so handled it that the property has not only paid off the total indebtedness, but has given a handsome income for Mrs. Brownell and her daughter.

New Cars for the Cincinnati Traction Company

For a long time single-truck cars have been used exclusively on city lines in Cincinnati. The present management, however, has seen fit to follow the example of many other companies throughout the United States, and has begun to equip with double-truck



FRONT END



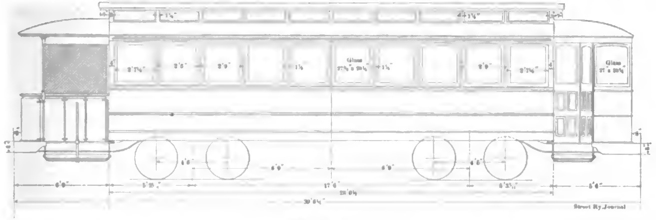
REAR END

CROSS SECTIONS OF STANDARD CLOSED CARS

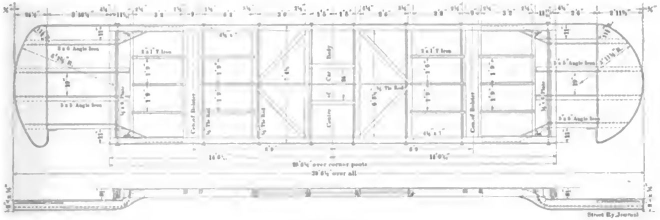
cars. The drawings showing the construction of these cars are given accompanying this article.

The length of the new car is 39 ft. 6½ ins. over all. The length of the body is 28 ft. ½ in. over corner posts. The trucks upon which these cars are mounted are Peckham 14B 3, extra heavy, with 4 ft. 6-in. wheel base. The distance between truck centers is 17 ft. 6 ins.

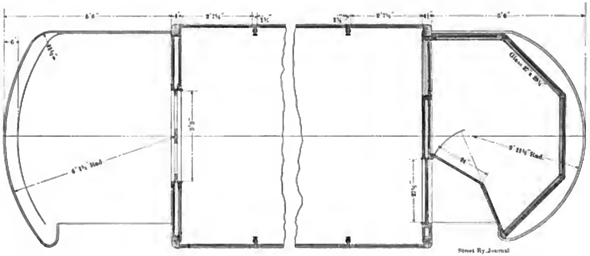
These cars will run single-ended, as can be seen by the platform arrangement, which gives the motorman a cab by himself, free from all interference by passengers. The cars will be equipped



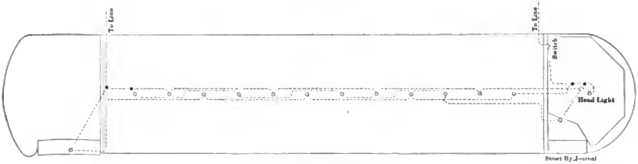
SIDE ELEVATION



FLOOR FRAMING



PLATFORMS



PLAN OF WIRING CARS

with Westinghouse number 68 motors, two motors on each truck. These cars are being built at the Cincinnati Traction Company's large shops in Cincinnati, where such an extensive plant for car building has been erected that the company has seen fit to take a number of contracts for cars from other street railway companies in order to make it profitable to keep these shops in operation. The shops are under the charge of Robert Dunning, master mechanic, who, with President and General Manager W. Kelsey Schoepf, decided upon the design of the cars now being built.

New England Street Railway Club

The first fall meeting of the New England Street Railway Club was held at Wesleyan Hall, 36 Bromfield Street, Boston, on Thursday evening, Oct. 23, with President Farrington in the chair. The subject for discussion was the "Multiple Unit System," and the meeting began with a paper upon this topic by Paul Winsor, assistant to the vice-president of the Boston Elevated Railway Company.

In speaking of multiple unit control Mr. Winsor stated his desire to cover the subject broadly, and referred to the definition given by F. J. Sprague, in the May 4, 1901, issue of the STREET RAILWAY JOURNAL, as follows: "Briefly defined it is a system of control of railway motor controllers, whatever their number, and wherever situated in a train, through a secondary electric circuit, common to all the cars from or through which it is desired to exercise control. The number and position of equipped or unequipped units, and to a certain extent the character of these units, is immaterial, and variation in end relation should likewise be a matter of indifference." Mr. Winsor then said in part:

"Nearly all the members of this club are single-car men, and few roads in the East, operated by electricity, are using more than one car per train. In cities where rapid transit service is a necessity in congested districts at high speed it becomes very necessary to use more than one car in a train in order to handle the traffic properly, especially as the time interval between high-speed cars must be considerably greater than that between slower speed equipments. It is now about two years since an exhaustive series of tests were made at night in the Tremont Street subway by the Boston Elevated Railway Company on the different types of multiple unit control then on the market. Trains were run back and forth, the power consumption of the equipments measured, and after a careful analysis of the results the Sprague system was adopted by the company as the one apparently best suited to its requirements. The systems tested were the Sprague, Westinghouse and General Electric. As is well known the Sprague Company now is controlled by the Sprague Company, and I understand that there is some arrangement between the Westinghouse and General Electric Companies whereby patent litigation is avoided when the two types of controls come into competition. I believe that the electric railway world owes more to Frank J. Sprague in connection with the multiple unit system than to any other man, and it owes much to him in view of his earlier pioneer work in surface car practice as well. Not only is he a tremendous enthusiast himself, but as he has the power of making others enthusiastic, and it is largely due to his persistent efforts that the control of to-day is in its present practical form.

"All three systems have master controllers on the car platforms, connected by cables to the control system proper. The Sprague and General Electric controllers resemble closely the ordinary platform street car controller, but the Westinghouse master controller is slightly different in its outward form, but essentially similar in its operating features. In general the Westinghouse system is the simplest of the three. It involves no new or untried devices, and all the apparatus which goes to make it up has been used for years in other service. The main controllers are usually placed in a closet on each motor car. One air cylinder moves the reverser around, and another operates the main controller drum, which makes the series parallel combinations of motors which are found in ordinary work. The power for moving the control cylinders is derived from compressed air supplied by the air-brake system, and the air valves are opened and closed by small electro-magnets, actuated by a small battery current.

"The first movement throws the reversers forward or back, the second operates the air cylinder of the car circuit breaker, closing a rather quick break switch by air pressure, and the third master control movement connects to the controller drum through its air valves, causing a step by step movement, called 'notching up,' and throwing the motors into the usual series parallel combinations. When the master controller is off and air cylinder opens the automatic circuit breaker referred to, and the main controller drum also returns to the off position.

"The greatest danger in any control system is the possible inability to cut off power when necessary. On ordinary street cars an overhead switch on the platform accomplishes this. In the usual multiple unit practice the failure of the current supply opens the control circuits, and every possible safeguard is employed to avoid the danger above suggested. In the Westinghouse system the train cable has seven wires, one each for the battery current, forward reverse, backward reverse, series, multiple, off and main switch. There are five air cylinders, one each for the main switch, forward reverse, backward reverse, notching up main controller drum and off controller. In the Sprague system the main control is similar to that of the ordinary street car controller in its functions, except that owing to patent courses, the reverser drum is in a separate case from the controller drum, and the series and multiple connections are all made on a separate piece of apparatus. The first motion of the master controller handle throws current to the reverse solenoid, turning the drum to either forward or back position, and the main controller drum is then released, and notched up by a small direct-connected motor called the 'pilot motor,' whereby the main motors of the car are operated in the usual fashion. The pilot motor is not controlled directly by the master controller, but is operated by relays. After the first step has been passed over the master controller cylinder, which starts the reverser the second step operates the relays of the pilot motor rheostat. The Sprague system derives its current from the trolley or third rail, as does the General Electric.

"On the relay circuits of the pilot motor is an automatic throttle which absolutely limits the acceleration of each car, and prevents more than a certain predetermined current's flowing through the motors. If this throttle is traversed by too large a current the contact lifts, and the pilot motor stops the rheostat and controller drum at once. Thus the acceleration is automatic, and it is absolutely impossible for a motorman to vary it. As soon as the main motors have speeded up properly the pilot motor starts again, and so proceeds until all the resistance is cut out. Little or no training in the actual handling of the controller is required with new motormen. It is impossible for a motorman to jerk a train in starting. Any notch of the control can be run upon for yard movement. As yet, I understand that the throttle is not applied to the General Electric system, a mechanical feature being introduced to caution the motorman from accelerating too fast. In the Sprague system is a 'coast' contact, which runs the pilot motor backward, thereby throwing the rheostat off the circuits. The car cannot possibly be started without the reversers being either positively in forward or back position.

"One of the safeguards of the Sprague system is the facility of opening the main circuits which exists. This may be done either by the reverser, the automatic stop relay, which is actuated by the reverser solenoid current, and runs the pilot motor backward, or the coast relay. The reverser cannot be thrown in a second time unless the main controller is completely at the 'off' position. The car will not move unless the reverser is in one position or the other for forward or back motion.

"The General Electric system has the usual master controller in the cab, and its reverser is a piece of apparatus by itself, operated directly from the master controller by solenoids. It is a dead switch, and never moves while the current is on, and 'stays put' in its last position when once the controller handle is moved forward. Only the rupturing of the current supply will throw the reverser off. The series, multiple, and resistance contacts are each made on separate pieces of apparatus, called 'contactors.' A two-motor equipment of moderate size requires thirteen contactors per car. I have seen this control in operation in New York or Brooklyn, where it has been in service nearly two years, and the apparatus is certainly very rugged, and has stood the test of working experience very well. In the General Electric train line are nine wires, there being two for the reverser, one for the series, one for the multiple position, and five for resistance combinations. These operate the thirteen contactors. A four-motor equipment requires twenty-six contactors.

"There are four fundamental requirements in any system of multiple unit control:

"1st. Absolute certainty of the opening of the main motor circuits when the master controller goes to 'off' position.

"2d. Proper car direction of movement under all circumstances.

"3d. Motor-control circuit never closed unless all resistance is in, and then the step by step cutting out of this resistance.

"4th. In my opinion very important automatic throttle control.

"I think those of you that have operated motors of over 75 hp will agree that they are very hard upon controllers. A few of our cars on the elevated division are equipped with four 75-hp motors, and the remainder with two 150-hp motors. The current of the latter equipments is very hard upon the control, and prob-

ably four times as frequent inspection is required over the four-motor equipments.

"More trouble arises from the heavy currents encountered in slow-speed yard work than with the lighter currents required to operate at high speeds. We have no circuit breakers on the elevated cars in Boston, as we did not feel that there was any breaker made which might not 'freeze' or stick at some critical time. Instead we have used No-Arc fuses with considerable success, and lately a copper ribbon fuse, 1¼ ins. wide, 9 ins. between terminals, 10-1000 of an inch thick, with a 1-in. roll. These fuses rupture nicely at 600 amps. We have also used shoe fuses successfully on each of the four contact-shoes, these are constituted of copper wire. The small percentage of weight on drivers found in locomotive systems limits the acceleration which can be obtained. Then two 150-hp per axle is about the limit of equipment, which can readily be applied to the type of cars now in use in this country. By the adoption of the multiple unit electric system the Liverpool Overhead Railway has raised its schedule speed from 12 miles to 19 miles per hour. The Manhattan Elevated in New York use the General Electric system of mutiple control, two cars out of three being motor cars. In rush hours two trains are coupled together, making four motor cars and two trailers per train. The train can be operated from any platform, and in any of the three multiple unit systems there is practically no limit to the number of cars that can be operated in a train together. Trains are generally cheaper to operate than the same number single cars in point of transportation wages. The multiple unit system gives a very elastic arrangement of cars from the operating standpoint. The best of brakes should be installed on all such high-powered equipments as are to-day utilizing the multiple unit control.

" 'Straight air' is easier to handle than automatic air in many classes of service, as simply opening the valve handle applies the brakes by direct-air pressure, but with more than one car straight air brakes are very dangerous, especially on grades. Here it is hard to handle, and to get the proper application is not easy. The brake must be entirely released before a second application can be made, and if many are made on a single grade it is not long before the motorman finds himself out of air supply. It takes about one second to restore 1 lb. of air with this system, and unless the valve is in the off position the auxiliary reservoir cannot be restored. Steam roads using straight air employ a retaining valve, to enable long applications to be made on grades."

In the discussion which followed, Chief Electrician Hall, of the Boston & Maine Railroad, stated that his road uses the multiple unit system of control on its line between Concord and Manchester, N. H. It has been found extremely useful in handling rush business.

H. S. Knowlton, of Boston, then spoke of the multiple unit control as installed upon the Seattle-Tacoma Interurban Railway, a road managed and built by Stone & Webster. The line connecting the two cities was opened for business in September of this year, and is about 36 miles long, a schedule time of about 1¼ hours in limited express service being feasible upon it. There are local trains in addition to the express trains. Each train consists of a 30-ton motor car, hauling a 20-ton trailer, and the maximum speed is above 60 m. p. h., with four General Electric 66 (125 hp) motors, gear ratio 1.55. Current is supplied to three sub-stations at about 25,000 volts, three phase, and applied to the motors from both third rail and trolley, according to the right of way at 600 volts. In each sub-station is a 300-kw motor generator set, with a storage battery, operating with a booster in multiple with the set on the station bus-bars. The road is also to be equipped with express cars weighing from 25 tons to 30 tons, each car carrying four General Electric 66-motors, and operating at high speeds in order to get out of the way of the passenger trains, the road being single-tracked. The road also is planning for two or more electric freight locomotives, each equipped with four General Electric 66-motors, geared for a maximum speed of 12 miles per hour, with a 275-ton train on level track. It has been proposed to arrange to throw all four motors in full multiple in the freight equipments, and thus obtain a speed of 24 miles per hour approximately, with the same weight of train, blowing air through the motors by a small fan-motor blower, in order to reduce the heating. On this particular road the cost of the multiple unit system, with all its advantages, was not prohibitively greater than a straight locomotive system, and the lesser points of decreased platform space and more evenly distributed weight upon car body, were not lightly passed by. It has been found difficult to operate the interurban trains at slow enough speeds in Seattle on account of the high-speed gearing, high-powered motors and multiple connection of two motors in the series position. This can probably be obviated by a special commutating switch, with which the motorman can throw all four motors in series for city running, and thus apply 125 volts or slightly over in city service, thereby enabling the slower city speeds of 12 m. p. h. and under to be properly held, supplemented by judicious braking and coasting. Care has to be used in operating more than one motor car in a train at a time, as the indiscriminate bunching of several equipments would overload the sub-station nearest, even with the battery auxiliary. He further stated that it was his opinion that the energy consumption of trains operating on such a road as the Seattle-Tacoma should not exceed 70 watt-hours per ton mile at the sub-station, direct-current, bus-bars. The maximum accelerating current of each motor trailer train would probably work out in excess of 800 amps. The energy consumption of the control circuits would probably amount to less than 1 per cent of the average current per train.

The paper on "Car House Labor-Saving Appliances, by William Pestell, of the Worcester Consolidated Street Railway Company, was reserved for a later meeting.

Hudson Valley Railway Strike Ended

The strike on the Hudson Valley Railway has been settled and the lines are again in working order with a full complement of men, and no interference from any source. The company persisted in its refusal to recognize the union, and, as the old employees found that their places were being filled satisfactorily by non-union men, they yielded to the inevitable and made the best terms they could. This decision, it is believed, was prompted in a measure by the fact that the company has maintained a consistent attitude throughout the difficulty, and that it became evident that the management was not to be intimidated by the violence of the mob. The latest outrages, culminating in the riot on Oct. 4, resulted in the indictment of twenty-five men, who were charged with participating in that affair. Thomas Halligan, a boilermaker from New York, who, it is alleged, caused considerable trouble along the line as an agitator, was arrested in Ballston last week. Halligan heard that a warrant was out for his arrest and was trying to escape to New York. It is charged that the prisoner was implicated in the blowing up of the trolley car at Stillwater and other similar outrages. The criminal proceedings had the effect of frightening the labor leaders from other cities, and they quickly left the field of action. With their departure negotiations were reopened on behalf of the men.

On Saturday a committee of the Glens Falls men called on President Colvin and General Manager Josselyn, and after a consultation was asked to formulate a statement of terms upon which the men would return to work. This was agreed on, and the committee submitted terms which, after some amendments, were accepted by the company's officers. The Glens Falls division held several conferences during the day and finally voted to accept the agreement and return to work. The same terms were submitted to the Saratoga and Stillwater divisions, and the Saratoga men voted favorably, while the Stillwater men rejected them. A committee then went to Stillwater and brought back a committee of six, which had several consultations with the representatives of the company. The committee went back to Stillwater, and a meeting of that division was held, at which it was decided to accept the terms and return to work.

It was announced that the terms upon which the strike was settled provide that the men who have been receiving 16 cents an hour will receive 17 cents, and men who have been receiving 18½ cents will hereafter be paid 19 cents. Instead of having inspectors on the Stillwater division, who are paid 25 cents and 15 cents, that work will be done at night by men from the main offices. All the former employees will be reinstated in their old positions, except those who are under indictment.

The company makes no contract with the union, and does not recognize it in the settlement, the men returning to work as individuals. It is further announced that the men will abandon their present affiliation with the union on the lines of the United Traction Company, and that a new organization will be formed to consist exclusively of employees of the Hudson Valley Company, and have no connection with any other Union.

The case of Motorman Osgood, which has been one of the mooted points, will be placed on exactly the footing that it had before the strike, and he will have a hearing by the officers of the company. Hereafter any employee has the right to appeal to the general manager of the company.

The strike cost the company and the men a great deal of money, but the heaviest expenditure was that for the maintenance of the troops which were called out to preserve order and protect property. This will fall upon the counties in which the disturbances occurred.

Accident Blanks

The extended paper on the subject of accidents, by C. R. Barnes, electrical expert of the New York Board of Railroad Commissioners, and the paper and discussion on the adjustment of accident claims at the recent Detroit convention, indicate the practical importance of this subject of street railway operation and the necessity of procuring and having on file full details in regard to any accident. In no other way can the claim agent be sure of the actual liability of the company to the victim of the disaster, or the advisability of settling a claim before a suit is brought.

The methods followed by the different railway companies in securing reports of accidents are multifold, but practically all include a statement to be secured from the conductor and motorman, the victim, if possible, as well as any witnesses who may be on the car or in the neighborhood. A study of the different blanks in use reveals a variety of the practice. Thus, the San Francisco & San Mateo Railway Company requests the witnesses, besides making a statement of the accident, to indicate where he or she was at the time the accident occurred, and if a passenger to mark his position on a small sketchof a car contained in the blank, or if a pedestrian, on a sketch of the street. The accident blank of this company to be filled out by witnesses is given below:

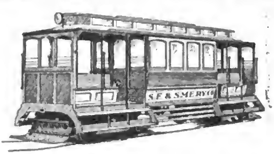
San Francisco & San Mateo E. Ry. Co.
Office: 102 Thirtieth Street,
San Francisco.

Accident Report No........

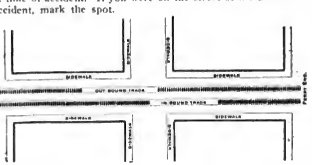
STATEMENT OF

Name ....
Occupation ....
Address ....
Date ....190....
Date of accident...........................Time...............
Were you a passenger..
State number of car..
Where did you board the car....................................
In what direction was the car going (towards the Ferry or away from it)...
Were you sitting or standing upon the car......................
Were you on the right or left-hand side of the car, looking ahead ....

Please mark the place you occupied on the car on this sketch.



Mark on diagram below, names of streets and position of car at time of accident. If you were on the street at the time of the accident, mark the spot.



State the sex of person injured and about what age.

Extent of injury or damage to property so far as you were able to see it.

CAUSE OF ACCIDENT:—

Here state as fully as you are able how the accident occurred, from your point of view. Also state as accurately as possible: (1) Was the bell rung by the motorman before the accident? (2) The distance or time during which it was rung. (3) How far the car ran after the accident occurred. (4) Any other particulars you think material.

Please sign your statement in full.

The information required on the blank to be filled out by conductors in the case of all accidents is as follows:

ACCIDENT REPORT.

INSTRUCTIONS.

On this blank will be reported all accidents to persons or property, however they may be caused, and accidents to cars, with injury to same.

Date of Report.......18.., Hour and Date of Accident......18..
Run No....... Car No......, Badge No......, Line............
Leaving..........Street at..........M. Motorman............
For ....
At or near which Street....................Exact Time.........
Number of Passengers on Car..................................
Name and address of person injured...........................
Extent of injury...
....
Address of relatives or friends..............................
What disposition made of injured person......................
Age ....
Description ....
Cause of Accident..
What Physician (if any) attended injured person..............
By whose order was he summoned...............................
Detention to car...
State briefly amount damage (if any) to car..................
Give a complete account of how the accident occurred. (State if the bell was rung and for what distance it was ringing before the accident occurred; at what speed the car was traveling just before the accident; if it slowed up at all; the distance car ran, after the accident, before it came to a stop, and any other particulars you recollect. If there is not enough space here for you to write all you know, ask the Receiving Clerk for a Supplemental Accident form, and continue on it your account of the accident.)

A number of companies have adopted the policy of printing the accident blanks to be filled out by the conductor and motorman, a set of rules to be followed by them in case of accident, so that these rules will be fresh in their minds and that there will be no possibility of a claim of ignorance of it. Some of these instructions are very complete, as will be seen from the following, which are reproduced from the report used by the New Orleans City Railroad Company:

ACCIDENT RULES.

The term accident includes injury to persons or property, collisions, breakages of all kinds to the cars, ejections, personal trouble in car between employees and passengers or between passengers, and any event of any name or nature occurring upon a trip, wherein damages occur to persons or their property, to car, to vehicles, or wherein the possibility of damages may arise from any action of employees or passengers themselves, whether complained of or not.

Conductors are not permitted to use discretion as to reporting or not any occurrence included in above statement, but must report promptly all matters coming within above list.

Reports must be truthful and state exact facts, without fear, favor or prejudice, and no attempt must be made in a report to shield any employee, or to conceal any of the circumstances surrounding the occurrence reported. Reports must state facts which can be sworn to in court by the employee reporting or by the party or parties named as witnesses. Inferences, opinions and suggestions must be stated as such, and not as facts. Reports must give:

1st. Date of accident and exact time of day when it occurred.

2d. Exact place of occurrence, full name and address of party injured, or likely to have been injured, either in person, property or feelings; the owner of property damaged or doing damage to company's property; if vehicle, name of driver, license number and year of issue.

3d. Nature of accident, and cause of its occurrence. This cause must be carefully ascertained.

4th. Full name and address of all passengers, bystanders and employees, as far as possible, whether they saw how the accident happened or not.

5th. Distance where car stopped, after the accident happened, from place on the street where accident occurred; measurement to be made by stepping the distance from the front end of car to point of accident. This measurement should be witnessed by a bystander, or some one not connected with the company.

6th. Statement of injuries or damages as well as any expressions of opinion from bystanders regarding the accident.

Above report must be filled out upon blank for that purpose, signed by the conductor and motorman, and left at the station after turning in car.

In the event of personal injury care must be taken to render all the necessary assistance and attention to person injured.

The most trivial and apparently unimportant accident or occurrence in or about the car, even where a person declines to give name, claims no injury, or seems to regard the whole matter as trifling, must be reported with as much care as though the damage or affair was of the utmost importance.

All accidents must be telephoned to general office of company as soon as possible, and especially in the event of a serious accident, the general office must be notified immediately so that prompt aid may be furnished and investigation begun pending the full report.

It is expected that a report will be made of all accidents or injuries that may occur on the track, or within 10 ft. of same, whether the car was concerned in the accident or not.

Attention is specially called to questions arising between conductors and passengers, as to the payment of fare, character of money offered, change furnished, transfers or other complaints leading to disorderly or boisterous conduct, in each of which events conductors must secure positive proof and eye witnesses, so as to be able to clearly substantiate the truthfulness of his report in court, particularly before any ejection or arrest is attempted, and full report of the same must be promptly made in accordance with above rules. No ejection must be made without first refunding fare.

Conductors or other employees must not talk about, or give any information whatever concerning an accident to any person, other than the proper officer or person delegated with the authority of the company to investigate the occurrence, and all questions asked of any employee of company, except by person or persons above named, must be answered by directing the questioner to general office for information.

Employees must not visit an injured party, or family, to make inquiries or discuss accident without authority of company.

The above rules must be strictly observed, and too much stress cannot be laid upon their importance. If any doubt as to their meaning in any respect exists in the minds of employees, they should consult, for their own protection and the company's, their station foreman.

In other cases rules are much more brief, as will be seen by reference to the formula printed on the inside of the accident report book used on the street railway system of the Washington Water Power Company, of Spokane, Wash., and which are given below:

RULES IN REGARD TO ACCIDENTS.

The conductors will use every possible precaution to avoid accidents. If an accident should occur, they will—

1st. Stop the car immediately, ascertain the name, residence and business address of the injured person, render all possible assistance; if necessary taking them to a drug store, if one is near by.

2d. In case the accident is at all serious, conductor will telephone immediately to superintendent's office—Telephone 437½—stating place and nature of accident.

3d. They will ascertain the names, residence and business addresses of all passengers in car, and of all persons who witnessed the accident, and at end of trip make out a written report and send same at once to superintendent, giving full and detailed report of the occurrence.

4th. Conductors will refrain from conversation or giving any information of any accident to any person other than the proper officials of the company. You will not accompany injured party home or call upon same, without consent of superintendent.

NOTE.—The above rules regarding accidents are of the utmost importance, and must be observed, no matter how slight the accident to person or property.

For Example.—If a person falls in stepping from your car, even when the car is at a standstill, and the accident is due entirely to passenger's own carelessness, and passenger insists that he or she is not hurt, the name and address of such person, with witnesses, must be taken and reported to the superintendent. This is absolutely necessary for the protection of both company and conductor. Accident reports must be handed to proper officer of the company at the first opportunity.

Avoiding Accidents.—Before going around curves motormen must be sure there is no danger to persons or teams before proceeding.

Before leaving car to flag across other tracks, conductors must request passengers to remain seated.

When approaching bridges, viaducts, poles or other objects near the track, conductors will warn all persons standing on footboard of open cars or on rear platform of closed cars.

Decision on Chicago Transfer Cases

A decision of much importance was handed down by the Illinois Supreme Court, Oct. 25, regarding the right of the Chicago Union Traction Company and the Chicago Consolidated Traction Company to charge more than one fare for a ride from the city limits down town, or to refuse transfers from the North Side to the West Side lines and visa versa. The Chicago Union Traction Company operates all the downtown surface lines on the North Side and West Side, and the Chicago Traction Company owns the lines in the outlying districts. The Chicago Consolidated Traction Company is the property of the Chicago Union Traction Company. Last spring some of the residents of districts near the city limits along the Consolidated Traction Company's lines revived an old city ordinance requiring the issuance of transfers between any two street railway lines owned or controlled by the same company, and demanded that instead of paying two fares as heretofore in order to reach the business district, they be given free transfers. Suit was brought to compel the companies to do this. The decision of the lower court was favorable to the city, and the recent Supreme Court decision confirms the decision of the lower court. The practical effect of the decision is not only to establish the power of the city to require free transfers between the lines of the Union and the Consolidated Traction Companies but also to require free transfers between the lines on the West Side and North Side which are owned by different underlying companies, but are all leased and operated by the Chicago Union Traction Company. The decision even goes further than this, and establishes the power of the city to regulate fares in spite of franchise terms. This would hardly seem to be in accordance with the decision of the United States Supreme Court last March, when the power of the Detroit City Council to change rates of fare from those named in the ordinance was denied, and the franchise considered as a contract that could not be broken. The points involved are not all exactly the same, but it would be interesting to see what disposal the United States Supreme Court would make of the Chicago case.

The directors of the Chicago Union Traction Company have held a meeting and instructed its officers to comply with the decision and prepare to issue transfers between outlying and downtown lines, and between the North Side and West Side. Just what effect it will have on the earnings cannot be safely predicted.

The decision will end a stubborn fight between citizens of outlying wards and the Union Traction Company over "one fare" transportation.

Judge Ball upheld the city ordinance requiring this "one fare" ride in the spring. The Union Traction Company refused to act on this decision until it had been passed on by the Supreme Court. The citizens affected endeavored to force compliance at once, and the result was a succession of small fights in which passengers were ejected from West Side and North Side electric and cable trains.

In passing on this question the Supreme Court, first of all, affirms the city's right to regulate fares. It says an examination of the city charters of 1851, 1863 and 1872 reveals the fact that the power had been granted. It is further stated that the general doctrine is that the Legislature has the right to regulate fares and charges of common carriers, and that the municipality may exercise that power by delegation from the State.

On the question of the franchise contract between the city and the street railway companies the court held that the corporations exercise their powers subject to municipal regulations, and if there were any contracts such as claimed by the Union Traction Company, through assignment to it from the subsidiary companies, the enforcement of the transfer ordinance is not a violation of them.

The freight business of the Toledo interurban lines has increased so rapidly of late that it has been decided to double the facilities of the present freight station by the erection of a duplicate of the present building, which was illustrated and described in a recent issue of this paper. The structure will be 125 ft. x 28 ft., and will have four doors. It will be arranged so that freight can be unloaded from the trucks into the cars.

Why Transfers Should be Registered

BY GEORGE WILKES

The general public must be taken into consideration in determining upon any system of collecting and registering fares. In certain States the "bobtail car" and the requirement that passengers deposit their fares in boxes, provided for the purpose, proved objectionable, and the public was sustained by the courts. The Canadian "coffee-pot," though not a preventive of dishonesty, has been tried and found wanting in public estimation. The European system of issuing printed receipts, numbered consecutively, accompanied by an inspector's periodical verification of the sequence of their issue by the conductor and their possession by the passenger, would not be tolerated, nor would the proposition contained in the paper, "Registration of Transfers," by C. D. Meneely, read at the recent convention of the American Street Railway Association, admittedly inadvisable under federal law, to award cash prizes, determined by public drawings, to certain holders of fare receipts, prove profitable. The American public, unfortunately, does not consider it dishonorable to defraud a corporation, especially a railway, and a negotiable value—which no perspective prize could influence—would attach to such receipts, and they would eventually return to and be reissued by the dishonest employee. The public cannot be depended upon to detect and report dishonesty, though experience has demonstrated that a few may advise of seeming discrepancies where fare registers are in use.

Taking into consideration our requirements it is doubtful if the present general method, properly applied, can be improved upon.

Perfect accountancy exacts a record of all transactions; conductors should therefore be required to account for all passengers riding on their cars. The non-registration of transfers is a violation of this fundamental principle and practically conveys an assurance of immunity from detection to the dishonest employee. Advocates of non-registration exact the collection of a value of which they require no accounting. Should transfer returns be exacted, though not registered, trading between dishonest conductors naturally results, to enable them to cover their peculations of cash fares. These returns, with the registered fares, will equal and frequently exceed the total of passengers carried. Registration is the only practical basis for the detection of trading of transfers between conductors. It is a fallacy to assume that the non-registration of transfers focuses the attention of the conductor on the collection and registration of real revenue—cash fares. Condoned carelessness in one direction will not improve service in another.

Transfers properly registered may be readily checked and separated from cash collections; evidence to the contrary being an indication of weakness of method or incompetency of a secret service department.

As the transfer cannot be divested of its value to the traveling public, that value cannot be nullified through non-registration by conductors, nor should proper registration attach a value to it comparable with a cash fare.

It is not intended, in this article, to cover the entire field of a conductor's duties in the operation of a street car, excepting in the relation to the collection and registration of cash fares and transfers and their proper accountancy; considering the scope, a slight digression is allowable where a standard of employee and proper discipline are necessary to the maintenance of a service.

Experience has proven the error that any character of man is competent to collect fares. A conductor's duties are arduous and difficult, and his efficiency determines the public sentiment of a community toward the management. The conductor should, therefore, be selected with a view to his ultimate efficiency. He should possess a fair education, to enable him to render complete and accurate returns of his collections on his "day card," such as may be required by his company.

As simplicity in accounts lessens opportunity for error and fraud, "day cards" should conform to such a requirement. The line, run and car numbers, the conductor's and motorman's names and badge numbers, and the reading of the totalizer figures of the register at the commencement and ending of a shift or a day's work, the difference between such readings, the commencing and ending numbers of transfer pads issued and the difference between such numbers should be clearly indicated. The several character of fares should be separated under proper columns for each half-trip, and should be indicative of the trip number, direction shown on register and schedule leaving and arrival time at terminals. The "day card" and unused transfers should accompany all cash collected during the shift or day. Transfers collected should be enclosed in an envelope, properly marked, to indicate the trip on which they were collected, and deposited in a receptacle, provided for the purpose, at each terminal at the conclusion of each half trip, or such a receptacle may be placed in each car for the same purpose. It is preferable, if practicable, that transfers be printed with the date of intended issue and be issued only by transfer agents. Under all circumstances transfer points should be well defined and limited in number. Should transfers be issued by conductors they should be given only at the time of payment of the fare. A general transfer station, such as in operation by the Nashville (Tenn.) Railway and others is advisable where transfer issues may be restricted to a single point.

Like in accounts, simplicity in fare registers lessens opportunity for fraud. Registers are intended to indicate to the public the honesty of the servant, while multiplex registers have a tendency to confuse, to the advantage of the unscrupulous employee. Mechanically written "day cards" are liable to create differences difficult to adjust, and will dissatisfy and demoralize an honest conductor.

Cash, coupons, tickets, etc., representative of a 5-cent fare, should be registered together, and transfers separately, on the same or another dial. A desirable method of registering transfers would consist of a combined dial register and cancelling bell punch, to be worn on the conductor's person. Each register dial should plainly indicate the direction. Too little attention is given this important detail. A dishonest conductor might have several passengers properly registered on his "out" trip, and purposely fail to change his register for the ensuing "in" trip; he would thus be in a position to collect fares without registering, to the extent of those recorded for the previous "out" trip, and have the register cover the total of passengers on the car.

An occasional clerical comparison of transfer returns to determine the necessary proximity of intersecting cars may be made, in addition to secret service, to determine if trading exists. The desirability of the uniformed register inspector must remain a matter of doubt.

Given proper discipline and an efficient employment and inspection service, it will be impossible for a conductor to tamper with a register without the fact becoming known through a single inspection report.

On interurban roads, where varied rates of fare prevail, 5-cent fares should be registered, and other and through fares should be audited from the punched duplicate of a duplex ticket, the original being furnished the passenger.

Careful selection of employees, fair wages, considerate treatment and encouragement of a conscientious performance of duties are essential features of a proper management of properties.

Transfers should be printed in such form as to admit of their easy manipulation. Different colors may be used to indicate the transferred direction, as red for North, white for South, blue for East, yellow for West. It is essential that they be numbered consecutively for record purposes and to detect counterfeiting. Date, time and transfer point should be indicated by punch marks, or otherwise, on all transfers issued.

Mr. Vreeland Not to Go to London

A statement was published in one of the New York papers, last week, that Mr. Vreeland, president of the Interurban Street Railway Company, of New York, had been offered and had accepted the management of the Yerkes underground railways in London. The report has been officially and absolutely denied by Mr. Vreeland, who states that he has no present intention of leaving the New York system, which he has done so much to perfect. The rumor was the occasion for a number of very complimentary notices in regard to Mr. Vreeland's management in the daily press, which indicates the high regard in which he is held in this city. It is not possible to reproduce all of these, but the following is taken from an editorial on the subject in the New York Tribune:

The assurance that Mr. Vreeland is to stay in New York and keep on attending to the business which has had the advantage of his supervision so long will, we think, give general pleasure. Under his management of the Metropolitan lines many improvements have been effected for which he is fairly entitled to praise. Outsiders cannot know just how great his share of credit ought to be, but the general understanding is that the benefits which the public enjoys are largely due to his sagacity and enterprising spirit. Important consolidations contributing to the convenience of the community have been effected, an up-to-date motive power has been installed, the equipment has been otherwise vastly improved and a liberal transfer system has been introduced. In short, New York does not now suffer greatly by comparison with other cities in respect to street railroad facilities, whereas not long ago it was absurdly and disgracefully behind the times. It should be added that under Mr. Vreeland's administration the company has lived on good terms with its employees, whose well being it has aimed to promote by various wise measures, including a pension system.

Transmission Lines for Electric Railways

BY ALTON D. ADAMS

The question is often asked, where does direct feeding to trolley lines cease to be good practice, and at what point do sub-stations enter the problem advantageously?

The economic limits of distribution to electric railways at 500 volts to 600 volts is bound to vary with other factors, but they are not fixed with even approximate uniformity by the practice of existing systems. If a trolley system is divided into separate parts, each of which has its own feeder from the power station, the limiting conditions for the length of any feeder may be readily determined. Take, for illustration, a case where the feeder must deliver 200 kw for use in the car motors and cover loss in the return circuit. If this delivery of energy is to be made at a distance of 5 miles from the generating station it will be well to put the station voltage at 600 approximately, and allow a drop of about 100 volts in the feeder at maximum load. Taking 11 ohms per mill foot as the resistance of commercial copper wire, the size of cable necessary to deliver 200 kw at 500 volts on the trolley wire when the drop is just 100 volts, is found from the formula

$$\text{C. M.} = \frac{400 \times 11 \times 26{,}400}{100} = 1{,}161{,}600.$$

As this is an odd size of cable, it will be better to use the nearest standard size, which is 1,000,000 C. M. If this figure for the cable is substituted in the formula just given, with X in place of 100, the drop of pressure in the cable will be found to be 116 volts. So to get 500 volts at the trolley wire the station voltage must be 616. Of course the trolley line voltage of 500 above the negative bus-bar at the station will not all be available for the motors, because there must be a material drop of pressure along the 5 miles of return circuit through the rails. If this drop along the rails equals that in the feeder the pressure between motor terminals will be only 500-116 or 384 volts. This pressure is lower than ought to be permitted in good practice, so that the drop of 116 volts in the feeder is fully as much as it should be for any ordinary case. A cable of 1,000,000 C. M., with weather-proof insulation, weighs very close to 18,750 lbs. per mile, so that the 5 miles of it in this case will have a weight of 93,700 lbs. At 15 cents per pound this feeder 5 miles long costs $14,055.

Assume now that another section of the trolley line is so located that a feeder to it must extend 10 miles from the power station, and that this section also requires 200 kw delivered at the trolley wire. As it is not advisable to allow a drop of pressure greater than that in the other cable, the weight must go up as the square of the distance. In other words, the feeder 10 miles long must consist of two cables of 1,000,000 C. M. each, or their equivalent in wires of other section, so that the weight of feeder is 374,800 lbs., and its cost is $56,220.

Evidently the conditions named approach, if they do not pass, the limit where it will pay to change to transmission at high pressure and erect a sub-station with transformers and rotary converters. Conditions as to the requirements for energy on particular sections of a trolley line are frequently not as clear cut as those just assumed, or the distant loads as heavy, but examples from actual construction are not wanting to show the great weights of long feeders. Another factor that tends to reduce the weight of present railway feeders is the fact that such feeders have often been put up without accurate computation of the maximum rate at which they must transmit energy. As a result it is not hard to-day to find electric railways on which, at times of greatest load, hardly more than one-half of the energy sent out by the power station is expended in the car motors. The following examples of fairly heavy feed wires are taken from lines that have been constructed within the last year:

In one case a single-track railway, about 22 miles long, has a generating station about 3 miles from one end of it, and a sub-station, which for present purposes may be considered another generating station, about 12.8 miles from the generating station and 7 miles from the other end of the track. This line is equipped with twenty-five cars that carry sixty-five motors, and the heaviest part of the traffic is on that half of the line nearer the generating plant. From this plant the trolley wire is fed with 41,250 ft. of cable, with a section of 500,000 C. M., extending in both directions along the track, and for a distance of 25,000 ft. toward the sub-station. Besides the feeders just named a pair of No. 0000 wires extend all the way from the generating station to the more distant end of the line, with a double length of 95,000 ft. This pair of 0000 feeders is also supplied with energy from the sub-station. All of these feeders convey energy at 500 volts to 600 volts. Taking the weight of weather-proof wire, double braided, at 720 lbs. per 1000 ft. of No. 0000, and 1875 lbs. per 1000 ft. for 500,000 C. M. cable, the weight of feeders on this line reaches 206,475 lbs., or nearly 9400 lbs. per mile of track. At 15 cents per pound the cost of these feeders is $30,981, or $1,408 per mile of track. These figures are for a line of track no part of which is more than 6 miles from a station feeding it, and on which traffic is only moderately heavy.

In another case, feeders, with an aggregate section of 1,811,000 C. M., are run from a sub-station with a capacity of 600 kw in rotary converters. These feeders extend to central points in the electric railways of two distant cities, one of which points is about 9 miles, and the other point about 7.8 miles from the sub-station. From the sub-station to these two feeding points the weight of feeders for the trolley wire is approximately 300,000 lbs., or 500 lbs. per kilowatt capacity of the rotaries in the sub-station. At 15 cents per pound these trolley feeders represent an investment of $75 for each kilowatt of capacity in the sub-station from which they deliver energy to a distance of about 9 miles. Seventy-five dollars per kilowatt of capacity will go a long way toward paying for step-down transformers, rotary converters and sub-stations. Both theory and the best practice seem to indicate that the economic radius of distribution to electric railways at 500 volts to 600 volts is less than 10 miles.

Alternating generators for electric railway work may now be had with voltages up to 13,000, so that in ordinary transmissions it is not necessary to use step-up transformers.

The Buffalo, Dunkirk & Western Railway

Details of the proposed Buffalo, Dunkirk & Western Railway have been given out by the Cleveland people who are interested in the company. Among them are Hon. Luther Allen, James W. Holcomb and Jay Latimer, who are interested in the Cleveland, Painesville & Ashtabula Railway, now under construction. These gentlemen have acquired an interest in the Dunkirk & Point Gratiot Railway Company, operating 7 miles of road out of Dunkirk, N. Y. This property is to be consolidated with the proposed road. The line will run out of Buffalo on Ridge Street to West Seneca, down the Erie Shore Road, 10 miles to Lake View Station; thence by private right of way through Angola, Farnham, Irving, Silver Creek and Dunkirk, running through Dunkirk on the tracks of the Dunkirk & Point Gratiot Railway Company. From Dunkirk to Buffalo all the right of way has been secured, and much of it has been secured from Dunkirk to Westfield. At Westfield the line will connect with a line to be built by the Erie Rapid Transit Company, and when links are completed there will be a continuous line along the shores of Lake Erie from Buffalo to Detroit. It is denied that as soon as these links are filled up an effort will be made to consolidate all the connecting roads into a single line, which would be nearly 400 miles in length. W. J. Conners, of Buffalo, and Daniel F. Toomey, of Dunkirk, are among the New York men who are interested in the Buffalo, Dunkirk & Western Railway.

Changes in the Personnel of the Cincinnati Traction Company

A number of changes have recently been made in the personnel of the Cincinnati Traction Company, owing to the recent resignation of R. I. Todd, former second vice-president and assistant general manager of the company. Dana Stevens, the treasurer of the company, has been made assistant general manager, and will assume the duties formerly looked after by Mr. Todd. His title will be assistant general manager, the second vice-presidency having been abolished. W. H. McAllister, the present auditor of the company, has been named to succeed Mr. Stevens as treasurer, and Charles F. Callaway, the assistant auditor, will become the auditor.

Address of the Secretary of the Street Railway Accountants' Association

W. B. Brockway, secretary of the Street Railway Accountants' Association of America, requests the publication of a note that all mail to him relating to the Accountants' Association should be addressed to his residence, 40 Morris Street, Yonkers, N. Y. Mr. Brockway's business address is Room 417, Broad Exchange, 25 Broad Street, New York.

COMMUNICATIONS

President Vreeland's Address

Oct. 30, 1902.

EDITORS STREET RAILWAY JOURNAL:

The presidential address, delivered at the Detroit convention, by Mr. Vreeland, of the Metropolitan Street Railway Company, of New York city, outlined in the clearest possible manner the general relations of the street railways with municipal authorities and newspapers in the majority of cities in the United States. His remarks were not only absolutely correct, but have been strikingly exemplified in the case of the newspapers, during the last two or three weeks, by the comments which have been printed in a number of cases on the address itself. In fact, some editors were so anxious to set their papers right before the general public that they overstepped the mark, and showed in their articles an animus which Mr. Vreeland characterized, in exceedingly moderate language, when he said: "And the public newspapers so far from taking into account the service we are rendering and protecting us against the schemes of demagogues, are rather inclined to regard injuries so inflicted with amused indifference, if not with positive favor."

In this statement Mr. Vreeland hits the nail on the bead. If the editors of some of our daily papers were better informed regarding the profits made by the majority of street railways, and of business in general, instead of possessing the unbounded ability of "excoriation," they would take a milder and more common sense position relative to the majority of public service corporations. It is easier, however, to take the role of general critic, because it takes less knowledge of the true conditions, and this attitude is, as a rule, a more popular one with many readers, who are pleased to feel that somebody else is championing their rights and defending them against oppression, rather than commending the other fellow. As a result the policy of villification continues.

One result of this plan of indiscriminate denunciation and superficial analysis is already showing itself. This is that the general public, or certainly that part of it whose good opinion is worth having, is largely discounting any statements of the kind referred to in papers which indulge in that sort of thing. When a man with even an averaged sized bump of common sense discovers that the editor of any particular paper has the habit of consigning all persons, parties and corporations who disagree with his particular notions, to the limbo of unregenerated souls, or does so as a matter of policy with all public servants, he very soon learns to disregard anything which may be said in the paper in relation to such subjects. If our daily newspaper editors, certainly those who cater to the intelligent portion of the community, could only realize that their present policy is weakening the hold which their opinions have on their readers, the better it would be for every one concerned, and Mr. Vreeland deserves the warm gratitude of all public service corporations, as well as all fair-minded newspaper readers, for the fearless position which he has taken on this subject. The corporations do not object to intelligent criticism, but to that form of it which is based on prejudice and an insufficient knowledge of facts.

A WESTERN MANAGER.

Work of Committees

Nov. 1, 1902.

EDITORS STREET RAILWAY JOURNAL:

There is one feature of the work of the American Street Railway Association that is worthy of special commendation, and that is its committee work. In every technical association standing committees are necessary. There are certain problems of railway construction, maintenance, operation and general management which can be solved only after many years of careful and continuous consideration. Ample time must be given for collecting facts and figures, for arranging and examining them, for comparing the results of one method or of one locality, or of one period with another, and of determining what is best fitted to survive. Such work must be done by a selected committee, composed of the men most competent to deal with the matter in hand. Having once been selected, the precedent has very properly been established of not changing them every year.

The gentlemen who constitute these committees are busily engaged with the important interests in their keeping, and living as they do in widely separated sections of the country they find it difficult to have more than two or three committee conferences during the year. It is not conducive to the study of problems for the solution of which time is demanded to be continually changing the personnel of the committees. Results of value cannot be accomplished unless there is continuity of service on the important working committees. Men who value their reputations often hesitate to serve on one-year committees, that are expected to present to the succeeding annual convention a cut and dried solution of some important problem. They are, however, willing to serve on committees which are permitted to report progress each year until they have had all the time necessary to reach a definite conclusion and make a final report.

The association is to be congratulated upon having adopted, some years ago, the plan of having standing committees. It has at present a committee on standards and one on standard code of rules. Although these committees are not provided for in the constitution or by-laws of the association they have, by common consent, become known as continuous committees. The question of signals and safety appliances has grown to be of such vital importance to the members of the association that the suggestion has been made to have those subjects also referred to a standing committee. The annual reports of these committees should be of infinitely more value than any paper presented by a single individual, because they represent the careful conclusions of several practical men. It has been the history of every association that has accomplished great and lasting results that its chief reliance has been upon its standing committees, composed of experts in the different departments. To them has fallen the grave responsibility of originating, formulating and developing the association standards, and recommending to the association their adoption.

While it is true that the action of the association must continue to be recommendatory in its character, the fact must not be lost sight of what its recommendations represent. They represent the convictions of the ablest and best railroad managers of the country, who have had exceptional opportunities for gathering information, and who have applied their large experience to the solution of the practical questions submitted to them. It is not to be desired that the action of the association should be otherwise than recommendatory, because it must be borne in mind that the association is conducted in the mutual interest of its members. In view of the diversity of conditions prevailing it is not to their mutual advantage that the action of the association should be made binding upon all the roads. But when the association, after careful investigation and due deliberation, has placed the seal of its approval upon a certain solution of a problem, who is there great enough in himself to say that the action taken is not in accordance with the best practice, and is not for the best interests of the railroads as a whole?

The value of the American Street Railway Association to the electric railways of this continent and to the public, was never better illustrated than at the recent annual meeting in Detroit. The wide range of the subjects discussed, the active and earnest participation of the thoughtful and experienced representatives of the great and small urban and interurban roads, the spirit of mutual interest and co-operation of this body of acknowledged experts, the evident desire to bring about reforms in behalf of the public as well as of the corporations, the public attention to the address of the president and to the proceedings of the convention, amply justify the existence of the association.

A DELEGATE TO THE LAST CONVENTION.

Selling Current from Railway Service

Oct. 30, 1902.

EDITORS STREET RAILWAY JOURNAL:

Can you furnish us any data regarding prices charged per watt hour for the sale of current from 500-volt service? We have endeavored to establish rates for the sale of power and are anxious to learn what other companies are charging.

JAMES R. ADAMS.

Owing to the attitude of the insurance companies very few street railways have attempted to sell current from 500-volt service, and as a result very little data regarding prices, etc., are obtainable. As a matter of fact, very few street railway companies are in position to sell current, as very few of them have a surplus of power available. It is much more common practice for street railway companies to buy current for the operation of their lines than to sell it for motor service, and in a number of cases where current is being purchased for this purpose the prevailing rate averages from 2 cents to 3 cents. The electric lighting companies, however, furnish current for incandescent lighting at prices ranging from 10 cents to 25 cents per kilowatt-hour; 15 cents to 20 cents per kilowatt-hour may be considered a fair average price. Many of the companies include in this price lamp renewals, but others do not, and there does not seem to be any uniformity in practice on this point. Of course, the rate for current for motor service should be considerably lower than that charged for electric lighting, but this would depend largely upon local conditions, the amount of current required and the time when the service was given, also whether it would be for a short period or extend over several hours a day.

Signals on Interurban Lines

BY ARTHUR WENTWORTH

In his paper at the recent Detroit convention G. W. Palmer, Jr., speaking of collisions, said: "There is only one way to prevent these accidents, namely, to adopt such rules and methods of operation as will insure that but a single car will occupy any block or section of track at any one time." In a paper on the same subject at the recent Lake George convention Thomas E. Mitten said: "Theoretically the ideal system would be that controlled by an automatic block, operated independent of trolley circuit, and absolute in its action, which would permit of but a single car or train upon a section of track at one time." It would appear that both gentlemen refer to blocking apart cars or trains moving in the same direction. The art of signalling has not yet reached that point where trains or cars in both directions, on single-track roads, can be operated from start to finish without special orders, and guided solely by the block system. For single-track operation the train despatcher is a necessity, which probably cannot be dispensed with for many years to come.

There are many steam roads in the country that operate on crowded sections of double track an automatic, absolute block signal system. The blocks are exceedingly short, and the plant is quite intricate and is expensive to install and maintain. It may be just as well to dismiss from our minds for the present all idea of applying such a refinement of block signalling to the interurban roads and content ourselves with the consideration of that which is cheaper and more practicable. The conditions which are to be met on any given road must be the determining factors. The interval between cars or trains on the interurban lines varies, as a rule, from fifteen minutes to an hour. It is of rare occurrence that the interval will be shorter than fifteen minutes, except where extra cars or trains are sent out and operated as sections of a regular run. The operation of trains in two or more sections is not in itself objectionable, provided proper safeguards are established. The problem with the interurban roads in the operation of trains in sections seems to be to keep the following section from running into its leader, rather than to prevent butting or head-on collisions with cars or trains in the opposite direction. What is wanted is some block signal system or some method of operation which will prevent rear end collisions in the few instances where the interval between cars or trains is less than fifteen minutes. On a road where the sidings are six miles to 8 miles apart, and the speed averages 30 miles to 40 miles per hour, it is entirely practicable to operate a steady fifteen-minute interval and block the cars or trains absolutely 6 miles to 8 mile apart. The question, what kind of a block signal should be used, will depend entirely upon the amount of money each road can spend for the purpose.

Whatever form or character of block signal is used the only thing reasonably to be expected of it is to give an indication to the following car or train whether the block ahead is clear or whether it is occupied. Having given this information to the motorman it remains for the manager of the road, or his train despatcher, to say how the motorman shall be governed. When the clear signal is given there can be no doubt that the rule should permit the motorman to proceed. But what is he to do when the signal indicates that the block is occupied? Will he proceed or wait until the block is cleared? Without question it would be safer to wait until the block is cleared. Any manager who expects to secure absolute safety in operation must insist upon the absolute space limit, and only one car or train within that space at one time. But it is the experience of all the interurban lines that there are times when this is impracticable. In such cases the rule should be to give written notice that the block is occupied, and hold the car or train crew receiving such notice responsible for safe operation, requiring them, under pain of instant dismissal, to approach all curves and obscure places slowly and under absolute control. It should, however, be understood that this does not relieve the crew of the car or train ahead from properly protecting itself. Permissive, or time limit, blocking is operated on the theory that one car or train may safely pass into a block already occupied, provided extreme caution is used by both train and car crews. Only the closest inspection and the most rigid discipline can make it certain that the men will exercise extreme care. It is easy enough to make rules, but a great many disembodied spirits could testify that human lives have paid the penalty of human frailty and carelessness. Roads that are obliged to operate under such conditions may just as well recognize the hazardousness of it, and do the best they can by discipline or by mechancial means to protect their danger points. Having realized that the absolute space limit is the fundamental principle of safety in block signal practice, it remains for each road to get as near to it as its conditions will permit.

Where the interval between cars or trains is fifteen minutes or over there should be little difficulty in devising some simple but effective means of operating the space limit by means of the telegraph or telephone. If the road is too poor to afford some system of manual block signals, with the necessary expense ot telegraph or telephone operators, each train or car crew might be made to report themselves to headquarters from each siding or intermediate block station. Now that the interurban roads are going into the business of carrying mail, express and heavy freight, it is necessary to have station buildings, with agents at every town or village and at many of the country sidings. Where there are no agents to assist in the operation of the block system the train crews could be called into requisition, as above indicated.

In the discussion of Mr. Palmer's paper at the Detroit convention, Mr. McCormack contributed a lengthy but interesting statement outlining what has been done by the steam roads, impressing upon the managers of the electric roads the importance of providing some adequate block signal system. He described several well-known block signal systems, but it does not appear that he recommends any of them as being adapted to the conditions of service on the interurban roads. It is to be regretted that with Mr. McCormack's experience in the operation of steam and interurban roads he did not recommend some system of signalling or some method of operation that would meet the requirements of the interurban lines. The managers of the interurban lines seem to be deeply impressed with the importance of the subject, as shown by the expressions from Mr. Palmer and Mr. Mitten, and they are anxiously asking for some system or method that is reliable and not too intricate or expensive. Where the attendance of station agents, operators or switchmen can be secured, it appears that the samaphore signal, operated manually, as directed by telegraph or telephone, would be the cheapest and most reliable system to be adopted. If the road cannot go to the expense of the installation and care of semaphore signals, a green and a red flag may be made to do the necessary duty by day, and the same color of lights at night. Although the human element enters largely into the operation of the telegraph or telephone block system it may, by careful and systematic training and inspection, under suitable rules, be depended upon to give the proper indication to the motorman, and that is about all that any block system will do.

Restriction on a Jersey Trolley Franchise

The New Jersey & Pennsylvania Traction Company has won part of its fight for 3-cent fares in Trenton, the Common Council granting to the company the right to bring its Trenton, Lawrenceville & Princeton Railroad into the center of the city, and showing a favorable disposition toward the ordinance granting similar favors to the Yardley, Morrisville & Trenton Street Railway, which is also owned by the New Jersey & Pennsylvania Traction Company.

The franchise is unique in that it places more restrictions on the company than has ever before been attempted in this city, and perhaps in this State. The ordinance provides that the fare shall be not more than 3 cents, with free transfers within the city limits, nor more than 5 cents to any point within 5 miles of the limits. Streets occupied are to be paved by the company for a distance of 2 ft. outside the rails, where double track is constructed, and 3 ft. where single track is laid. The right to use the streets shall not be exclusive, but must be shared with any other company or companies bearing a proportionate share of the expense entailed. The right of the city to purchase the company's Delaware River Bridge is made a provision of this grant. In case of any dispute between the company and its employees which might threaten to tie up the road, five arbitrators shall be selected —two by the employees, two by the company and the fifth by the combination; and if this committee fails to settle the difficulty, then a commission shall be appointed by the Common Council. The company is given the right to cross Humboldt Street, Sweet's Avenue, Fountain Avenue and Ingham Street at grade with the extension, where it will leave North Willow Street to run in a direct line to the present terminus. The franchise covers West Hanover Street from North Warren, in the center of the city, to North Willow, near the State Capitol, and up North Willow, crossing the Philadelphia & Reading Railway at grade, to Pennington Avenue, a distance of 2800 ft., where the street will be left and the line will proceed on private right of way for a distance of 2000 ft. to the present terminus at Ingham Street. It is for this 4800 ft. of track that the company is asked to make the concessions named in the franchise.

The New Jersey & Pennsylvania Traction Company also asked for a franchise for 2400 ft. on West Hanover Street, and less than

1000 ft. on Calhoun, or a total of 3400 ft. in all. This ordinance has been laid over until another meeting because of the fact that the city's direct water mains, between the pumping station and the reservoir, run through this street. The company offers to protect the mains in any manner that electrical experts may decide, and, in addition thereto, assume responsibility for any damages that may arise from escaping electrical currents or the jarring of the cars. It also offers to widen the street, at its own expense, from 8 ft. to 20 ft., in order that the tracks shall not really occupy the street space itself. In addition to this the same terms are offered as in the Princeton extension franchise. It is believed that the Council will pass this ordinance, as public opinion demands it. It would interfere with no other company and would be a great help in establishing closer relations between Trenton and the Bucks County (Pennsylvania) towns across the Delaware. Five cents will take one to Morrisville or Yardley when the line is completed.

The New Jersey & Pennsylvania Traction Company will pay in the neighborhood of $50,000 for these franchises for 8200 ft. of right of way, or more properly speaking, 6200 ft., counting out the private property crossed by the Princeton extension. First of all the company will give to the city, in the Calhoun Street widening, over $25,000 worth of property, including attendant expenses, and the paving will cost nearly that much more. On streets where the pavement is already laid, as is the case upon all except Calhoun, the company will pay the propertyowners for the amount of pavement, in accordance with the specifications of the ordinance, but this is included in the $50,000 estimate. The company will also pay the city $7,900 for land taken in the neighborhood of the old reservoir property, and as a fitting climax the company is required to pay to the city 1 per cent of its gross earnings after ten years and 3 per cent after twenty years, although the life of the franchise is limited to twenty years.

The New Jersey & Pennsylvania Traction Company, or Johnson Syndicate, as it is locally known, is the outcome of the late Albert L. Johnson's New York-Philadelphia trolley scheme, and is similar in many ways to the Cleveland plans. John B. Hoefgen, the successful bidder for franchises in Cleveland, is president of the Trenton, Lawrenceville & Princeton Railroad, owned by the New Jersey & Pennsylvania Traction Company. The company has expended large sums of money in Trenton and vicinity, and the indications are that it will spend much more very soon. The Delaware Bridge cost more than $200,000, and about $100,000 more was expended in the purchase of properties to secure entrances. It cost the company $27,000 to build and pave the 0.6 mile of road in Princeton. The Princeton line is entirely on private right of way, enclosed with wire fence, and the fares for the 12 miles to Princeton are 10 cents, and to Yardley, 5.5 miles, 5 cents, including the crossing of the Delaware Bridge, which is 2 cents to foot passengers, thus literally making a 3-cent fare to Yardley.

The restrictions which have been imposed on these corporations are unusually burdensome, and cannot be defended. The railway interests in some cases invited this trouble by engaging in competition and blocking each other's progress.

With the entrance of the New Jersey & Pennsylvania Traction Company to the city there will be two foreign corporations in Trenton, although this company's president and superintendent are making this city their permanent home. The Camden & Trenton Railway Company has secured a franchise allowing it to reach the center of the city, and both companies have maps filed covering the whole city. The Trenton & New Brunswick reaches the city line, the Delaware Valley Traction, which is seeking a franchise in Atlantic City, is hard at work securing rights of way in this vicinity, and the Trenton, Pennington & Hopewell Street Railway Company proposes building a line to Hopewell.

Tramways in Norway

The following is a list of the tramway companies in Norway, length of line, number of cars and some statistics on number of passengers carried during past years:

City	Name or Company	Length in Km	Motor Cars	Trail Cars	Passengers Carried
Kristiania	Kristiania Elektriske Sporvei	8.45	35	22	In 1895, 2,735,174; in 1900, 5,355,285; in 1901, 5,490,098; in first half 1902, 2,823,947
Kristiania	Kristiania Sporveisselskab	12.61	47	33	In 1876, 1,462,200; in 1890, 2,890,600; in 1899, 5,021,500; in 1901, 9,350,300
Kristiania	Kristianias Kommunale Sporveie	7.07	20	12	In 1900, *2,951,509; in 1901, 3,023,805. In first half 1902, 1,417,850
Kristiania	Holmenkolbanen	6.96	Total 26	..	First ten months 1898, *651,744; in 1901, 909,460
Bergen	Bergens Elektriske Sporvei	6.8	16	5	July 1, 1897, to June 30, 1898, 1,420,038; July 1, 1901, to June 30, 1902, 1,486,192
Trondhjems	Trondhjems Elektriske Sporvei	3.5	11	..	In 1901, about *1,000,000

* First business year

Comparative Statement of the Brooklyn Rapid Transit System

A digest of the annual report of the Brooklyn Rapid Transit Company has already been printed in these pages. The full annual report is just at hand and contains the following comparative statement of earnings and expenses for the years ending June 30, 1902 and 1901:

Gross Earnings	1902	1901	Inc. or Dec., + or − Amount	Pr. Ct.
	$	$	$	
Passenger	12,321,265	11,718,969	+602,336	5.14
Freight, mail and express	64,902	58,394	+ 6,508	11.15
Advertising	124,455	122,501	+ 1,954	1.59
Total earnings from operation	12,510,622	11,899,824	+610,798	5.13
Operating Expenses				
Maintenance of way and structure	567,059	378,800	+188,259	49.69
Maintenance of equipment	1,160,990	891,966	+269,013	30.16
Operation of power plant	1,262,429	1,024,979	+237,450	23.16
Operation of cars—trainmen's wages	2,605,330	2,414,062	+191,268	7.92
Operation of cars—other expenses	975,561	889,827	+ 85,734	9.63
Damages and legal expenses	1,094,745	1,157,593	— 62,848	5.43
General expenses	543,274	458,761	+ 84,513	18.42
Total operating expenses	8,209,397	7,216,008	+993,389	13.04
Net earnings from operation	4,301,225	4,683,816	—382,591	08.17
Income from Other Sources				
Rent of land and buildings	93,218	67,566	+ 25,652	37.96
Rent of tracks and structure	99,051	100,226	— 1,175	1.17
Miscellaneous	85,247	67,914	+ 17,333	25.52
Total income	4,578,771	4,919,551	—340,780	6.93
Deductions				
Taxes	742,817	754,696	— 11,800	1.56
Interest and rentals—net	3,732,633	3,587,122	+145,511	4.05
Total deductions	4,475,450	4,341,748	+133,702	3.08
Net income	103,321	577,803	—474,482	82.12
Special appropriations	84,428	228,678	—144,250	63.07
Surplus	18,893	349,125	—330,232	94.59
Car mileage, surface	36,840,898	35,334,216	+1,506,682	4.26
Car mileage, elevated	15,844,082	14,821,709	+1,022,373	6.90
Total car mileage	52,684,980	50,155,925	+2,529,055	5.04

The Woman in the Case

One essential difference between the all-pervading electric railways and their older brothers, the steam roads, is the attitude of the general public toward the former. Almost every one who rides or observes the operation of electric cars soon believes that he knows all about the methods of operation and feels certain he can run a car just as well as a regular employee. A recent incident on the Cincinnati, Dayton & Toledo Traction Company's southern division well illustrates this fact, but perhaps in a different manner from previous experiences.

This company employs an electric light block signal system of a kind in common use, whereby the presence of a car in the block is indicated by switching in a certain bank of lamps. The lights are thrown in by the motorman by means of a hand lever when his car enters the block, and are thrown out at the other end when he arrives there.

On this particular occasion an extra car, finishing its run, pulled into the Trenton car house, and the crew did not throw out the signal lights as the car left the main track. Meanwhile, a regular car arrived at the other end of the track and found the lights against them. Knowing that no regular car could be coming and guessing that the extra crew had forgotten to throw the signal, or else were taking their time to do so, they threw the signal switch at their end back and forth several times, as is customary, in order to flash the light and call the attention of men at the car house to it.

The woman in the case lived immediately opposite the car house, and having become accustomed to the way the signals were operated, went out and threw the signal switch to indicate a clear

track, giving the regular car the right of way. No sooner had she done this and the waiting crew cut the light in again as their own signal, than the tardy extra crew, who had been housing their car, came out and threw the signal to clear track again. As a result, when the regular car arrived at the car house its crew found they had been running without protection.

An investigation followed, and nothing would have ever been known, but the woman told about it. Finding she was likely to get into trouble under the Ohio railroad law, she appeared at the general manager's office to tell her story and to beg off. Her excuse was somewhat as follows: "I knew that the car was waiting up at Thornton's switch for nothing, and my husband was coming home from work on it. I cook on a gasolene stove, and my supper was all ready. Now, Mr. Sloat, if you knew how hard it was to keep a supper warm on a gasolene stove, without spoiling, you wouldn't blame me for going over there and throwing that switch, so that my husband could come home."

She said much more, but from the foregoing the reader can surmise that she got off with a lecture only.

The John Fritz Dinner

A banquet was given at the Waldorf-Astoria on the evening of Oct. 31 to John Fritz, the well-known steel manufacturer and inventor of Bethlehem, Pa., to celebrate his eightieth birthday, and also the foundation of the John Fritz medal. The societies co-operating in the establishment of the medal were the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechancial Engineers and the American Institute of Electrical Engineers. The medal fund, which has been mentioned in this paper, was secured by small subscriptions, in order to make it representative, and the subscribers included, besides Americans, distinguished engineers and men engaged in the iron and steel industries in several of the leading countries of Europe. The fund raised amounted to something like $6,000.

The speakers included Colonel H. G. Prout (toastmaster), Mr. Fritz, Rear Admirable Melville, General Eugene Griffin, John Thomson, Charles H. Haswell, T. Commerford Martin, George S. Morison, Rossiter W. Raymond, Robert W. Hunt, Elihu Thomson, Oliver Williams, D. A. Tompkins and J. C. Kafer. Telegrams of congratulation were received from Andrew Carnegie, C. M. Schwab and others. Mr. Fritz was awarded at the dinner the first John Fritz medal, and was also presented a volume containing the signatures of the subscribers to the fund and a loving cup, the gift of Irving M. Scott, of the Union Iron Works, of San Francisco. The cup was presented to Mr. Fritz by J. C. Kafer. A letter was also read from Hon. A. S. Hewitt, who was to have been present, but who was detained by illness, making a strong plea for individual liberty, which, he said, made possible a career like that of Mr. Fritz.

Funeral of the Late Prof. Short

The body of the late Professor S. H. Short, who died recently in London, has been brought to this country, and will be given burial at Woodlawn Cemetery, New York. Funeral services will be held at the Church of the Messiah, at the corner of East Thirty-Fourth Street and Park Avenue, New York, on Tuesday, Nov. 11, at 2:30 p. m. All friends of Professor Short are invited to attend the services at the church, and the interment later at Woodlawn, taking train over the Harlem division of the New York Central, immediately after the service, by special car provided.

Topics of the Week

In the six days of the Grand Army of the Republic encampment at Washington it is reported that 2,000,000 passengers were carried by the Washington Railway & Electric Company. It was a trying period for the employees of the company, but the efficiency with which the vast throngs were handled speaks volumes for the company and its employees.

"What is to become of the old locomotives?" is a question often suggested by the substitution of the electric service for steam on the "L" roads of New York. Already the Second Avenue and Third Avenue lines have been equipped with electric motors, and the Fifty-Eighth Street branch of the Sixth Avenue line is now operated electrically. In a few months it is hoped the entire service will be changed over. The old steam locomotives are being stored in the Manhattan yards at 129th Street, pending disposition of them. The cabs are closed up, the smokestacks protected, and the entire equipment has a cast-off appearance. Many of them have been disposed of to small roads, mining properties, logging camps and other out-of-the-way places, but they will no longer be utilized for passenger service.

The North American Company, which has just acquired control of the Detroit lighting companies, is largely interested in electric lighting and railway properties in other cities, including Milwaukee, Cincinnati and St. Louis. The company was organized in 1890 under the New Jersey laws, and is known as a holding company. It has done much toward developing the street railway and lighting interests of the country, and is composed of many prominent financiers.

Until a few months ago the method in vogue in Leipzig of avoiding accidents at crossings of electric railways was either to station a flagman at the crossings or to have the conductor run forward to see if the other line was clear. Now an automatic signal lantern, which makes it unnecessary for the trainmen to leave their cars, is being used by the local street railway company. The lantern consists of two boxes, arranged one above the other, each having two sides fitted with red and the other two with green glass, the red being above the green. The cars on one line cause the incandescent lamps in the upper box to burn; the cars on the other line, the lamps in the lower one. This causes, owing to the arrangement of the glass in the boxes, a green light to appear to the first line, which indicates "free passage," and a red light to the second line, which means "stop." Signals are also visible in day time, as reflectors shut out the light of the sun, and the lantern is well lighted from the inside.

A report from Boston says that the residents of Orange, Mass., have been "taken in" to the extent of $25,000 by a sleek swindler, who represented himself to be the promoter of an electric railway to extend from Orange to Miller's Falls, where a road is in operation to Greenfield. A company was organized to build the road, and the brazen-faced fakir, with a flood of oratory that set forth the project in most alluring fashion, aroused the good people of the district to such excitement that the banks were opened and the gold began to flow to him in an ever increasing stream. But the greatest surprise was when he induced the directors of a bank to indorse $25,000 worth of the company's notes, which he discounted in Boston for $15,000. After this coup he made his escape, leaving an enraged public shouting for his scalp. Now, to those who have attempted to negotiate a loan in New England this story will seem incredible, especially as great publicity was given to a swindle of this kind, perpetrated on the residents of Willimantic, Conn., only a few months ago. At that time all New England was warned of the new field that was being operated. But to the sturdy "Down-Easter" there seems to be something alluring about the electric railway, and he falls a ready victim before it. The fakirs, noting this, have not failed to make the most of every opportunity, and if steps are not taken to protect the poor populace the railway fakir will, in point of the numbers of dupes and gold returned, be a close second to Mary Baker Eddy.

Commenting on the demand for recognition of the union which has been made by the striking motormen and conductors of the Hudson Valley Railroad and the refusal of the company to consider it, the New York Times very clearly points out that the position of the men is illogical, and cannot be enforced. If it were possible to unite in a trade union all the men who have learned the trade of that union, and if that trade deals with a public necessity, there is reason to believe that the demands of such a union will be respectfully considered, and even granted, if they do not render the pursuit of the business unprofitable. But what about conducting and running trolley cars? It is unskilled labor. There are differences, of course, in the way in which it is done, but they are individual differences, depending upon native quickness of perception. A union of the men who, at any given time, happen to be in possession of the "jobs" of motormen or conductors is hence not a trades union. It is simply "organized labor," or, in case of a strike, organized idleness. The strikers of a trade union rely for success upon their monopoly of a certain skill necessary to the community. The strikers of organized but unskilled labor rely upon their power to bully and frighten equally capable unemployed persons from taking the jobs they have abandoned. When there are enough unemployed and unskilled persons available to take these jobs, at the minimum wages of unskilled labor, they can be prevented from doing so only by violence or intimidation, by breaches of the peace—in a word, by mob law. Consequently it is pointed out the employers of motormen and conductors would be foolish to yield to their demands for "recognition."

The Strike in Geneva

Various reports have been published during the last two months in the daily papers in regard to the street railway strike in Geneva, Switzerland, and have attracted more than usual interest and attention from the fact that the principal owners of the Geneva Tramway Company are Henry A. Butters and John Hays Hammond, who are well known in this country, and because the general manager of the company is H. P. Bradford, formerly general manager of the Cincinnati Inclined Plane Railway Company, and later of the Federal District Railway, of Mexico. The history of the strike, which is nominally still on, though practically over, may be summed up briefly as follows:

An Anglo-American syndicate was organized several years ago to consolidate and equip with electricity the two or three existing tramway and interurban properties at Geneva, and spent about 22,000,000 francs, or $4,400,000, in carrying out this work, and also in extending the different lines in a number of directions. The first year of operation with electricity produced, however, net earnings of only 1 per cent, and those of the following year showed only 2 per cent on the investment. This was due largely to the retention of antiquated methods of operation on the part of the local manager, who had previously held a similar position with one of the absorbed companies. On Aug. 16 this manager retired, and Mr. Bradford was appointed to the position. The task devolving on Mr. Bradford was recognized as a difficult one, partly on account of the natural antipathy of the working force and public to a foreign manager and partly because of the necessity of introducing a policy of retrenchment as regards the expenses, which, however necessary to the company, was certain to be unpopular with the men.

Symptoms of discontent soon began to be manifested. On Aug. 30 Mr. Bradford and his assistant, Mr. Arthur Schell, posted a bulletin, announcing that after Sept. 14 the services of forty-four employees, who, in their judgment, were unnecessary for the operation of the road, would be dispensed with. As a result of this and on the same evening a meeting was held of the employees, and on Saturday, Aug. 31, a general strike was declared. The employees, after going out on strike immediately adjourned to a photographer's, where a group view was taken. This photograph shows 98 motormen, 98 conductors, 65 car house men, 50 repair shop men, 66 supernumeraries, 50 track men, 12 line men, 30 receivers and inspectors and 20 bookkeepers and clerks, making a total of 489 men on strike.

From the initiation of the strike all important steps in it seem to have been dictated from political motives. The liberal laws of Switzerland, which, for some reasons, are very commendable, have attracted to that country a large number of socialists, who have been driven from other Continental countries, and many of these have made their headquarters in Geneva. The result is that the city is a hotbed of socialists and anarchists, who are strong numerically as well as politically.

The direction of the strikers was at first taken by a prominent local lawyer, Mr. Moosbrugger, who was a publisher of one of the newspapers in Geneva, a radical deputy and municipal councillor, together with an ex-employee, Mr. Gonvers, who is said to have been a motorman on the Versoix line. The sympathies of the public seemed to be at first with the strikers, for it should be said that the strike of Aug. 31 was only the first of two which have occurred on the Geneva system during the last two months. This strike lasted two days. On Sept. 1, after various negotiations, the two parties to the dispute agreed to leave the question to a committee of arbitration to be appointed by the Council of State. The government appointed a commission of three members, viz.: Mr. H. Fazy, president; Mr. Thiébaud, head of the railway department (soon, however, replaced by Mr. Romieux, one of his associates), and Mr. Odier, the attorney general. On Sept. 2, while awaiting the decision of this board of arbitration, the street railway service was recommenced.

On Sept. 12 the decision of the board was rendered, and was favorable to the employees, who obtained the principal points for which they had contended, viz.: return of the forty-four employees who had been discharged and a modification of the rules instituted for their government, and which had been adopted by the new management. An employee by the name of Dumand, who had been particularly obnoxious to the management, having apologized for his actions, was taken back into the service again.

It was believed at the time that the incident was closed, but the results did not justify this favorable interpretation. After several days there were signs of more discontent. With or without reason the employees claimed that the decision of the board of arbitration was not being lived up to by the company. A committee of the employees drew up a series of complaints, and on Sept. 25 they were submitted to the Council of State. The company defended itself against these charges, and after a hearing the government declared its explanations were satisfactory, and that in both letter and spirit the decision of the board of arbitration was being followed by the company. This reply did not satisfy the employees, and on Sept. 27 the committee of employees, headed by Mr. Gonvers, as Mr. Moosbrugger had become disgusted and had retired, declared a second strike.

Although serious in many of its consequences, this strike did not affect the company as much as the first one. On the first day several cars were run out, and this number was increased day by day until Oct. 3, when the entire number of cars used in the service was running. Up to the time of writing this article, however, the night cars had not been put in service. As can easily be assumed these steps were not looked upon with favor by the striking employees, who, being flushed with the success of the first strike, adopted obstructive tactics to prevent the running of the cars. There was considerable rioting, in which a number of cars was smashed, and the militia was finally called out. There were several fights, some fifty soldiers were wounded, a large number of arrests made, and many of the rioters were deported. It was found that nearly all the rioters and strikers were foreigners, and most of them were from Italy.

On Oct. 3 the company announced that it had sufficient employees to operate its cars, and refused to consider the re-employment of any of its former men who were then on strike. The trades unions, which are particularly strong in Switzerland, now took up active sympathy with the strikers, and a general strike of all trades to act in sympathy with the railway strikers was seriously discussed, but no action was taken. In the meantime the canton commissioners issued a proclamation, pointing out the fact that the disturbers of the peace were not natives of the country, and calling on all good citizens to refrain from riotous action or from sympathy with those who were disorderly disposed. The unreasonable demands and turbulent conduct of the ex-employees have had the effect of the withdrawal from them of the sympathy of the intelligent portion of the community, and the reputable gentlemen who, through a misunderstanding of the situation, were drawn into active participation with the employees during the first strike, are now having considerable difficulty in explaining their position satisfactorily to themselves or to anyone else whose opinion is worth having.

Power Employed in the United States

Census Report (No. 247) on "Power Employed in Manufactures," made by Edward H. Sanborn and Thomas Commerford Martin, expert special agents, has just been issued, and shows a wealth of most interesting information as well as most painstaking and careful research in its compilation and arrangement. It is impossible to reproduce any of the many and valuable tables presented in this report, but a few statistics will be quoted.

The report, for instance, shows that the aggregate motive power employed in manufacturing establishments in the United States during the census year was 11,300,081 hp. as compared with 5,954,655 hp in 1890, 3,410,837 hp in 1880, and 2,346,142 hp in 1870. Of the total power used in manufactures during the census year, steam engines furnished 8,742,416 hp. or 77.4 per cent of the aggregate; water-wheels supplied 1,727,258 hp, or 15.3 per cent; electric motors, 311,016 hp, or 2.7 per cent; gas and gasolene engines, 143,850 hp, or 1.3 per cent, and other forms of mechanical power 54,490 hp, or 0.5 per cent. In addition to the power noted, which was generated by the establishments by which it was used, rented power was used to the extent of 321,051 hp, or 2.8 per cent of the total. Of this rented power 183,682 hp was electric, and 137,369 hp was other power.

During 1900 over 1200 electric railway lines were in operation in the United States, and the total capacity of their power plants exceeded 1,000,000 hp. There are over 3300 central stations for the distribution of electric current for lighting and power purposes, and the total amount of steam power used to generate it is estimated to be more than 1,500,000 hp.

As shown steam still continues to be pre-eminently the primary power of greatest importance, and the census returns indicate that the proportion of steam to the total of all powers has increased very largely in the last thirty years. The increase in the case of gas engines, however, from 8930 hp to 143,850 hp, a gain of 134,920 hp, is proportionately the largest increase in any form of primary power shown by a comparison of the figures of the eleventh and twelfth censuses, amounting to 1,510.9 per cent. The average horse-power per gas engine in 1900 was 9.7 hp.

The total amount of waterpower reported as used by manufacturing establishments in 1900 was 1,727,258 hp; 1,263,343 hp in 1890; 1,225,379 hp in 1880, and 1,130,431 hp in 1870.

London Letter

(From Our Regular Correspondent.)

The Central London Railway, having experimented with exhaustion fans as a method of removing the foul air from the tube, has decided that such a method is not successful, and will now endeavor to improve the atmosphere by forcing fresh air into the tube from the outside, through numerous pipes throughout the length of the tube provided with taps by which even distribution will be accomplished.

It is now stated that an influential English syndicate is promoting a line to run under the Central London Railway from the city to the Marble Arch, at which place it is to connect with a line called the Northwest London Railway, authorized two or three years ago, to run from the Marble Arch to Cricklewood. It may be taken for granted that the scheme will be opposed by the Central London Company, but the promoters of the bill will no doubt point out that the "two-penny tube" is already crowded with traffic during the business hours, and that, therefore, it could not properly accommodate the passengers of the Northwest London Railway if that line were to be made simply as a branch from the Marble Arch.

Arrangements have been entered into by the Corporation of Warrington and the South Lancashire Tramways Company, whereby their respective lines will be joined together on the boundaries of Warrington and Winwick. The Corporation of Warrington is just completing their portion of the work, and on the Tramways Company completing theirs it will be possible for the general public to travel along the roads from Warrington to Bedford Leigh, St. Helens, Prescot, Liverpool and vice versa. Eventually it is intended that there shall be a continuous tramway route between Liverpool, St. Helens, Wigan, Warrington, Bolton and Manchester.

The Great Yarmouth electric tramways, which were laid down early in the summer at a cost of £40,000, have just completed the first quarter's working. The takings during that period amounted to about £4,100, and the profits have reached £2,125 for the three months. The Council now contemplates laying down some 3 miles of additional lines.

A contract to the value of half a million sterling has been placed with the British Westinghouse Electric & Manufacturing Company, London, by the Clyde Valley Electrical Company, Glasgow, for the equipment of their two generating stations, which are to supply electrical power for industrial purposes over an area of 755 square miles. The station will be ready in about eighteen months' time.

It is anticipated that early next year the electric trams of Sheerness will be in active operation. The work of laying the rails, erecting the trolley poles and constructing the generating station is satisfactorily proceeding. The cars will be capable of seating fifty passengers, and will be fitted with reverse staircases similar to those on the Chatham cars. The trolley, however, will be different. The overhead wires are at a considerable height, and the current will be collected from them by means of the Siemen bow. There will be about 2½ miles of lines, the gage being a narrow one, and the line economically laid. The Kent Electric Power Company have the scheme in hand, the contractors being Messrs. J. G. White & Co., of London.

Engineers have recently been engaged on behalf of the British streets in Coatbridge and Airdrie with a view to starting operations in laying the tramway lines in these burghs. It is intended that operations will commence at or about Christmas in both towns, and that the tramways will be open for traffic in about four months thereafter. The company intend laying the line all the way from the west end of Coatbridge to Clarkson Church in the east end of Airdrie, and not, as was feared, stopping at the Carlisle Road.

The fight for and against the municipalization of tramways in Birmingham and the Midlands goes on with increased keenness as the time of the municipal elections approaches. The retiring councillors and their opponents are making the question a test. While Birmingham is divided as to whether the corporation or the British Electric Traction Company should be supreme, Walsall has made up its mind that municipalization is the only course.

The highways and sewers committee of the Burton-on-Trent Corporation have, on the recommendation of their electrical advisers, Messrs. Kincaid, Waller and Manville, of London, decided not to proceed further with the question of adopting the Loraine or surface contact stud system for tramways, in use at Wolverhampton, but to go on with the original scheme of overhead trolley wires.

The stimulating results of competition have been evidenced in Liverpool by the development of the electric tram system. Prior to the introduction of the cars the Overhead Railway Company, itself an electrical undertaking, had a practical monopoly of the passenger traffic along the dock line, having itself "knocked out" the horse omnibuses. The advent of the electric trams has now exercised so serious an effect upon the traffic of the Overhead Railway that the directors of the latter undertaking had to boldly face the situation. The consequence has been a remarkable acceleration of the train service, which was inaugurated yesterday by some trial runs and an inspection of the railway and its equipment generally. Sir William Forwood, the chairman, and a numerous company of guests attended. The speed now attained is 19 miles an hour, including stoppages, which is stated to largely exceed the speed of numerous similar railways both in this country and in the United States. The new equipment has been furnished by Dick, Kerr & Co.

The Ipswich Town Council have accepted tenders in connection with the scheme for applying electricity to the tramway system and the erection of a dust destructor amounting to £105,143. The dust destrnctor and chimney shaft represent about £9,000 of this amount. The total mentioned does not include the cost of street widenings, or of cars, etc., and Mr. Jervis, the chairman of the committee, states that the total cost of the new tramway scheme will be about £200,000.

A company has been formed for the purpose of obtaining powers for constructing an electric tramway between Cardiff and Penarth. The directorate comprises some prominent local commercial gentlemen, and there is every reason to believe that the venture, if it receives the sanction of the Board of Trade, will prove a financial success, and certainly it would be a public convenience.

The work necessary for the substitution of electricity for steam on the Mersey Tunnel Railway is progressing rapidly, and it is confidently anticipated that the service will be completely transformed and electric trains running through the tunnel by the first week in December. The work of equipping the railway is being done by the British Westinghouse Electric & Manufacturing Company, under the direction of Mr. J. W. Cooper, but the traffic upon the completion of the transformation will be conducted and controlled by the staff of the Mersey Railway Company. At present no definite service at an increased speed has been arranged, but a more frequent service of trains is assured. Trains can be run through the tunnel at 3-minute intervals, but this will only be done if the traffic demands justify it. The trains can be driven at a speed of 50 miles an hour, but it is intended at first to allow 11 minutes for the trip between Liverpool and Rock Ferry, with stops at each station on the route. While on this question it should be noted that the cars are to be fitted with the Westinghouse compressed air brake, which is absolutely automatic in case of a failure in the motor or current. The signals will be worked by hand as at present, but possibly an electric automatic device may be utilized in the future.

As a result of the severe competition of the Glasgow electric tramways to the suburban districts of Glasgow, the Glasgow & Southwestern Railway Company announce that they intend to withdraw their suburban trains. Last half-year the railway company carried a quarter of a million fewer passengers, three-quarters of the reduction being in the suburban traffic.

At different points along the Cardiff electrical tramway system what are known as time recorders are being fixed. In addition to serving the useful purpose of denoting the time to the public, they act as a check on the drivers and conductors, the last-named having at the end of each journey to apply a key to a certain piece of mechanism, and this indicates how long it has taken to travel to and from various points.

Mr. E. Rotter, A. M. I. C. E., has been appointed as consulting engineer to the corporation of Rochester for their proposed tramway scheme.

Mr. Theodore Beran, assistant commercial manager of the British Thomson-Houston Company, Ltd., of Rugby, was given a complimentary dinner Oct. 1 by a number of his colleagues at the Rugby works, as a mark of their appreciation, prior to his departure for New York, and to assure him of a cordial welcome on his return to Rugby, which will probably be before the end of the year. Speeches were made by Messrs. Walton, chief engineer of the company; Beran, Doverhill, Churchill, Wallis, Swift, Clark and Phipps.

Electrical circles in London, and in fact throughout the world, have been deeply moved to learn of the untimely demise of Professor Sidney H. Short, who has for the past three or four years been acting as technical director of Messrs. Dick, Kerr & Co., of London. Mr. Short had established for himself an enviable reputation in England in connection with the almost unprecedented success and phenomenal growth of Dick, Kerr & Co.'s electrical business, and had surrounded himself with a large and influential circle of friends. Mrs. Short, who has always taken an active interest in Mr. Shorts's success, had also made a

social position for herself in London, and has our most sincere sympathy in her sad bereavement. Reference has already been made to Mr. Short's work in another article. A. C. S.

Recent Annual Reports

The eighth annual report by the Tramways committee of the Town Council of Glasgow for the year ended May 31, 1902, shows the following statement:

	Electric Traction			Horse Traction			Total		
	£	s.	d.	£	s.	d	£	s.	d.
Traffic receipts	582,145	16	6	30,680	5	10	612,826	2	4
Other receipts	1,092	17	11	494	4	8	1,587	2	7
Totals	583,238	14	5	31,174	10	6	614,413	4	11
Working expenses (inc. depreciation)	373,174	4	3	31,928	16	4	405,103	0	7
	Surplus			Deficit					
Balance to net revenue account	210,064	10	2	754	5	10	209,310	4	4

Total amount carried to net account		£209,310 4 4
Which has been applied as under:—		
Interest and sinking fund, etc., on cost of Govan & Ibrox Tramways	£ 5,057 3 10	
Interest on capital	54,282 17 10	
Sinking fund	36,974 15 9	
Sinking Fund	36,974 15 9	
Payment to common good	12,500 0 0	
		108,814 17 5
Net balance added to general reserve fund		£100,495 6 11

The amount of the capital account on June 1, 1901, as reduced by depreciation, was £1,793,934 8s. 1d. To this sum falls to be added £408,043 7s. 10d., being the net amount expended on capital account during the year, and there falls to be deducted (1) £67,402 1s. 2d., being the amount of depreciation written off for the year, and (2) £93,539 15s. 9d., being the amount written off against the general reserve fund. The net amount expended on capital account, as at May 31, 1902, was therefore £2,041,035 19s. 0d.

The total amount borrowed for capital purposes is now £1,884,-605 12s. 7d., of which £260,500 was borrowed during the past year.

The following general remarks will be of interest: The last horse cars were withdrawn from service April 14, 1902, so that this is the last annual report in which the horse traction account will appear. The company now has 536 electric passenger cars.

Throughout the summer months of 1901, the International Exhibition created a very large traffic. During the week ended Sept. 28, 1901, the number of passengers carried reached 3,724,037, and the traffic revenue amounted to £14,277 11s. 3d. This constitutes a record for the department.

On Aug. 19, 1901, the committee reduced the working hours of motormen and conductors and other members of the traffic staff from ten hours to nine hours per day without any reduction in wages.

On April 3 the Corporation approved of the recommendation that the penny stage be extended to cover any four consecutive halfpenny stages, instead of three. The average length of the halfpenny stage is slightly over half a mile, or .58, so that the average length of the penny stage is now 2.32 miles. This change came into operation on June 1, 1902.

The financial results of electric traction as compared with horse traction have, so far, been entirely satisfactory. Although the car mileage has been very much increased, the average revenue per mile has slightly increased, being 11.90d against 11.82d and 11.55d for 1901 and the two preceeding years. The working expenses, amounting to 5.30d per car mile, or, including amounts set aside for depreciation and permanent way renewal, 7.51d, are about 2d per mile less than the working expenses under horse traction.

The report of the Manchester Corporation Tramways for the year ended March 31, 1902, is given in abstract below:

	Car Mileage	Passengers Carried	Receipts			Average Receipts per Car Mile
			£	s.	d.	d.
Electric traction	1,684,348	21,443,188	85,651	15	5	12.20
Horse traction	146,781	2,147,100	5,967	12	11	9.79
Total	1,831,129	23,590,288	91,619	8	4	12.00

New Publications

A Manual of Drawing, by C. E. Coolidge. 92 pages, 10 full page plates. Price, $1.00. Published by John Wiley & Sons, New York, 1902.

This manual is intended to put in permanent form a drafting room system that may be accepted as standard, and thus tend to relieve the student of unnecessary burdens. It is recognized that the student should not be looked upon as an experienced commercial draftsman, and to facilitate his advancement in this department, it is proposed to surround him, as far as possible, with the atmosphere and sensation of the commercial drafting room and teach him at least one good system well. It is not claimed that the system elaborated in this book is complete, but it is intended to present a fair average drafting room system, such as are in use in this country. The work incorporates much data and other information that have been received from the leading manufacturing concerns of the United States.

Electric Street Railways, by Edwin J. Houston, Ph. D., and A. E. Kennelly, Sc. D. 367 pages. Price, $1.00. Published by the Electrical World and Engineer, New York, 1902.

This is a reprint of the popular work of Messrs. Houston and Kennelly, which has found so much favor among students and practical electric railway men. It is presented in convenient form, and is well arranged and illustrated with drawings and half-tones of the machines described.

The Electric Motor and the Transmission of Power, by Edwin J. Houston, Ph. D., and A. E. Kennelly, Sc. D. 377 pages. Price, $1.00. Published by the Electrical World and Engineer, New York, 1902.

This is a reprint of the valuable work on electric power transmission, which formed one of the most popular volumes of the electro-technical series prepared by these authors.

A Unique Periodical

In its monthly magazine, The Four-Track News, the passenger department of the New York Central & Hudson River Railroad has created a decided novelty in the journalistic field. If the publication had been originated and conducted by anyone else than George S. Daniels, it would doubtless have been referred to generally as the "house organ" of the New York Central lines, and its circulation would necessarily have been entirely gratuitous. A might be expected of Mr. Daniels, however, a broad-minded editorial policy has been adopted and The Four-Track News is no mere "house organ," but an interesting and valuable magazine, both for regular and occasional travelers, whether living within the territory covered by the New York Central lines or not. The Four-Track News is 50 cents a year, five cents a copy, and can be had of George H. Daniels, general passenger agent, publisher, Grand Central Station, New York.

Peculiar Accident on High-Speed Road

A peculiar accident happened the other night on the road of the Columbus, Buckeye Lake & Newark Traction Company to a motor car going west from Newark toward Columbus, about 9:30 o'clock. Some malicious person had tied a rope to a large stone and threw the other end of the rope up over the trolley wire. As the car was going at a rate of about 25 miles an hour, the stone went through the front window, striking the motorman on the head and knocking him off the stool. The cars are equipped with the General Electric multiple controller, and it is necessary at all times for the motorman to hold down the spring on the handle. As soon as his hand was removed from this spring the power was cut off; consequently the car stopped. The conductor, after giving two bells to proceed and receiving no response, went through the car to the front end and found the motorman lying unconscious in the vestibule.

J. R. Harrigan, the general manager of the company, says that but for this precautionary device the car would have probably run off the track at the approaching curve, and might possibly have run into the canal.

In the opinion of the San Francisco Post the proposition to issue bonds to the extent of $700,000 for the construction of a municipal railway on Geary Street, that city, "is one of the most important which has been submitted to our people since the adoption of the constitution in 1879." What a beautiful example the Post is of the rabid municipal ownership advocate, foaming at the mouth, and, in the vernacular of the street urchin, throwing fits.

A Decision on Interurban Roads in Ohio

Judge Harter, of the Common Pleas Court, at Canton, Ohio, has handed down a decision upon the status of interurban lines, which, if sustained by higher courts, will render municipal councils practically helpless in dealing with them. Recently the Stark Railway Company served notice on the Canton Council that it found it necessary to construct a terminal loop in the business section of Canton. After opposition the Council made the grant as to a railway company. A propertyowner immediately filed an injunction suit, claiming the road could not take advantage of the rights granted to railways. The court decided in favor of the plaintiff, holding that as an interurban electric railway it was not necessary for it to go through the ordinary course pursued by city lines to secure a franchise for a loop over city streets, and that such a line could proceed in the same manner as a steam road and appropriate the right of way and pay the property-owners any damages that a jury would allow.

Street Railway Patents

UNITED STATES PATENTS ISSUED OCT. 21, 1902

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

711,646. Buffer for Railway Cars; W. F. Richards, Buffalo, N. Y. App. filed March 10, 1902. A buffer, supported by springs in such a manner as to remain in contact with its mate while the car passes curves of short radius.

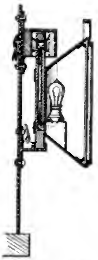
711,753. Protecting Rail for Open Cars; C. E. Baltz, Rahway, N. J. App. filed July 16, 1902. The guard rail is pivoted to the side of the car by means of links and rollers in such a way that one man can shift the rail.

711,832. Adjustable Side Bearing for Cars; L. C. Denison, Anaconda, Mont. App. filed June 26, 1902. A box having an opening through one of its walls for the admission of shims and a bearing block resting in the box and on the shims therein.

711,842. Car Seat; H. L. Flint, Cambridge, Mass. App. filed Jan. 2, 1902. An automatic locking device for the seat and a connection between the seats of twin seats, whereby they are caused to rotate in unison.

711,861. Truck for Street Cars; R. H. Hornbrook and W. H. Woodcock, Canton, Ohio. App. filed April 22, 1902. The truck has open side trusses, consisting of an arched upper cord, a horizontal lower cord and interposed struts, all of ordinary commercial shapes.

711,867. Portable Electrically Illuminated Sign; H. S. Kemp, Richmond, Va. App. filed Feb. 25, 1902. The sign, with its lamps mounted on a frame, can be bodily removed from the car and replaced without deranging the circuits.



PATENT NO. 711,867

711,868. Illuminated Sign; H. S. Kemp, Richmond, Va. App. filed Feb. 25, 1902. A modification of the preceding patent.

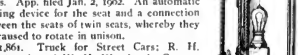
711,878. Car Starting Device; F. B. Nims, Lake Odessa, Mich. App. filed Feb. 28, 1902. The shoe in which the lever is pivoted is provided with a peculiar clamping device to hold it on the rail.

711,890. Car Brake; L. C. Johnson and W. S. Johnson, Detroit, Mich. App. filed June 27, 1902. Details.

711,915. Car Brake; R. H. Wakeman, Brockroad, Va. App. filed Aug. 25, 1900. Details.

UNITED STATES PATENTS ISSUED OCT. 28, 1902.

712,011. Car Brake; J. S. Sheets, Philadelphia, Pa. App. filed Nov. 22, 1901. The brakes are connected in pairs and operated in



PATENT NO. 712,333

unison by a toggle mechanism. Means whereby the brake hanger is clamped to the cross-tie.

712,131. Insulated Rail-Joint; G. L. Hall, Brooklyn, N. Y. App. filed Jan. 18, 1902. Consists of a two-part fish-plate. Means for uniting the two parts and means for insulating the two-rail ends and the two parts of the fish-plate from each other.

712,132. Insulated Rail-Joint; G. L. Hall, Brooklyn, N. Y. App. filed Feb. 12, 1902. Consists of a two-part fish-plate in combination with an angle chair. Means for insulating the two parts of the fish-plate from each other and of the angle-chair from one of the rail ends.

712,181. Side Bearing for Railway Cars; F. R. Cornwall, St. Louis, Mo. App. filed March 10, 1902. A side bearing having a support provided with a circular hub flange, a roller provided with a flange extending over said hub flange, and anti-friction devices interposed between the hub flange and roller flange.

712,224. Side Bearing; C. H. Williams, Jr., Chicago, Ill. App. filed March 31, 1902. The bearing has a divided spindle journaled therein, and rollers arranged on the ends of the spindle.

712,281. Device for Lessening the Noise of Vibration in Vehicles; H. G. Farr, Winchester, Mass. App. filed Feb. 14, 1902. A copper wire covered with non-vibrating mat rial is coiled about the axle, the ends of the wire being bared and rigidly secured to the axle adjacent opposite ends thereof.

712,320. Expansion Joint Coupling for Track Rails; J. W. McBurney, Fort Palmer, Pa. App. filed June 27, 1902. A flat bar having a dove-tail tongue on one side, lateral enlargements on the ends of the tongue to engage T-slots in the track-rail webs and a laterally-flanged locking plate, having a laterally-open channel dove-tailed in cross section, that is adapted to receive the dove-tail member of the tongue.

712,333. Electric Railway Signal; C. V. Richey, Washington, D. C. App. filed April 8, 1902. One of the track rails forms a continuous conductor, the other rail being divided into blocks or sections having batteries at the junction of each section. Each battery has one pole connected to the end of one section and the other pole to the contiguous end of the next section. The ends of a section are connected to similar poles of adjacent batteries, whereby the sections are alternately negative and positive, the signals being in circuit with each battery, and the circuit being closed through the trucks of the cars.

712,430. Railway Signal; G. L. Wilson, Chicago, Ill. App. filed Sept. 16, 1901. A wire is attached to the support of a bridge or culvert and to a signal light; tension on the wire, caused by displacement of the rail-supporting structure, causes the signal light to be exposed.

PERSONAL MENTION

MR. J. L. GREATSINGER, president of the Brooklyn Rapid Transit Company, has recently returned from a vacation of several weeks.

MR. M. H. SHERMAN, vice-president of the Los Angeles Pacific Railway Company, of Los Angeles, Cal., has returned to California after a short trip to the East. Mr. Sherman visited New York, Washington, Niagara Falls, Quebec and several other large cities, and in Vermont looked over the home of his boyhood days at Lake George.

MR. GEORGE F. CHAPMAN, formerly of the North Jersey Street Railway Company, and now general manager of the United Railways of San Francisco, has recently had dedicated to him a march by Horst, entitled "The United Railroads." This piece of music has become very popular in San Francisco, and is being played by the Golden Gate Park Band at Golden Gate Park.

MR. O. W. BRAIN, electrical engineer of the New South Wales Railways & Tramways department, succeeded the late Mr. P. B. Elwell in this position, and not Mr. G. Fischer, as stated in the September issue, Mr. Fischer having been, before he severed his connection with the government engineering force, supervising civil and mechanical engineer for tramway construction.

MR. E. C. MILLS, of E. W. Mills & Co., Ltd., Wellington, New Zealand, is spending some time in this country on a business trip. Mr. Mills' firm is an extensive dealer in general machinery and supplies in New Zealand. While in this country Mr. Mills will arrange for purchases, in behalf of his firm, of electrical and other machinery. His address while in New York is care of the Livingston Nail Company, 104 Reade Street.

MR. JAMES T. ROOD, formerly electrical engineer of the Natural Food Company, of Niagara Falls, N. Y., has accepted a position with the Worcester Consolidated Street Railway Company in the department of motive power and machinery. Mr. Rood is a graduate of the Worcester Polytechnic Institute, class of 1898, and previous to his work with the Natural Food Company was employed by the General Electric Company at the Lynn factory, the Bernstein Electric Company, of Boston, and the Worcester & Holden Street Railway Company.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Nov. 5, 1902.

Thanks to the energetic measures of the Secretary of the Treasury the money market has regained a comparatively normal condition. Purchases of government bonds, under the terms of the recent Treasury circular, have been sufficient to place to the credit of the New York banks nearly $22,000,000 during the past fortnight. This, together with forwardings of gold arriving at Pacific coast ports, has added so liberally to the cash holdings of the local institutions that their surplus reserve now stands at the comfortable sum of over $21,000,000. Not only is this twice as large as was held a year ago, but it is considerably above any recent average for the surplus item at this season. Reflecting this rapid resuscitation of resources, money on call has loaned freely between 4 and 5 per cent, and time loans are in much better supply, with even some concessions noted from the schedule rate of 6 per cent for all dates. The offerings of this class of accommodation at the moment are perceptibly greater than the demand. Nevertheless, it would be rash to assume that the main problems which have hung over the money market for the past two months have been solved. The Treasury still continues to draw out much more in customs and internal revenue receipts than it pays out in ordinary government expenditure, and while the outgo to the interior is visibly slackening, there are as yet no signs of a complete check. Moreover, the great uncertainty remains of how much of our unpaid debit balance abroad will have to be settled in gold. That we shall be called upon to ship gold freely between now and Christmas is practically certain. Sterling exchange, after a brief period of reaction last week, has again reached the high level of the season, and is very close to the gold-shipping point. No opinions are expressed among authorities, however, as to what sum will have to go out in order to relieve the present strain in the exchange market. Much depends upon the volume of our grain exports, which are at length beginning to increase in something like a normal manner. The probabilities, summing the situation up, are that no further relaxation will occur in the money market, but, on the contrary, that the demands upon local bank reserves will be such as to harden rates again before the end of the year.

The Stock Market

Stock speculation has been influenced during the past fortnight by the gold export probabilities and by the uncertainty of the Congressional election, the latter having a closer bearing upon the daily movement than the former. The general run of Wall Street sentiment has been bearish, and operations have been conducted on the short side more freely than on the long side. As the larger financial interests have been content to leave the market to itself, their attitude has been construed in some quarters as an indication that they consider prices high enough, and are not prepared to encourage a further rise. This undoubtedly has made the outside public more timid, and at the same time has induced some liquidation of outside holdings. But whether these unfavorable inferences regarding the views of the leaders are correct or not, is something that still remains to be proved. Many shrewd persons are inclined to think that the big financiers and operators are merely biding their time, awaiting a clearer outlook in the money market, and that they will, at the proper moment, launch out on a new campaign for higher prices. This theory finds support in the obvious fact that stocks are, for the most part, very strongly held. Now that the election uncertainty is out of the way the chances favor more activity, at least in speculative circles, than has been witnessed during the past two weeks. The fear of a labor outbreak among the Western railway employees, which gained some ground a fortnight ago, has disappeared under the assurances that the men will probably get a part of what they demand. But there is still an uneasy feeling in many quarters over the signs of a more aggressive spirit on the part of the labor unions, which have come more into evidence since the partial success of the union coal miners.

Manhattan Elevated has been the feature of the local traction group, and for that matter one of the leaders in the general market during the recent trading. It seems to be quite certain that the stock is getting more active support from the insiders than it has enjoyed for a very long time. Apparently it is the intention of these powerful interests to make the introduction of the electric service on the West Side lines the occasion for directing attention afresh to the improved earnings and prospects of the road under the electric installations. Predictions are freely made on the Stock Exchange that the price of Manhattan will soon cross that of Metropolitan. The latter stock, however has been benefited by the recent rise in the elevated shares. Brooklyn Rapid Transit also appears to occupy a better position in the market than it did before the recent quarterly report was published, with its encouraging show of increasing net earnings.

Philadelphia

Local traction stocks in Philadelphia have shown noteworthy strength despite the uncertain course of the general market. Activity in the recent dealings has been confined chiefly to American Railways, Philadelphia Rapid Transit and Union Traction. In all these issues a fair volume of business has been done, on a rising level of prices. Rapid Transit has advanced to 18½, which once again is the high record, the movement being accompanied by definite statements that earnings of the lessee company are running at least $4,000 a day ahead of a year ago. American Railways has also reached a new top price, at 53½, anticipating what many people believe to be a reasonable probability, that the dividend on the shares will soon be raised. Union Traction has made less advance than the other members of the active trio, most of the recent transactions occurring around 47¼. A feature of the past week has been a further sharp advance in Indianapolis Street Railway from 87 to 90. This is a net gain of 50 points since last spring. No other reason is discoverable for the movement than that all the available stock is being bought in, in connection with the consolidation schemes in the Indiana trolley field. Sales of Union Traction, of Indiana (138 shares), were reported last Saturday at 54. Other transactions of less importance are to be noted in Consolidated Traction, of New Jersey, at 69¾, Philadelphia Traction at 98¼, and a small investment lot of Germantown & Norristown at 174. Bond sales of the last two weeks comprise Consolidated Traction, of New Jersey 5s, at 110 to 110½, Electric-People's Traction 4s at 98¼, People's Passenger 4s at 105, United Railways 4s between 89 and 89½, American Railways 5s at 107¾, and Wilmington & Chester Traction 5s at 105.

Chicago

Despite vigorous denials there is excellent ground for the statement that negotiations for the reorganization of the finances of the Union Traction Company are under way. Our informant in Chicago says that he obtains the information from a high source, that action must soon be taken, although just what the plan will be is not divulged. Union Traction shares have moved rather uncertainly in the recent market, but with a fairly strong undertone. The common, after selling down to 16½, recovered to 17½. Only a few odd sales of the preferred are reported, at 48. It was said that the South Side Elevated, after election, would ask for the right to construct a third track to Forty-Third Street. The stock has been strong at 110. Metropolitan issues have also been in demand, the common moving up from 39¾ to 40⅞. It is calculated that the road, when all its feeders are in operation and its new downtown terminal completed, will be in a position to earn the full 5 per cent on the preferred stock, and also be able to pay something within the next year on the common. Earnings of both surface and elevated lines are keeping up remarkably well. The only other noteworthy transactions beyond those already recorded, comprise Northwestern Elevated common from 34⅛ to 35, City Railway at 212, West Chicago from 94½ to 92¼, and Lake Street at 9⅞.

Other Traction Securities

Boston traction issues have pretty closely followed the course of the general market in the recent trading, and have, therefore, been dull and rather depressed. Massachusetts Electric common, after selling up to 39, dropped off to 37¾, and the preferred reacted from 96 to 95. Boston Elevated, on fractional lots, went down two points, to 154, and West End remained barely steady at 93½. In Baltimore also business has been dull. United Railways common at 14, the income bonds at 68¼, and the general 4s at 94¾ to 95, are the quotations at which all the transactions have been made. Nashville Railway common fell from 5¼ to 5, and then recovered to 5¼. Nashville certificates sold down from 77⅜ to 77⅛, but later recovered the loss. Fifty shares of Lexington Railway sold at 50. The only bond sales reported, other than those just mentioned, were Baltimore Traction 5s at 118½, City Passenger 5s at 108, and Atlanta Street Railway 5s at 106¼.

Traction sales on the Cleveland Exchange numbered only 1740 shares last week, as compared with 3974 shares for the week before. Lake Shore Electric opened at 17, and dropped suddenly to

15, upon the report that an assessment of $6 to $10 per share was contemplated. This was promptly denied by the financing committee, but the uncertainty regarding the future of the property and the prospects of an increase of the preferred issue, held the stock at the low mark. Sales number 640 shares. Two fifty-share lots of Cleveland, Painesville & Eastern sold at 33¼ and 35, the first in a long time. Cincinnati, Dayton & Toledo sold to the extent of only 200 shares; range from 40¾ to 41½. Aurora, Elgin & Chicago common sold at 39¼ and 38¼, a trifle higher than former figures. Northern Ohio Traction common fluctuated between 63 and 64, on sales of 210 shares. Monday the only sales were 100 Western Ohio, at 29½, and 100 Northern Ohio Traction preferred at 93¼, equal to the previous sale. At Toledo several blocks of Toledo & Western bonds were sacrificed, and the price was forced down from 93 to 87. At that figure the bonds were eagerly taken by prominent financial men.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Oct. 21	Closing Bid Nov. 3
American Railways Company	52¼	53
Aurora, Elgin & Chicago	37	38
Boston Elevated	155¾	152
Brooklyn R. T.	63	62⅜
Chicago City	212	212
Chicago Union Tr. (common)	18	16½
Chicago Union Tr. (preferred)	50	47
Cleveland Electric	86	85¼
Columbus (common)	56	55¾
Columbus (preferred)	106	105½
Consolidated Traction of N. J.	69½	69⅜
Consolidated Traction of N. J. 5s	110¾	110½
Detroit United	88	87
Electric People's Traction (Philadelphia) 4s	98¼	98⅛
Elgin, Aurora & Southern	55	a59
Indianapolis Street Railway 4s	87	88
Lake Shore Electric	15	13½
Lake Street Elevated	9¾	9⅜
Manhattan Railway	134⅝	136⅞
Massachusetts Elec. Cos. (common)	38	37½
Massachusetts Elec. Cos. (preferred)	95	95½
Metropolitan Elevated, Chicago (common)	40⅝	40
Metropolitan Elevated, Chicago	88½	88½
Metropolitan Street	139½	140⅛
New Orleans Railways (common)	17	—
New Orleans Railways (preferred)	53¼	—
North American	121¼	123⅜
Northern Ohio Traction (common)	63¼	a66
Northern Ohio Traction (preferred)	92	93½
North Jersey	33⅝	—
Northwestern Elevated, Chicago (common)	34½	34⅜
Philadelphia Rapid Transit	17⅝	18
Philadelphia Traction	98	98
St. Louis Transit (common)	—	28½
South Side Elevated (Chicago)	110	108
Syracuse Rapid Transit	a31⅝	32
Syracuse Rapid Transit (preferred)	a78⅞	a78
Third Avenue	127	128
Toledo Railway & Light	a38	a40
Twin City, Minneapolis (common)	120	118
United Railways, St. Louis (preferred)	—	—
United Railways, St. Louis, 4s	85⅝	—
Union Traction (Philadelphia)	47	47⅜
Western Ohio Railway	29	27

a Asked.

Iron and Steel

The iron market has been concerned during the past two weeks by the sharp cutting of price schedules in some of the manufactured forms, notably in wire, nails and sheet steel. It is given out that the competition of outside concerns has forced the Steel Corporation to make these reductions. But, while this has naturally aroused some uneasiness as the first sign of any sort indicating reaction in the iron trade, it does not appear that any of the other branches have been at all affected. Pig iron furnaces are running at full capacity, and their output is sold ahead for over six months. The steel market is in an equally strong position. Quotations are as follows: Bessemer pig $21.75 and $22.00, steel billets $31.50 to $32.00, steel rails $28.00.

Metals

Quotations for the leading metals are as follows: Copper, 11⅝ cents; tin, 26½ cents; lead, 4⅛ cents, and spelter 5.45 cents.

BIRMINGHAM, ALA.—It is said that the Alabama Steel & Wire Company, which plans to build a big blast-iron furnace and steel plant at Gadsden, has purchased the Gadsden Ice Company, Gadsden Electric Light Company, and Alabama City, Gadsden & Attalla Electric Railway.

CHICAGO, ILL.—It is reported that plans are being considered for a complete financial reorganization of the Chicago Union Traction. From one source it is said that the plan is to scale down the fixed charges by asking the consent of the stockholders, while from another source it is said that a plan is being considered to replace all various guaranteed stocks and various bonds by new 4 per cent bonds.

WESTBORO, MASS.—The Westboro & Hopkinton Street Railway Company has petitioned the Railroad Commission for its approval of an issue of bonds to the amount of $40,000.

WORCESTER, MASS.—The annual statement of the Worcester Consolidated Street Railways Company's earnings, made for the purpose of apportioning its excise tax, shows that the gross earnings were $1,208,248. This is more than $50,000 greater than last year. The earnings average $9,262 for each of the 129.899 miles of track operated. The company pays an excise tax of $27,073, or $208.41 on each mile of track. The Massachusetts statutes provide for the excise tax to be 2¼ per cent of the gross earnings of the company, which is divided among the cities and towns in which it has locations, according to the mileage of tracks. In addition to the excise tax of $27,073 the company has to pay a corporation tax of $28,488, and a tax of $15,531 on real estate, making its total tax $80,592. The corporation tax is $11,905 greater than last year.

ONSET BAY, MASS.—Application has been made for the appointment of a receiver for the East Wareham, Onset Bay and Point Independence Street Railway Company, looking to the dissolution of the company. The company's rights and privileges are now enjoyed by the New Bedford & Onset Street Railway Company, and this action is taken to close up the affairs of the old company, which operated the line of horse cars between East Wareham and Onset.

NORTH ADAMS, MASS.—The annual financial statement of the Hoosac Valley Street Railway Company shows that the earnings from passenger traffic were $110,543, and the operating expenses $83,000. More than $13,000 was expended during the year for repairs on roadbed and track, $8,000 for repair on cars and equipment, and $21,000 for power. The expenditure for wages of employees was $24,000. The company added to its property, such as cars and electrical equipment, overhead construction and additional land and equipment at the power station, for which it expended $184,000.

DETROIT, MICH.—It is generally believed that the deal for the sale of the Detroit & Toledo Shore Line to the Grand Trunk Railway (steam) has fallen through as nothing has been heard of it for several weeks. It is thought that the Detroit United Railway Company will take up the proposition, and place the road in operation.

HELENA, MONT.—The Federal Trust & Savings Bank has been made trustee under the mortgage securing an issue of $500,000 6 per cent bonds of the Helena Light & Traction Company.

NEW YORK, N. Y.—It is reported that negotiations are in progress looking to a consolidation of the United Gas Improvement Company and the North American Company. As is well known, the former operates gas works in more than thirty leading cities of the United States, and also controls the Connecticut Railway & Lighting Company, the street railway, gas and electric companies of Providence, R. I., and most of the gas and electric light companies in the territory adjacent to this city, except on Long Island. The North American Company controls electric railway, electric light and gas companies in and near Cincinnati, in Milwaukee and in St. Louis. This company has recently taken the electric light properties of Detroit, paying therefor about $4,000,000.

NEW YORK, N. Y.—The New York News Bureau says that the agreement under which the $2,300,000 bonds of the Nashville Railway Company have been sold to Isidor Newman & Sons, of New Orleans, and Ladenburg, Thalmann & Co., of New York, has been signed and delivered. "Nearly all of the bonds," says the News Bureau, "have already been deposited with the International Trust Company. The price to be paid is 80 cents on the dollar, and is to be made three instalments of $15, $30 and $35 on each $100 par of every bond on Nov. 3, Jan. 3, and March 3. No arrangement has yet been made with the stockholders, and it is not known how they will fare. It is believed that they will be treated liberally by the new purchasers of the bonds."

CLEVELAND, OHIO.—The Pomeroy-Mandelbaum syndicate is preparing to issue the securities of the Central Ohio Traction Company. This company is a consolidation of the old Central Ohio Traction Company, which the syndicate purchased some months ago, and the Mansfield, Crestlin & Galion Railway, which has just been completed. As soon as possible the syndicate will build the link from Wellington to Mansfield by way of Ashland, and then it is probable that both properties will be consolidated with the Cleveland, Elyria & Western Railway.

ZANESVILLE, OHIO.—The Zanesville Railway, Light & Power Company, which has absorbed the local street railway and the lighting plant, has filed a mortgage for $1,000,000, to secure an issue of 5 per cent bonds. Of these bonds $780,000 will be issued at once, the remaining $220,000 to be reserved for future improvements. Of the $780,000 to be issued at once, $250,000 will go to take up the outstanding 4 per cent bonds of the Zanesville Electric Railway Company. The new owners will make many improvements to both the railway and the lighting plant. The officers of the company are: F. A. Durban, of Zanesville, president; H. M. Byllesby, of Chicago, vice-president; W. D. Breed, of Cincinnati, treasurer; W. A. Gibbs, of Zanesville, secretary and manager.

SEATTLE, WASH.—The sale of the property of the Northern Railway Improvement Company, of New Whatcom, to Stone & Webster, of Boston, owners of the Seattle Electric Company, and Tacoma-Seattle Interurban Railway, was consummated a few days ago.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition. *b* All capital stock owned by Detroit United Ry.

COMPANY	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., Sept. '02	67,492	35,997	31,495	12,907	18,588
	1 " " '01	59,242	31,396	27,846	12,031	15,815
	6 " June '02	318,987	185,392	133,575	77,556	56,018
	6 " " '01	258,967	161,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,166	131,162	130,004
	12 " " '00	513,722	* 317,478	196,249	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., Sept. '02	131,606	81,990	50,616	23,866	26,750
	3 " " '02	414,635	251,730	162,807	71,508	91,299
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., Sept. '02	18,432	10,460	7,972	......	......
	1 " " '01	18,456	9,986	8,470	......	......
	3 " " '02	65,253	33,983	31,270	18,024	13,246
	3 " " '01	63,160	31,024	32,136	14,988	17,148
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,809,496	7,896,597	3,532,899	2,898,350	636,539
	12 " " '00	10,236,994	6,808,110	3,408,884	2,982,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,188	3,915,496	1,862,648	937,906	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	904,294	955,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., Sept. '02	1,124,394	607,591	516,802	......	......
	1 " " '01	1,080,158	664,611	415,548	......	......
	3 " " '02	3,587,739	1,881,774	1,705,965	......	......
	3 " " '01	3,411,101	2,032,245	1,378,855	......	......
	12 " June '02	12,789,716	*8952214	3,837,490	......	......
	12 " " '01	12,101,198	*7970636	4,131,563	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., *a*Sept. '02	321,356	141,325	180,831	77,502	82,329
	1 " " '00	255,32	108,934	146,388	81,981	64,157
	3 " " '02	1,019,518	506,664	512,864	235,741	277,113
	3 " " '00	791,470	344,745	446,725	245,798	250,982
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., Aug. '02	45,217	31,191	14,026	13,357	669
	1 " " '01	45,474	28,296	17,178	13,697	3,481
	6 " " '02	358,984	203,200	155,784	81,004	74,720
	6 " " '01	246,138	163,145	83,293	82,619	674
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Sept. '02	19,347	6,098	13,259	......	......
	1 " " '01	19,197	6,548	12,649	......	......
	9 " " '02	147,407	59,847	87,560	......	......
	9 " " '01	132,159	56,118	76,041	......	......
CLEVELAND, O. Eastern Ohio Traction Co.	1 m., Sept. '02	21,375	10,808	10,567	6,032	4,535
	1 " " '01	17,761	8,413	9,348	5,122	4,226
Cleveland, Elyria & Western	1 m., Sept. '02	30,461	14,990	15,461	......	......
	1 " " '01	27,430	12,317	15,083	......	......
	9 " " '02	219,968	122,051	97,919	......	......
	9 " " '01	185,992	100,787	85,205	......	......
	12 " Dec. '01	249,260	136,878	112,394	57,023	55,371
	12 " " '00	179,098	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Sept. '02	18,499	10,035	8,464	......	......
	1 " " '01	18,822	9,649	9,174	......	......
	9 " " '02	144,464	76,006	67,499	......	......
	9 " " '01	124,184	63,843	60,311	......	......
	12 " Dec. '01	164,971	* 87,102	77,869	72,500	5,399
	12 " " '00	141,112	* 69,592	71,520	72,500	† 980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.	1 m., Aug. '02	96,118	* 58,295	42,923	22,238	20,585
	1 " " '01	74,535	* 45,741	28,794	15,817	12,977
	8 " " '02	596,156	* 344,026	252,130	131,234	120,899
	8 " " '01	535,784	* 327,615	208,109	125,528	82,841
DETROIT, MICH. Detroit United Ry.	1 m., Sept. '02	323,618	176,993	146,625	......	......
	1 " " '01	292,381	153,338	139,043	......	......
	9 " " '02	2,578,696	1,449,499	1,129,197	......	......
	9 " " '01	2,243,842	1,228,802	1,016,980	......	......
	12 " Dec. '01	2,919,171	*1566765	1,352,406	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line *b*	1 m., Sept. '02	39,771	23,491	16,281	......	......
	1 " " '01	35,687	21,576	14,111	......	......
	9 " " '02	323,130	188,809	134,321	......	......
	9 " " '01	296,917	160,856	136,061	......	......
DULUTH, MINN. Duluth-Superior Tr.	1 m., Sept. '02	46,763	23,091	23,672	9,619	14,053
	1 " " '01	39,183	19,941	19,241	9,190	10,051
	9 " " '02	396,258	206,004	190,254	86,819	102,445
	9 " " '01	335,966	181,851	158,716	82,579	71,339
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., Sept. '02	37,806	20,273	17,533	8,333	9,200
	1 " " '01	34,169	17,089	17,080	8,333	8,747
	9 " " '02	308,241	179,124	129,117	75,000	54,117
	9 " " '01	275,564	153,324	122,242	75,000	47,242
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., Aug. '02	24,340	12,083	12,307	......	......
	1 " " '01	16,849	9,085	7,824	......	......
	6 " June '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O. The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Sept. '02	44,090	23,050	21,040	16,251	4,789
	4 " " '02	184,502	91,206	93,296	65,241	28,055
LONDON, ONT. London St. Ry. Co.	1 m., Sept. '02	18,157	8,648	9,509	2,110	7,399
	1 " " '01	15,034	7,854	7,179	1,873	5,306
	9 " " '02	115,061	70,812	44,849	20,284	24,565
	9 " " '01	106,709	65,919	40,790	17,848	22,947
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Sept. '02	259,591	110,736	148,854	70,891	78,953
	1 " " '01	210,632	93,587	117,045	63,998	53,047
	9 " " '02	2,014,941	946,509	1,068,452	596,811	471,621
	9 " " '01	1,795,247	878,339	906,908	561,401	345,507
	12 " Dec. '01	2,442,342	1,185,534	1,256,808	755,130	501,669
	12 " " '00	2,280,698	1,189,787	1,090,911	694,665	396,247
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Sept. '02	339,660	130,611	209,059	60,393	148,666
	1 " " '01	308,394	123,131	185,263	57,875	127,388
	9 " " '02	2,667,096	1,191,320	1,475,775	530,733	945,042
	9 " " '01	2,340,165	1,068,846	1,271,318	563,274	708,044
MONTREAL, CAN. Montreal St. Ry. Co.	12 m., Sept. '02	2,046,290	1,135,176	911,092	......	......
	12 " " '01	1,900,680	1,105,267	795,413	......	......
NEW YORK CITY. Manhattan Ry. Co.	12 m., June '02	11,291,711	5,518,585	5,773,126	2,699,670	3,073,456
	12 " " '01	10,258,271	5,258,229	5,000,042	2,677,706	2,322,336
Metropolitan St. Ry.	3 m., Dec. '01	3,887,036	1,738,972	2,148,064	1,151,140	992,924
	3 " " '00	3,786,030	1,689,649	2,096,381	1,138,467	947,914
	12 " June '02	15,806,641	7,385,883	8,480,756	4,815,421	3,665,337
	12 " " '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y. Olean St. Ry. Co.	1 m., July '02	6,569	3,216	3,353	1,771	1,582
	1 " " '01	5,964	2,217	3,747	1,768	1,979
	12 m., June '02	56,165	29,118	26,987	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co.	1 m., Sept. '02	9,480	5,217	4,263	2,083	2,180
	3 " " '02	28,674	15,881	12,793	6,250	6,543
	12 " June '02	86,798	*56,392	30,406	23,125	7,277
PHILADELPHIA, PA. Union Traction Co.	12 m., June '02	14,118,159	6,402,338	7,715,820	*6637781	1,078,039
	12 " " '01	13,431,681	5,836,186	7,595,494	*6734328	861,266
American Railways	1 m., Sept. '02	135,159	......	......	......	......
	1 " " '01	91,152	......	......	......	......
	3 " " '02	245,455	......	......	......	......
	3 " " '01	180,811	......	......	......	......
	12 " June '02	1,009,509	......	......	......	......
	12 " " '01	841,298	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., Sept. '02	95,762	46,063	47,699	24,833	22,866
	1 " " '01	82,428	45,854	36,573	24,942	11,632
	9 " " '02	881,802	433,691	398,181	223,381	164,800
	9 " " '01	758,110	449,253	308,858	223,018	86,840
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., Sept. '02	61,164	33,545	27,619	19,025	8,594
	1 " " '01	53,902	29,602	24,300	19,025	5,275
	3 " " '02	184,314	101,224	83,090	57,075	26,015
	3 " " '01	168,208	91,565	76,842	57,081	19,821
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., Sept. '02	127,040	62,001	65,038	38,321	26,717
	1 " " '01	114,667	50,512	64,156	37,813	26,343
	9 " " '02	1,069,059	546,588	522,470	342,709	179,762
	9 " " '01	959,029	460,895	498,214	301,730	196,484
	12 " Dec. '01	1,321,084	* 646,407	674,677	415,168	259,509
	12 " " '00	1,162,517	* 616,945	565,572	409,051	156,521
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,270	133,283	53,987	......	......
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	† 3,986
	3 " " '01	56,936	35,600	22,336	25,000	† 2,663
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co.	1 m., Aug. '02	38,990	* 20,450	18,540	......	......
	8 " " '02	276,403	* 154,479	121,924	......	......

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Transfers in Chicago

The recent decision of the Illinois Supreme Court to the effect that the Chicago Union Traction Company must give transfers between any two lines operated by it, as told last week, has given rise to many interesting questions relative to the practical application of the universal transfer system in Chicago, aside from the legal questions involved. The Chicago Union Traction Company is attempting to comply with the decision by giving a universal transfer system. This means that a person starting at the northern city limits may go to the heart of the city and transfer to cars taking him to the western city limits, a distance of about 20 miles. It was thought at first that a universal transfer system of this kind would make a great inroad in the gross receipts. Although it is too early at present writing to determine just what the outcome will be, there are many indications that it will increase the gross receipts by an increase in travel. If such is the case it will certainly be a happy outcome of what, at first, seemed to be a severe financial blow to the company, and would add additional evidence to the argument brought forward by Oren Root, Jr., of the Metropolitan Street Railway, of New York, in his article on the transfer system of that company in the STREET RAILWAY JOURNAL for October, 1901, in which he expressed the opinion that the liberal transfer system adopted by street railway companies of to-day has had as much, or more, to do with the increase in business than the change in motive power and general improvement of the service that has been going on the last ten years. However, it is too early to predict with certainty what the exact results will be in Chicago. Other interesting questions have come up in regard to the form of transfers and limitations in their illegitimate use, without limiting the usefulness of the transfer system to the public, and these are questions which the company is attempting to solve at the present time to the satisfaction of all concerned, though it may take some time and experiment to decide them. It was feared that there would be extensive trading in transfers as soon as the new system was inaugurated, but so far this does not seem to have made itself manifest. The practice of trading in transfers was stopped after a hard struggle on the lines of the Chicago City Railway Company several years ago, and in the present instance it is likely that the anticipation of similar trouble by the company and the preparations made to prevent it, have restrained any attempt to engage in this traffic.

One Reason of Carnegie's Success

The rectorial address delivered by Andrew Carnegie, at St. Andrew's University, Scotland, on Oct. 22, has attracted wide attention on both sides of the water, owing to the frank expressions to which he gave utterance on the future of the iron and steel business in Europe and America. The address will bear careful reading, coming from such an authority as Mr. Carnegie, who, in addition to his knowledge of iron and steel conditions, has the highest reputation as a successful organizer and business manager. It is for this reason that the statement made by Mr. Carnegie in his address as to one of the main causes which permitted him to build up the immense fortune and property which he did in Pittsburgh are worthy at least of the most careful consideration. Mr. Carnegie's testimony on this point was practically as follows: "If I found that I had at the head of any department of my business a man who was doing as well or better than anyone else I could obtain for that work, and who showed that he was faithful in the discharge of his duties and took additional responsibility as it was laid upon him, I saw to it that he was given a share of the profits and became practically a partner in the business." The record of Mr. Carnegie's associates shows that this was absolutely true. Mr. Carnegie became a multi-millionaire by allowing his associates, like Messrs. Phipps, Frick, Schwab and many others to become millionaires, and it was a well recognized principle at the Carnegie works that while the duties and responsibilities required of the heads of the departments were enormous, yet any-

one who demonstrated that he could successfully perform the work assigned to him would receive substantial reward.

The application of this principle need not be peculiar to the business of the manufacture of steel, but is equally well adapted to the railway business. In the case of a large corporation, where the stock is sold on the exchanges, there is not the same reason for the adoption of a plan of this kind, because anyone can acquire an interest in the business. But in a close corporation such as are most of the smaller street railway companies it is a different matter. In cases of this kind we have often seen a superintendent or general manager, whose services have almost been invaluable to a corporation, work on for a number of years with no financial interest in the company which he represents, and practically no chance to ever obtain it, and finally go to another company because he was offered a slight increase of salary. It would have been a good investment of the first company, after the man had proved his usefulness, to have made some arrangement with him by which he could have acquired on some terms an interest in the business to which he was devoting his time. It would not only have secured his services as long as they were wanted but it would have given him an additional incentive to give his best time and energies to the work of the corporation which he was serving. Unfortunately the large stockholders of a small company do not usually realize the importance of a thing of this kind until it is too late. They think, until they are deprived of a man's services, that he will always stay with them as long as they want him, and are surprised if he does not. But the careers of the most successful capitalists have shown that they have made money in proportion to the extent to which they have allowed their chief subordinates to have some share in the profits.

The Operation of the Jim Crow Law

A great deal of trouble has been caused by the enactment of the "Jim Crow" law in several Southern States, as the people who have been most inconvenienced by its enforcement comprise the class for whose benefit this legislation was intended. The complaints that were heard on all sides about the negroes crowding the white people, and the deep-seated Southern prejudice against admitting blacks to the same coaches in which white men and women rode, finally culminated in the introduction of several statutes prohibiting whites and blacks from riding in the same compartments in any public railway. Public sentiment favored these measures, that is, the opinion of the white population of the South was unanimous on this point, and that is the only sentiment that finds expression through the public press of that section; consequently, there was practically no opposition to the movement.

The railway companies accepted the decree and made provision for complying with its requirements. When practicable separate cars were assigned the negroes, and, in other cases, partitions or screens were erected to separate the classes. It may appear strange to a resident of New York, Chicago or any other Northern city, that such a distinction should be made, but it must be borne in mind that the conditions are entirely different here from those that obtain in Southern cities, and that the attitude of Northern patrons of street cars might undergo a marked change if they were subjected to the annoyance and discomfort incident to riding in a crowded car in which half or two-thirds of the passengers were blacks. At any rate the laws were placed on the statute books, and they have been rigidly enforced, but not, however, without considerable friction. The first person to be arrested for refusing to comply with this rule was a daughter of Jefferson Davis, and many times since then the operating companies have found it impossible at times to enforce the regulation against less distinguished patrons without resorting to severe measures.

Under the law in most States the company which permits white and black passengers to mingle in the same coach is liable as well as the offending passengers, and the companies, in self-protection, are therefore obliged to enforce the rule strictly, although they have frequently found much difficulty in doing so, especially during the rush hours. Very few instances have been reported where the blacks have invaded that portion of the car reserved for the white man, but the latter has been less considerate of the rights of the colored man. In New Orleans, it is reported, the white passengers have been in the habit of taking possession of the entire car, thus practically excluding the colored patrons, and the latter have generally refrained from using the cars. Some of them, however, have insisted upon the strict enforcement of the rule, and have proceeded against the company for permitting violation of the law on their lines. A large number of cases have been selected in which, it is claimed, evidence has been secured to show that the law has been openly violated. It is believed that dissatisfied labor leaders are satisfying their resentment against the company by encouraging this movement.

The law places the company in a very trying position, and it is bound to suffer considerable loss, both because of the refusal of the blacks to patronize the cars when they are huddled together, and by reason of the fact that proportionately more room must be reserved for the whites than their relative number warrants. If, in addition to this, the company is to be punished because the whites persist in violating the law, the lot of the corporation will indeed be a most unenviable one.

A Standard Set of Rules

The interest felt in the construction and adoption of a standard set of rules for the government of employees is shown by the fact that committees on the subject have been appointed by the Massachusetts and New York State Street Railway Associations and by the American Street Railway Association. Two reports have been rendered on this subject to each of the two latter associations, in which certain codes of rules have been suggested. Mr. Barnes, electrical expert of the New York State Railroad Commission, at the Caldwell convention, emphasized the importance of the adoption of some set of rules, stating that while the subject was of importance to the large companies it was of even greater vital interest to the smaller companies, many of whom were awaiting the action of the association upon the subject. All, or nearly all, managers agree that such a standard code is to the greatest degree desirable, but it has seemed impossible up to this time to unite upon any specific set of rules which will be satisfactory to all concerned. For this reason the article by Mr. Wheatly, published elsewhere in this issue, and which is a general discussion of the principles upon which such a standard code should be based, is deserving of careful reading.

* * *

The difficulty in drawing up any standard code of this kind is that conditions which apply on one road very often do not exist on another system, so that it would be difficult to enforce completely on all roads any standard set of rules covering all branches of railway work. Mr. Wheatly's suggestion is to omit from consideration as a part of the standard code those regulations which may not be considered to be fundamental principles of operation, and to add such non-essential rules to the code only at the option of each road. In this case they could be issued in the form of special instructions if desired. Thus on a road in the country districts, or one where the passengers are in the habit of carrying packages into the car, it might be perfectly proper and advisable to permit a larger sized package than on another road in a crowded city street. A package or bundle, which in the latter case would be a serious inconvenience to both conductor and passengers, would cause no trouble where the car is less crowded. Mr. Wheatly cites a number of other classes of rules, as, for instance, the amount of change a conductor must carry, whether transfers should be registered or not, etc., which can thus be left out of consideration in the adoption of a standard code and upon

which practice differs. If this is done it should simplify the work of preparing a standard system and add considerably to its chance of general adoption. That this is true is shown by the fact that most, if not all, of the criticisms directed against the codes suggested at the recent conventions of the New York and American Street Railway Associations were on points which, while desirable, can hardly be considered to be of fundamental importance in street railway operation.

* * *

Mr. Wheatly then discusses the general arrangement of the rules, recommends a proposed classification of them, and calls attention to the importance of the adoption of a standard nomenclature in the wording of the rules. The recommendations made by him are based largely upon the experience of the steam roads in the establishment of a standard code. Such a code, as has been shown by the experience of the steam roads, is not the production of a week or even of a year, but is the result of many years and of a large number of revisions. No one realizes the extent of the labor required in the preparation of a set of rules which are to be standard on all roads until he has undertaken the task. For this reason the establishment of a standing committee on this subject, as has been done by the American and New York associations, is a commendable step, as is also the retention from year to year on the committee of as many members as will serve and do valuable work. We do not expect to see at the next convention the completion of a code of rules which will be satisfactory to every member of the two associations. But the composition of each committee of the associations which have appointed committees on the subject is of the highest order, and we do expect at the next convention to see a revised set of rules which will constitute a long step toward the desired complete code.

The Use of Fuel Oil

The menacing coal situation has given great prominence to all possible remedial agents, but perhaps none has been more seriously considered than oil. In fact the householder jumped at the idea, and many furnaces and ranges have been equipped with kerosene burners. These can probably stand on their own merits, even at the comparatively high price of refined oil, for all household heating apparatus, for whatever purpose designed, is notably inefficient. But the larger uses of fuel, as, for instance, in power stations, have to be considered on quite another basis.' Crude oil must be the material burned if any economy is to be realized, and great skill must be used in the burning. Let us look at the facts a bit and see where we stand. So far as mere calorific value is concerned crude oil is just about five-thirds as good as a standard grade of steam coal. It is very easy to transport, store and handle as compared with coal, and in particular it requires far less labor in the fire-room. In many locations, where it can be had by piping from the wells, it is quite capable of beating out even very cheap coal, but as a whole its apparent great usefulness has been rather disappointing in the realization. Thus far managers of power plants at a considerable distance from the source of supply have hesitated about using fuel oil or engaging in experimental work with a view of its ultimate adoption, because of the uncertainty of delivery and lack of knowledge as to the continuance of the supply. In several cases, too, which have come to our attention railway managers have given their consent to the making of trials in their power houses, but the concerns securing this permission have availed themselves of it only to the extent of advertising it from the housetops in the localities where they were endeavoring to dispose of stock. It has been given of late a rather careful trial on locomotives of the Southern Pacific system, and from recent announcements it has been found wanting, the company going back to the use of soft coal. In Russia oil-burning locomotives have made a rather better record, but the results of experiments tried under an autocratic government, with an eye to developing natural resources of its domains, are a little open to suspicion. The Southern Pacific trials were apparently, at least, on a purely commercial basis, and therefore vastly more instructive.

* * *

We need hardly tell our readers, however, that tests on locomotives are by no means conclusive as to results to be obtained under the boilers of a power station. A locomotive does not generally use fuel economically, not on account of any inherent fault, but from the fact that to save weight combustion must be forced considerably beyond the economical limit. In itself the locomotive-type of boiler is a good one, but fuel economy is not the only thing to be considered in locomotive practice, where immense steaming power must be obtained in small compass. Aside from this, fuel oil being very rich in carbon, and very volatile as compared with other fuels, requires a very large and perfect air supply for its rapid and complete combustion. This is not easy to supply when combustion has to be forced to a very rapid rate, and the result reported from the locomotive trials was a fine coherent deposit of carbon in the boiler tubes, hard to remove and rapidly lowering the steaming powers of the boiler unless frequently cleaned out. Again, petroleum contains about 15 per cent, by weight, of hydrogen, an enormous amount as compared with other fuels, and with a really good air supply the temperature of combustion is very high indeed, so that there is considerable risk of injury to the boiler if the firing is not very carefully done—a serious matter in locomotive practice. It would seem, however, that in case of well-constructed furnaces for large stationary boilers in power stations these especial difficulties could be minimized, and this, indeed, has been the experience of investigators. In the few steamships fitted with oil-burning furnaces the reported results are decidedly better than in the case of locomotives, but here the comparison is perhaps unduly favorable to the oil on account of the lessened weight of fuel to be carried, the better storage and the diminished labor in the fire-room.

* * *

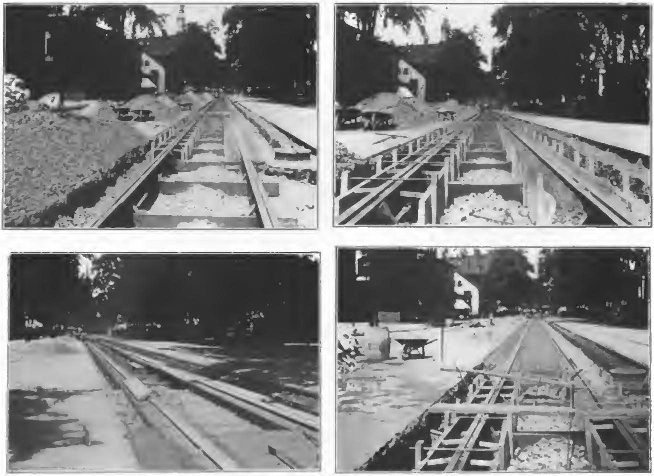
Some practical results recently obtained on steamships indicate that in actual steaming power, weight for weight, the petroleum is about four-thirds as good as coal. This result is evidently inferior to that which the relative calorific values of the fuels would indicate, but it checks fairly well with results obtained under stationary boilers. The truth is that the theoretical heating power of oil is very hard to approach in practice. If the combination is complete enough to do justice to the value of the thermal energy of the fuel, the flame must be nearly non-luminous, that is, with a very small mass of incandescent carbon particles. In this condition the fire gives out nearly all its heat by the convection of the heated gases and very little by radiation from the burning mass. And convection being a rather ineffective means of doing the work, it is hard in an oil-fed furnace to keep down the temperature of the flue gases, and considerable thermal effect is thus lost. If we are in the future to use fuel oil on a large scale as a substitute for coal, the furnace problem must be studied much more thoroughly than it has been in the past. Aside from the difficulty just mentioned, it has proved to be no easy or economical task to vaporize the fuel properly and render it fit for combustion. At present oil can be used economically in many localities where the oil supply is near, even where coal is fairly cheap, but unless considerable improvement is made in the methods of burning oil it will fail of the usefulness which properly should belong to it. Another serious practical objection to inaugurating any great increase in the use of fuel oil is that it is in the hands of probably the most perfect monopoly which has ever been organized. Hence, so long as, and wherever, oil has to be obtained through this single channel its price is fixed on a purely artificial schedule, which may sometimes be reasonable, but year in and year out will represent all the profit the business will stand. It, therefore, seems probable that for the present, at least, the station manager must exercise the greatest caution in going in for oil burning, and there seems to be a better outlook for economy in the skillful use of the lower grades of coal than in the tempting but rather troublesome use of oil.

New Track Construction in Hartford

In an article published in the STREET RAILWAY JOURNAL for April 13, 1901, an acount was given of the investigation by the municipal authorities of Hartford on the desirability of grooved girder rails and their use by the Hartford Street Railway Company on some of the main streets in that city. The city authorities, without giving any particular reason, expressed themselves in favor of the installation in Hartford of the "Metropolitan Standard" type of grooved rail, as employed by the Metropolitan Street Railway Company, of New York. The general manager, Norman McD. Crawford, of the Hartford Company, appeared before the committee of the Council and argued that while a rail of this kind might be most desirable for New York city streets, it was not necessarily the best for the conditions in Hartford, where the climatic conditions were more severe than in New York, and a tour of inspection was made by the committee of the Council to several cities in which various types of grooved rail were in use. A compromise was finally effected, in which the type of rail shown on the opposite page was adopted. This section is very similar to the Metropolitan type except that the groove is about ¼ in. wider at the top. It weighs 103 lbs. per yard.

During the present season a considerable amount of track has been laid with these rails in Hartford. The rails are laid on ties, which are spaced 6 ft. apart and in a concrete stringer, which is 18 ins. deep and 21 ins. wide. No concrete is placed under the ties, which simply serve the purpose of lining and surfacing the track. The ties used are 6 ins x 8 ins. x 7 ft. Different stages of the process of laying this rail in asphalt-paved streets are shown in the accompanying four engravings. As will be seen, elbow braces are used inside and outside of each tie for both rails. The concrete stringer is then formed around each rail and clamped in place, after which the space between the ties and the stringers are filled up with broken stone, with a top dressing of 6 ins. of concrete. The asphalt is then laid over the concrete.

In view of the success attained in other cities with wood paving, the company has also recently decided to put in a considerable amount of wood paving between its tracks.



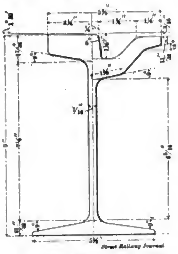
VIEWS OF HARTFORD TRACK CONSTRUCTION, SHOWING METHOD OF LAYING RAILS IN CONCRETE

Wood paving has for a long time not been popular in this country, although it has been used very extensively abroad. One reason for this has been the early wood paving in this country was laid with round or hexagonal blocks, which were not chemically treated or else were simply dipped in tar. As a result, the paving blocks suffered from dry rot, and soon became useless, leaving the paving in a very uneven condition.

As the Hartford Street Railway Company was obliged by its charter to do a certain amount of paving, the use of wooden blocks was seriously considered by Mr. Crawford, who inspected the installations of wood paving made during the last two years in Springfield, Boston and elsewhere. The testimony was so greatly in favor of this type of street that about 800 linear feet of it will shortly be laid in Hartford. The creo-resinate block of the United States Wood Preserving Company will be used. The creo-resinate process differs from the well-known creosoting process in several particulars. Dry heat is used instead of steam in the preliminary treatment, thereby killing all germs of decay. The blocks are heated up to 215 degs. F. without pressure, and then to 285 degs. with a pressure of about 90 lbs. The heat is then shut off and the tanks allowed to cool gradually until the heat has been reduced to 250 degs. and the pressure to about 40 lbs. Vacuum is then applied until about 26 ins. is reached, when the creo-resinate mixture is run into the cylinders at a temperature of 175 degs. to 200 degs. Hydraulic pressure is then applied, reaching 200 lbs. per square inch, and kept at this point until from 21 lbs. to 22 lbs. of the mixture per cubic foot has been absorbed. The liquid is then run off and milk of lime, at a temperature of 250 degs., is run in and a pressure of about 200 lbs. is applied for about an hour.

The blocks are of heart Georgia or long leaf pine, 3 ins. deep, 3 ins. wide, and 8 ins. long. They are laid on a sand cushion 1 in. deep, which rests on 6 ins. of concrete. The blocks are laid with the grain vertical. The joints are first filled with dry screened sand, and the pavement is then rolled with a 5-ton roller until the blocks present a uniform surface. The joints are then filled with a creo-resinate mixture heated to 300 degs. F., and the whole is covered temporarily with ½-in. dressing of clean, screened, dry sand.

According to Mr. Crawford, the cost of construction is practically the same for wooden block paving as for asphalt paving, except that the manufacturers give a ten-year guarantee instead of the usual one for five years, given with asphalt. There are a number of advantages, however, which the wood paving has over the asphalt. It is, of course, practically noiseless and far less slippery than asphalt, so that it gives a better footing for horses. Another advantage is that a company can do its own repairing and can replace a single block at any time without trouble. The question of wear is one which in the past has been, of course, a very critical one with wood paving, but the treatment to which the blocks are subjected seems to give a vitrifying effect, certainly so far as wear is concerned, to the blocks which gives them a long life. The effect of wear then seems to mat down the vertical fibers, making a hard, almost impenetrable surface, and when in this condition it is claimed that the wood will wear almost, if not quite, as long as granite blocks. In Boston, where a wood pavement has been in use on Newbury Street, Beacon Street and Harvard Bridge for several years, the wear is almost unnoticeable, and as the blocks on these streets are 4 ins. deep a wearing surface of from two to three times as deep as that of the ordinary asphalt pavements is provided.



SECTION OF NEW RAIL, HARTFORD, CONN.

An Important California Decision

Judge O. M. Wellborn, of the United States District Court, at Los Angeles, Cal., has handed down a decision to the effect that neither the Pacific Electric Company nor the Pacific Electric Railway Company will receive the famous freight carrying street railway franchise in the Sixth Ward and Seventh Ward, the sale of which was attempted by the City Council on Feb. 11 and 12, 1902. As a result, the matter of the proposed franchise stands just where it did before its original advertisement for sale: the bid of the Pacific Electric Company of $152,000, the cash for which has remained in the city treasurer's office ever since it was deposited by H. W. Hellman, will be drawn down and the Los Angeles Traction Company is adjudged to have secured no rights under its bid of $130,000. The court holds that the Council in refusing to accept the bid of the Traction Company had the power to do so, but having so acted and the raised bid of the Pacific Electric Company being wholly improper, the entire proceedings then fell, and a readvertisement of sale was the only thing that could have been done.

As has been stated, when the freight franchise was granted, allowing the company to haul freight within the city limits, and after it had been vetoed by the Mayor, the company refused to take back its $152,000 cash bid, the money being allowed to remain in the city treasury. The company claimed that the Council had full power to grant a valid franchise without the Mayor's sanction. The concession applied for by the syndicate covered the principal streets, and reached to the southern and eastern city limits. The opponents of the company claimed that after the bids for the sale of the franchise were opened it was found that the notice of the sale had been tampered with prior to its publication. Greater freighting privileges than were originally contemplated were granted, and the use of a third was provided for. Competitive bids were allowed twice before the franchise was granted. It is likely that the higher courts will be appealed to for a final decision.

An ordinance has been introduced in the City Council of St. Louis to authorize the Water Commissioner to collect fares on the electric railway that is operated by the city from Baden to the Chain of Rocks, a distance of 4 miles. At present the road is equipped with one car, and is operated solely for the city employees, especially those connected with the water department, who use it in going to and returning from their work.

Notes on Heavy Electric Traction Near Paris

Although Paris is behind every other large city in the world except, possibly, London, in modern methods of surface transportation, the city has an entirely different standing in regard to the utilization of electricity for heavy electric railway service. The backwardness in the application of electricity to surface transportation has not been the fault of the tramway companies, who

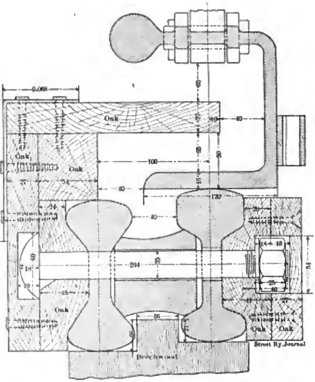


FIG. 1.—SECTION OF THIRD-RAIL CONSTRUCTION USED BETWEEN STATIONS, ORLEANS RAILWAY

have shown a most laudable effort to introduce mechanical traction on the city streets and have made experiments with steam, compressed air, fireless and Serpollet locomotives, storage battery cars, surface contact systems and underground conduit lines. But as the trolley has been prohibited, and as the length of the

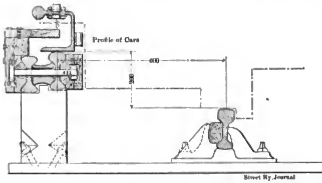


FIG 2.—SECTION THROUGH THIRD RAIL AND SERVICE RAIL BETWEEN STATIONS

companies' franchises has not been sufficient to warrant the introduction of the more expensive conduit system, little progress has been made. This is not so, however, with heavy electric traction, where the companies have not been hampered with municipal restrictions, but have been in a position to adopt the most improved types of electric apparatus.

The three principal systems of this kind of traction in Paris are the Metropolitan Underground Road, the electrical terminal line of the Paris and Orleans Railway, and the Paris-Versailles electric line, which is operated by the Western Railway Company, of France. It is not the purpose of this article to describe the

Metropolitan system, which was fully covered in the STREET RAILWAY JOURNAL for Sept. 1, 1900, and Sept. 6, 1902, nor to give a description of the Paris-Orleans line the engineering data of which were published on Dec. 21, 1901, but to describe some particulars of the latter system, derived from a recent inspection of the line, and also to give some details of the electric service of the Paris and Versailles line, which was put into commercial operation June 7, 1902.

The Orleans Railway installation is somewhat similar in char-

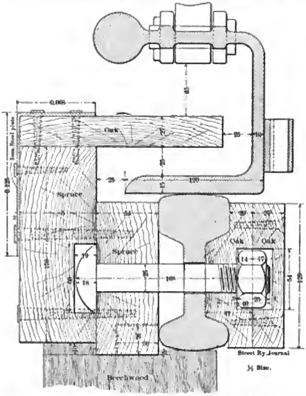


FIG. 3.—SECTION OF THIRD-RAIL CONSTRUCTION USED IN STATIONS

acter to that proposed by the New York Central and Pennsylvania Railroads in securing an entrance into New York City. That is, the through steam trains are stopped at the Austerlitz station, which is near the outskirts of the city, and are then drawn by electric locomotives a distance of 2½ miles (4 km) to the Quai d'Orsay station, not far from the Champs de Mars. The main features of the plant, which have already been described in these pages, are briefly as follows: Power is obtained from a station 3 miles (5 km) distant from the Quai d'Orsay station, and is transmitted at 5500 volts and 25 periods to two sub-stations, where it is transformed into 550 volts, direct current, by means of rotary converters. The electric locomotives used for this service were supplied by the French Thomson-Houston Company. Each locomotive weighs 40 tons, and is equipped with four General Electric 65-motors, which are geared to the axles. Each locomotive is capable of hauling, without overload, a train of 300 tons weight, not including the electric locomotive, the distance of 2½ miles in seven minutes. The maximum grade is 1.1 per cent. The series parallel controller used connects the motors in groups of two in series, then of four in parallel.

The principal points of interest on this road which have not been heretofore described, are the third-rail shoe, third-rail conductor and overhead conductor used in the switch yards and other points where the third-rail system could not well be applied. The shoes, of which there are four on each locomotive, are hung in the usual way by means of links, but, as shown in Fig. 1, the lower part is made L-shaped so as to pass under the timber guard which protects the third rail from accidental contact. The shoe is in two pieces, a lower wearing part of cast-iron and an upper part of steel, rivetted together. The upper and outer end of the shoe is made in the form of a cylinder, 1¾ ins. (45 mm) in diameter, to keep the center of gravity of the shoe under the center of support. The third rail on the outside track is made up of two "bull-

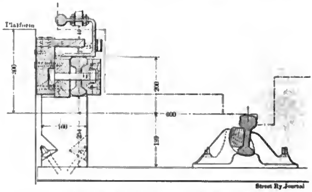
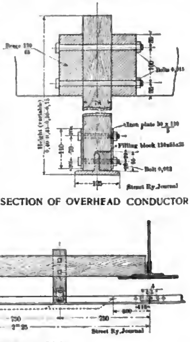


FIG. 4.—SECTION THROUGH THIRD RAIL AND SERVICE RAIL IN STATIONS

headed" rails, weighing 72 lbs. per yard (36 kg per meter), which are bolted together through a cast-iron filling block, the bolt also holding the wooden guard in place. Two rails are used on straight track, partly to get a symmetrical structure, for the third rail is not spiked to its wooden support or held in any way except by gravity, and partly to get additional conductivity. The third rail in the stations (Fig. 3) is slightly different, the head of the third rail being of a different shape, and there being only one rail, as there is less need for conductivity and the space available is less. The rails are bonded with Crown bonds. The insulator is a block of beach wood, 10 ins. (254 mm) high, as shown in the diagram. This wood is dipped in asphalt before being installed, but sections of the block show that the asphalt does not penetrate very far into the wood. The block is fastened to the ties by lag screws. As shown in Figs. 2 and 4 the center of the third rail is 23½ ins. (600 mm) outside the center of the outside of the service rail. Although mounted in wooden insulators the leakage is only 0.24 amps. per mile (0.15 amps. per kw) of track.



SECTION OF OVERHEAD CONDUCTOR

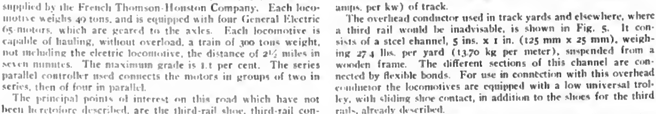


FIG. 5.—OVERHEAD CONSTRUCTION USED IN CAR HOUSES AND SWITCH YARDS

The overhead conductor used in track yards and elsewhere, where a third rail would be inadvisable, is shown in Fig. 5. It consists of a steel channel, 5 ins. x 1 in. (125 mm x 25 mm), weighing 27.4 lbs. per yard (13.70 kg per meter), suspended from a wooden frame. The different sections of this channel are connected by flexible bonds. For use in connection with this overhead conductor the locomotives are equipped with a low universal trolley, with sliding shoe contact, in addition to the shoes for the third rails, already described.

The total length of single track equipped with electric traction between the Austerlitz and the Quai d'Orsay stations is 9.55 miles

(15.288 km), of which 4.375 miles (6.998 km) are double third rail, 3.12 miles (4.58 km) are single third rail, and 2.32 miles (3.71 km) are overhead conductor.

THE PARIS-VERSAILLES LINE

The equipment of the line between Paris and Versailles, owned by the Western Railway Company of France, differs materially from that on the Orleans line, from the fact that the line is not in use for through service but for local service only, and electricity was adopted for its economical advantages and to avoid the use of smoke-producing locomotives in the tunnels through which the line runs.

The line, which is 11 miles (17.6 km) in length, is now in operation on the multiple unit system as a result of trials extending over two years, first with compressed-air locomotives and then with electric locomotives.

The compressed-air locomotives first tried were mounted on double trucks, as shown in Fig. 6, each carrying a compound, two-cylinder motor. The car contained thirty-three reservoirs, capable of carrying 4400 lbs. (2000 kg) of compressed air at 1420 lbs. per square inch (100 kg per centimeter) pressure. This was reduced in the motor cylinders to 280 lbs. (20 kg), as a working pressure in the high-pressure cylinders, and 140 lbs. (10 kg) in the low pressure. The reheater was carried under the middle of the motor car. The dimensions of the motor cylinder were 12.2 ins. and 29.9 ins. x 22-in. stroke (320 mm and 530 mm x 560 mm stroke). The length of the cars over all was 44 ft. (13.46 m).

The compressed-air cars having failed to give satisfaction, the company had constructed by a local electrical firm, the Société Anonyme de Locomotion Electrique, of Paris, ten electric locomotives, similar to that shown in Fig. 7. Four cars were equipped with General Electric motors and the other six with Brown, Boveri and Westinghouse motors, all of 225 hp each and four to the locomotive; but the method of attachment was that of the French builders, and curious, to say the least. Two methods were followed. In the case of the Brown, Boveri motors and most of the Westinghouse motors, the armatures were mounted on a hollow shaft encircling the axle, and with a diameter considerably larger than the axle itself. The shaft was then connected to the car wheel, and supported so as to be concentric with the axle by means of six spiral springs connected to the spokes of the car wheel. The geared motors were connected to the axles in the same way, that is, the gears were not mounted directly on the axle but on a hollow shaft, which was spring-supported from the car wheels in the manner already described. The locomotives were designed to run at 25 miles (40 km) per hour, and weighed complete 50 tons. The geared motors had four poles, and the gearless motors six poles.

The arrangement proved too complicated as well as inefficient, and was abandoned in favor of the multiple unit system. Last summer the traffic on the line was being cared for by means of two multiple unit trains, one equiped with the Sprague system and the other with the General Electric. The General Electric motor cars, of which there were two, were supplied by the French

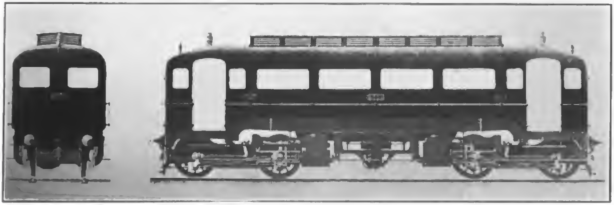


FIG. 6.—COMPRESSED AIR LOCOMOTIVE BUILT FOR VERSAILLES LINE

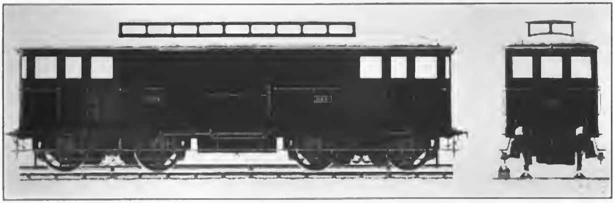


FIG. 7.—ORIGINAL ELECTRIC LOCOMOTIVE BUILT FOR VERSAILLES LINE

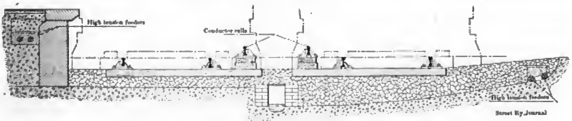


FIG. 8.—SECTION OF THIRD-RAIL TRACK, PARIS-VERSAILLES LINE

Thomson-Houston Company. They weighed 23.5 tons each, and were designed to draw four trail cars, weighing 11.3 tons each, making the total weight of the train, empty, 72.2 tons, and loaded, 87.2 tons. The motor cars are mounted on Brill No. 27 trucks, and are each equipped with two General Electric 55 motors. The Sprague equipment used the same motors, but the cars were mounted on McGuire trucks.

The third-rail construction used on the line is shown in Fig. 8. The construction differs from that used on the Paris-Orleans line, as the third rail is of the same section as the track rail, and weighs 92 lbs. to the yard (46 kg. per meter). The third rail is of the bull-headed type, supported in chairs which rest on insulators of paraffined wood, which in turn are supported on ties of longer length than the standard. The third rail is divided into sections of 5/8 of a mile (1 km).

FIG. 9.—SUB-STATION, WESTERN RAILWAY OF FRANCE, FOR OPERATING PARIS-VERSAILLES LINE

Power for the Paris-Versailles line is being supplied from a station at Moulineaux, along the line of route, at 5500 volts, 25 cycles, which is converted by rotaries into direct current at 550 volts. There are three main sub-stations, each of which contain four Thomson-Houston rotary converters of 300 kw each. The pressure is regulated on the alternating current side by a regulating transformer with a movable armature, permitting a variation of 15 per cent. The rotaries are started by direct current, supplied by a 40-kw generator, driven by an induction motor.

A view of one of the sub-stations of the company, of which there are three, one at the Champs de Mars, one at Meudon, and one at Viroflay, is shown in Fig. 9. The rotaries are placed in a row extending up and down the building between the transformers and the switchboard. The transformers are cooled by air blast, which is supplied by two blowers, each driven by an induction motor, one of which is shown in the lower right-hand corner of the engraving. As will easily be seen from the illustration, the air shaft extends the entire length of the building under the transformers, transformer regulators, etc., which are grouped in the following order: Reactance coil, induction regulator, group of three transformers, reactance coil for the second rotary, etc. The induction motors for starting the rotaries are not shown in the illustration.

Important Paper Changes Hands

Announcement is made in the current issue of the Engineering Record, of New York, of the sale of this paper by its publisher, Henry C. Meyer, to James H. McGraw, the president of the STREET RAILWAY JOURNAL, Electrical World and Engineer, and the American Electrician. The Engineering Record is one of the oldest and leading papers published in the engineering field, was founded by Mr. Meyer, and is about twenty-five years old. It is published weekly and is devoted to civil and industrial engineering. The announcement of the sale in the Engineering Record states that Mr. Meyer will continue to give the new publishers the benefit of his counsel and active co-operation in maintaining the high standing of the paper, and the same staff that has executed his directions in recent years will continue to conduct its affairs. The only change that is proposed is an increase in the value of the journal in its well established field, due to its affiliations with publications of similar standing in allied fields.

Promotions from the Ranks

The Cincinnati Traction Company has had posted in each of the car houses a notice that promotions in the service will hereafter be made from the ranks. An eligible list has been established, and as soon as a position is vacant it is filled from the list. Division superintendents' clerks, conductors and motormen are requested to make written application for examination as to fitness. The line of succession is: Motormen and conductors to division superintendents' clerks, and clerks to division superintendent. The notice says that no changes are anticipated at present; the list is to be made simply to inform the company as to the fitness of its employees for promotions. This policy has been adopted to stimulate the men to better endeavor and to bring out the best in them by showing that their future in the service depends on their merits alone. Promotions were previously made by choice of the officials.

The Proposed Standard Code of Rules

BY W. W. WHEATLY

In the annual conventions of the national and State associations the managers of the electric railroads are brought together for the solution of problems connected with railway construction, maintenance and operation. The most important topic that has engaged their attention for many years is the preparation and development of a standard code of rules. Each separate railroad, it is true, has its own code of rules, but each one is different from the other. The associations interested in the making of a standard code, after looking over the field, have discovered a heterogeneous mass of regulations that have been jumbled and twisted by the efforts of dozens of managers and superintendents, working independently of each other since the first street railway was put into operation. The desire is now for uniform rules, and these rules are expected to recognize all that is good in the present practice on a majority of the roads. The preparation of a code of rules suitable for all roads is no holiday task. It requires a great deal of time, study and hard work.

It is no reflection upon the committees that presented to the national and State conventions last year, and again this year, the draft of a proposed standard code to say that the associations acted wisely when they returned the rules to the committees with instructions to reconsider and report progress at the next meeting. The writer is deeply impressed with the value cf the original work done by these committees, and it is not intended as a criticism when the opinion is expressed that further changes in the proposed standard code are desirable before its presentation in completed form for adoption. The committees will do well to take more time and go over the rules carefully, in the light of the experience and knowledge acquired through the discussion upon their work in the recent convention and in the railway journals.

It is interesting as well as instructive to find that many of the principles now held to be sound in the management of electric street railways were formulated in the early days of steam railroads. Because such principles have stood the test of time and experience, and are essential to safety and efficiency in railway service they are likely to endure. In the preparation of a standard code for electric railroads much valuable time may be saved by observing and taking advantage of the work done in the same field by steam railroad men during the past twenty-five years. Being familiar with their work the writer is able to state that the standard code which they first adopted has been revised two or three times, with the result that certain rules, at one time thought to be essential, have been eliminated as superfluous, and other rules have been added to make the code more complete. It is now a model of its kind.

Two important objects are sought in the effort to provide a standard code of rules; one is a reform in the language, the grouping and the arrangement of the rules, and the other is a reform in the practice under the rules. The language should be a model of simplicity and precision, and should not be capable of more than one interpretation. Where words are used having more than one meaning, or where there is any doubt, there should be a definition to indicate the exact meaning. The same word or phrase used more than once in the code should invariably mean the same thing. The rules should be arranged in logical sequence, and the different rules belonging to one subject should be grouped together under a separate heading.

In developing a standard code for general use the practical difficulty is to make it cover all the different conditions of service on many roads. There are certain rules which apply to one group of roads but do not apply to others. There are, however, certain rules embodying principles which are of general application, and are essential to safe operation, and no road can afford to leave them out. Such rules will be recognized by all as the primary rules, and they should properly constitute the foundation work of the standard code. In developing the next or secondary rules the varying conditions of different roads will have to be recognized. The interurban roads with single track require special treatment, although their general safety requirements are the same as all other roads. There are some few roads operating at one time heavy city lines, light suburban lines and interurban single-track lines, and such roads would have need for the rules covering practically all conditions of service. When completed the code should provide a practical set of working rules, adapted to any urban or interurban electric railroad.

In the evolution of the electric railroads there is one particular feature which distinguishes it from the evolution of steam railroads. The electric roads began operation with double track, and by gradual process of development are now entering upon interurban single-track operation. The steam roads began with single track, and within recent years have been progressing into double-track operation. Yet by far the greater part of the mileage of electric roads is double track, while that of steam roads is largely single track. It was quite natural that this difference in conditions should be reflected in the growth of their respective codes of rules. The electric roads began with rules adapted largely to double-track operation, and the steam roads began with rules adapted largely to single-track operation. In recent years each has been seeking to supply its deficiency.

It is not the object of the writer at this time to develop a complete code of rules, but rather to indicate the essential requirements of simplicity of language, orderly grouping, arrangement in logical sequence, and the addition of such rules as will cover the conditions of service on the single-track roads. Before going further it may be well to indicate some of the things that would better be left out of consideration as a part of the standard code. It is sufficiently difficult to get a large number of roads to agree upon the essentials, and therefore the non-essentials should be left to the option of each road to be added to the code, or issued in the form of special instruction if desired. The following items are given as illustrations of things to be omitted from the code, viz.:

1. Care of cars in the car house.
2. Care of injured persons, calling physicians, etc.
3. Reporting accidents, giving information concerning them, etc.
4. Amount of change (cash) for conductors to carry.
5. The collection and registration of fares or transfers.
6. The specific reports to be made by conductors, motormen and others.
7. Ejectments from cars.
8. The assignment of men for work and the handling of the seniority list.
9. Technical instruction or information concerning the electrical equipment.

If the association thinks it desirable to have uniformity of practice in such matters it may, with propriety, issue rules covering the same under the heading "Recommended Practice of the American Street Railway Association," to be printed separate from the code.

Before proceeding with the details of grouping and arrangement it may not be out of place to illustrate the simplicity of language which is desired. For this purpose a copy of the general notice and a few of the general rules are given below (1) in the language suggested by the committee of the American Street Railway Association, and (2) placed opposite for comparison the same things in the language adopted by the steam railroads in their standard code:

SUGGESTED BY COMMITTEE OF AMERICAN STREET RAILWAY ASSOCIATION	ADOPTED BY STEAM RAILROADS
The rules herein set forth apply to and govern all lines operated by the ———— Railroad Company. They shall take effect ————, and shall supersede all prior rules and instructions in whatsoever form issued which are inconsistent therewith. In addition to these rules special instructions will be issued from time to time, as may be found necessary, and such instructions posted on the various bulletin boards, whether in conflict with these rules or not, which are given by proper authority, shall be fully observed while in force. Bulletin boards are located at the following points, and must be consulted daily by each employee of the transportation department:	The rules herein set forth govern the railroads operated by the ———— Company. They take effect ———— superseding all previous rules and instructions inconsistent therewith. Special instructions may be issued by proper authority.
Every employee whose duty is in any way prescribed by these rules must always have a copy of them at hand while on duty, and must be familiar with every rule.	Employees whose duties are prescribed by these rules must provide themselves with a copy.
All employees are required to be polite and considerate in their dealings or intercourse with the public; the reputation and prosperity of the company depend upon the promptness with which its business is conducted, and the manner in which its patrons are treated by its employees.	The service demands the faithful, intelligent and courteous discharge of duty.

All employees will be regarded in line for promotion, advancement depending upon the faithful discharge of duty and capacity for increased responsibility.	To obtain promotion capacity must be shown for greater responsibility.
Employees of any grade will be considered as accepting or continuing in employment subject to the dangers incident to this hazardous occupation.	Employees in accepting employment assume its risks.

The proper grouping and arrangement of the rules under distinct headings is really one of the first important steps in the development of a standard code. Without it the rules may be jumbled and thrown together in the most haphazard manner. By proper grouping it is made easy for roads with varying conditions to pick out and apply such portions of the code as are fitted to their requirements. Below are shown, in opposite columns, the grouping (1), as recommended by the committee of the American Street Railway Association, and (2) the grouping which seems to be more desirable, the latter being modelled after the standard code of the steam roads:

RECOMMENDED BY COMMITTEE A. S. R. A.	PROPOSED NEW GROUPING
	Form of order putting rules into effect.
General Notice.	General Notice.
General Rules.	General Rules.
	Sub-headings: 1. Rules for Deportment. 2. Rules for Road Operation.
	Definitions.
	Rules for single track (including rules for movement by special order).
	Rules for double track (including rules for movement by special order).
	Signal rules.
	Diagrams of hand, flag and lamp signals.
	Diagrams of car and train signals and of block signals.
Rules for Inspectors, Receivers and Depot Masters.	To be omitted from standard code, leaving each road free to add them in its own way
General Rules for Conductors and Motormen.	Included in general rules under the sub-headings.
Special Rules for Conductors and Motormen.	To be omitted from standard code, leaving each road free to add them in its own way.

The object in adding the group known as "definitions" has already been partially explained. The necessity of making clear the exact meaning of certain terms or phrases will become more apparent when the rules for the operation of single track, including the signal rules, are being developed, or when the necessities of electric operation require the coupling together of several cars to be operated as one unit and known as a train. Certain roads are already calling their conductors and motormen "trainmen," and calling their car service "train service;" although it is not apparent by what process of reasoning a single car, without markers on the rear, can be looked upon as a "train." If the word "train" is to be used the authority for it should appear in the standard code, and there should be a definition of it so that all may know what constitutes a "train."

EXAMPLE DEFINITIONS

Train.—A motor car or engine, with or without trailers, displaying markers.

Regular Train.—A train represented on the timetable. It may consist of sections.

Extra Train.—A train not represented on the timetable.

Timetable.—The authority for the movement of regular trains, subject to the rules. It contains the classified schedules of trains, with special instructions relating thereto.

The general rules, as previously stated, should be considered the primary rules, embodying the principles (1) of correct deportment of employees, and (2) the essentials for safety in the operation of the road. They should be sufficiently broad to be applied alike to urban or interurban roads, with single or double track. They should be so brief, simple and plain that the majority of the employees of all roads will, after a little time, become familiar with the language and almost able to repeat them from memory. Then when some emergency arises the application of the rules will become second nature. Following is an illustration of the primary or general rules applicable to all roads, arranged under sub-headings as suggested:

RULES FOR DEPORTMENT

The use of intoxicants by employees while on duty is prohibited. Their habitual use or the frequenting of places where they are sold is sufficient cause for dismissal.

The use of tobacco by employees when on duty on cars or in or about the depots (except where lounging rooms are provided) is prohibited.

The solicitation of advertisements or contributions for entertainments or similar purposes by or on behalf of any employee is prohibited.

RULES FOR ROAD OPERATION

Watches of conductors and motormen must be compared, before commencing each day's work, with a clock designated as a standard clock.

NOTE.—On long interurban runs it may be desirable to compare time with the standard clock before starting each trip.

Before starting each trip the proper signs and signals must be displayed. Conductor and motorman will each be responsible for his end of the car or train.

Cars or trains must be promptly stopped, and afford safe right of way to fire department vehicles, ambulances and emergency repair wagons.

When cars are being pushed by a motor car (except when shifting in the depots or yards) a flagman or signalman must take a conspicuous position on the front of the leading car, and signal the motorman in case of need.

The rules for the operation of single track, as well as for double track, are understood to be based upon and in harmony with the principles set forth in the primary rules, and should be considered as supplemental thereto. It should not be necessary to repeat any of the principles already embodied in the general rules, but to add thereto only such rules as apply specially to single or double-track operation. An illustration is given below (1) of rules applying specially to single track, and (2) directly opposite, for comparison, rules applying specially to double track:

RULES FOR SINGLE TRACK	RULES FOR DOUBLE TRACK
All trains in the direction specified in the timetable are superior to trains of the same class in the opposite direction.	When a train crosses over to, or obstructs the other track, unless otherwise provided, it must first be protected, as prescribed by Rule —— in both directions on that track.
An inferior train must keep out of the way of a superior train.	When a car or train is standing still, receiving or discharging passengers, any car or train in the opposite direction must make a full stop directly opposite the standing car or train.
A train must not leave its initial station on any division, or a junction, or pass from double to single track, until it has been ascertained whether all trains due, which are superior or of the same class, have arrived or left.	When passengers are alighting, and a car or train is approaching in the opposite direction, conductors and motormen must caution them to look out for the car or train on the other track.

The signal rules, as indicated, should be placed under a separate heading and should prescribe the different kinds of signals used by authority of the code, whether of color or form, visible or audible. The following forms are suggested:

VISIBLE SIGNALS	AUDIBLE SIGNALS
COLOR INDICATION	By Bell-Cord from Conductor to Motorman.
(a) Red—Stop.	SOUND INDICATION
(b) White—Proceed.	(a) 1—When car is moving, stop.
(c) Green—Proceed with caution.	(b) 2—When car is standing, start.
	(c) 3—When car is moving, stop at once.
	(d) 3—When car is standing, back the car.

The hand-flag and lamp signals, the car and train signals, the block signals and the interlocking signals should each one be prescribed in due form, with their indications. These should be followed by the rules governing the use of the signals. The manner of using the signals should be illustrated by diagrams, especially the hand-flag and lamp signals and the car and train signals. All roads use signals of one kind or another on their cars or trains and along their lines. Each road should be able to find in the signal rules that which is suited to its particular requirements.

It should be emphasized that all unnecessary or non-essential matter ought to be omitted from the rules. A careful examination of the rules proposed by the committee at the Detroit convention of the American Street Railway Association will convince the reader that much work yet remains to be done before the proposed rules will pass muster. Rule 42 in the general rules for conductors and motormen is an illustration taken at random. It reads:

"Conductors and motormen must be neat and clean in appearance and wear the uniform and badge prescribed by the company —the badge must be kept in good condition and worn on the front of the cap, and the uniform must be clean and in good repair."

The obvious criticisms are: (1) That it is not necessary to twice

state the requirement of cleanliness; (2) it is unwise to attempt to dictate to all roads where the badge shall be worn; some may want it worn elsewhere than on the cap; (3) the badge and the uniform are intended to be worn only *on duty*, but the rule would seem to require that they be worn at all times; (4) the keeping of the badge in good condition should be understood. Would it not cover the matter in fewer words and with more force to make the rule read as follows:

Rule 42. Conductors and motormen on duty must wear the prescribed badge and uniform, and be neat in appearance.

Rule 9 of the general rules may be cited as another example. It reads:

"In the event of any of the company's apparatus, breakage of the overhead line, charging a pole in the public street, unsafe settlement of building or structures, etc., whereby imminent danger of personal injury is caused, the first employee discovering the fact must arrange to protect the danger point, advising the proper authorities, by the first available means, of the character and location of the trouble. He must not relinquish such responsibility until properly relieved."

The obvious criticisms are: (1) That the language is involved and ungrammatical; (2) the employee is told what he should do in three or four probable emergencies; why stop at three or four; why not tell him what to do in many other emergencies? (3) it should not be undertaken to make rules in a standard code to instruct the employee what to do in each and every emergency that arises. This rule and all others like it should be left out entirely. If any road thinks its employees require such instruction it may be given in special form.

Too much stress cannot be laid upon the point that the standard code should enunciate principles only and not attempt to go into all the minor details of operation.

Arbitration of Chicago Union Traction Wages

In the STREET RAILWAY JOURNAL of June 14, 1902, a brief account was given of the events leading up to an agreement between the officers of the Chicago Union Traction Company and the Amalgamated Association of Street Railway Employees of America. The Amalgamated Association had been organizing a union among the employees of the Chicago Union Traction Company, and as some of the union men were dissatisfied and claimed that union men were being discriminated against by the management, an agreement was drawn up and signed by the officers of the company and the union, in which the Chicago Union Traction Company promised not to oppose the organization of its employees into the Amalgamated Association. The company further agreed to meet and treat with the committees of this organization on all questions and grievances, and in all cases of failure to agree it was provided in the contract that all questions should be settled by arbitration. In July the union men presented to the Chicago Union Traction Company a demand for an increase in wages of approximately 33 per cent. Conductors and motormen on the electric lines of the Chicago Union Traction Company, who had been getting 21 cents an hour, asked for 28 cents. Conductors and motormen of the Chicago Consolidated Traction Company had been getting 17 cents to 19 cents, and asked for 28 cents. Cable car conductors and gripmen, getting 21 cents to 23 cents, asked for 28 cents and 30 cents. In addition the men asked that all men employed on extra runs, trippers and trailers, should be paid for eight hours work. After several conferences President Roach made what was probably the most remarkable and liberal offer ever made, under such circumstances, in the history of electric railroading. This offer was as follows:

Sec. 1. Officers of the Union Traction Company will treat with the officers of the Union concerning all grievances of the men.

Sec. 2. Officers of the Union shall have power to adjust all differences between the company and the men. In case of a failure to agree all matters shall be arbitrated.

Sec. 3. Wages of gripmen shall be 21 cents an hour; conductors of grip and trail cars and combination grip cars, 24 cents an hour; motormen and conductors on electric lines and conductors on single trailer cars, 22 cents an hour.

Sec. 4. Gripmen, motormen and conductors are to be paid this rate on the understanding that no regular run is to be considered less than ten hours.

Sec. 5. Runs are to be not less than ten hours, nor more than eleven, hours a day.

Sec. 6. Trippers, trailers and extra runs are to be paid for at the rate of $1.75 for a run of six hours or less. Such runs extending over six hours are to be figured as full days of ten hours.

Hours of trippers are to be between 5 and 10 a. m. and 3 and 7 p. m.

Sec. 7. All night-car crews are to receive the highest rate of pay now given any single-night crew. Night runs are not to exceed seven hours. (This means that night crews are to get $2.40.)

Sec. 8. In case of delays over schedule time gripmen, motormen and conductors are to receive pay at the regular rate of wages.

Sec. 9. The company agrees to take up the question of wages, hours and conditions affecting the car house and shop employees just as soon as presented by the men in those departments.

Sec. 10. The company agrees immediately to disband and abolish the benevolent society known as Union No. 2, for the sake of harmony, and will recommend that all members of the benevolent association join the Union on the understanding that the Union will accept such members without prejudice. The company will also require that all new men entering its service shall join the Union after sixty days.

Sec. 11. This wage scale and agreement to remain in effect until Aug. 21, 1904.

In spite of this liberal offer, which was especially favorable to trippers, who are the most likely to be underpaid, the men voted not to accept the company's offer, but to submit the case to arbitration. There was a general feeling on the part of the public in Chicago, as well as other laboring men, that the employees were foolish in rejecting this offer, because of its extreme liberality, and by this vote the men undoubtedly lost much of the public sympathy they would otherwise have kept. The matter was then submitted to arbitration. Clarence Darrow was selected by the employees for the arbitration board, and Wallace Heckman by the company. Both are well-known attorneys. These two arbitrators selected as a third, William J. Onahan, president of the Home Savings Bank. Mr. Onahan was the organizer of the St. Patrick's Societies of Chicago, and has been prominent in Catholic affairs. In 1869 he was elected city collector, and in 1888 was chosen comptroller. Later he served on the library board. He is known as a lecturer and writer. After several weeks deliberation the arbitration board made its report and findings on November 6, as follows:

Nov. 3, 1902.

In the matter of the differences between the employees of the Union Traction and Consolidated Traction Street Railway Companies and said companies the Board of Arbitration makes the following finding:

1. The wages of motormen and conductors running electric cars on the Union Traction lines, and conductors of grip cars or trains shall be 24 cents per hour, except as hereinafter provided.

2. The wages of gripmen and conductors operating more than one car, including combination grip cars, on the Union Traction lines shall be 25 cents per hour.

3. The wages of the motormen and conductors of the Consolidated Traction Company shall be 23 cents per hour.

4. Employees who have served the company for less time than six months shall receive the same wages as are now paid, provided the company shall not discriminate so as to discharge old employees and take on new ones for the purpose of hiring at a lower rate.

5. Trippers shall receive $1.75 per day, excepting such trippers as have not been in the employ of the company for a period of six months, and as to such trippers the rate shall be the same as now fixed.

6. Night men on the West Side shall receive 40 cents per hour; night men on the North Side shall receive $2.50 per night for such men as now receive $2.25, and $2.65 per night for such men as now receive $2.40. This scale of wages shall be in force and effect from Sept. 15, 1902, to May 31, 1904.

The Board has not been able in this limited time to fix the wages of car house men, and it suggests that both the companies and the organization furnish men to examine carefully the wages of men of each car house and attempt to adjust them, and, on their failure, the Board reserves the question of fixing the wages of the car house men, and such findings as to wages shall date from the 15th day of September, 1902.

The Board further finds that there was no substantial evidence before the commission that the street car companies had discriminated in any way against the members of the Amalgamated Association after the agreement, on the 31st day of May, 1902, but further finds that the existence of the so-called Benevolent Association, or Union No. 2, tends to create inharmony and dissatisfaction among the men and affects the efficiency of the service, and for this reason recommends that it shall be abolished and the company released from the payment of any death, sickness or accident benefits on account of any contract with their employees or such society. The employees shall be required to sign such release before accepting this scale of wages.

This commission, for lack of time, reserves the question of reinstatement of the discharged men whose cases are pending before the commission.

W. J. ONAHAN,
CLARENCE S. DARROW,
WALLACE HECKMAN.

Thus the wage question on the lines of the Chicago Union Traction Company and the Chicago Consolidated Traction Company, which it controls, has been finally settled, for a year at least. The requests of the men on the Chicago City Railway for an increase of wages, it will be remembered, were settled by a board of arbitration in September, the wages agreed upon being 24 cents an hour, or the same as previously offered by the company before the matter went to arbitration.

Both the Republican and Democratic parties made use of advertising space in street cars in Central and Western Massachusetts previous to the last election for the first time in that section.

Report of the Committee on Standards*

BY N. H. HEFT, JOHN I. BEGGS, E. G. CONNETTE, E. A. NEWMAN AND R. T. LAFFIN

The committee on standards, appointed in pursuance of the action of the last annual meeting of the association, have given individually, at their homes, and collectively as a committee at meetings, considerable thought to the matters involved, and have carried on much correspondence in an earnest effort to obtain data which would enable them to present at this meeting of the association ideas that would be of advantage to the electric railways throughout the country.

It is unnecessary, however, to suggest that because of the great changes and vast improvements being made in the type, design and construction of motors that it is difficult to make any definite recommendation upon this point, as we feel that the next year or two may radically change the ideas of the manufacturers as well as the operating departments of the several roads with relation to the matter of motors.

With regard to the matter of rails and trucks we present more definite conclusions for your consideration.

At the first meeting of the committee the subjects to be considered by the committee were divided and assigned to the members as follows:

N. H. Heft (Meriden, Conn.).—Wheels, axles, axle brasses, journals, journal-boxes, brake-heads, brake-shoes, etc.

John I. Beggs (Milwaukee, Wis.).—Rails.

E. A. Newman (Portland, Me.).—Motors.

E. G. Connette (Syracuse, N. Y.).—Trucks.

R. T. Laffin (Worcester, Mass.).—Painting.

Will Christy (Akron, Ohio).—Car bodies for city and suburban service, including ventilation; also the question of the oval roof.

C. F. Holmes (Kansas City, Mo.).—Standard overhead construction for high-speed city and suburban roads, including trolley wheels.

RAILS

The committee having carefully considered this subject, and having consulted with experts, recommends that this association adopt as a standard for either a "T" or girder rail, the form of rail shown in Figs. 1 and 2; the height of the rails to be governed by the character of the pavement required in the municipalities, and the weight of the rail to be not less than 70 lbs. for the "T"-rail and not less than 90 lbs. for the girder rail per yard.

It will be observed by examining these illustrations that the head of the rail is made to conform to the angle of the tread of the car wheels, for the following reasons. First, to increase the contact area, thus increasing the tractive force; and second, causing a more uniform wear across the head of the rail and tread of the wheel.

The width of this head should be not less than 3 ins. With a rail-head of this form and dimensions, a car wheel having a 3-in. tread and flange of 1⅛ ins. in depth (which should be used on all suburban cars), can be operated without interfering with pavements, with safety, at a high rate of speed on suburban and interurban roads, and with less cost for maintenance than the present form, due to the increased surface contact between the wheel and rail and decreased wear on flange.

The committee is of the opinion that the "T"-rail is the most desirable and practicable rail for all purposes, and advises its use wherever the consent of the municipality can be obtained; and an earnest and persistent effort should be made on the part of all electric railways to obtain such consent.

In all places where a "T"-rail, as here described, cannot be used, your committee recommends a grooved girder rail of the form shown in Fig. 2. This form of rail, owing to the bearing being placed directly over the center line of web, gives a rail of greater stiffness, one with a head of 3 ins. in width, as well as a deeper and wider groove, and one which can be paved in the same manner as other girder rails.

In view of the rapid construction of suburban and interurban lines, which enter the cities over the tracks of city lines, the committee deems it advisable to recommend, in the renewal of special work where suburban or interurban cars are operated, and in all special work for new construction, that particular attention be given to the depth and width of the groove, as shown in Fig. 3, applicable to special work in connection with "T" or grooved girder rails.

MOTORS

Street railway motors are subjected to such varying conditions and uses as to render it almost impossible to outline what might be considered a standard motor. Neither would it be practicable to standardize certain horse-power motors for certain weights of cars, as the conditions of operation are so varied that what might be perfectly satisfactory in one case would be unsatisfactory in another. Generally speaking, for city service motors of between 35 hp and 40 hp are most practicable. For ordinary suburban service motors of this capacity, with four motor equipments, would meet nearly all ordinary conditions and requirements. For high-speed service on long suburban and interurban roads motors of greater capacity are desirable and should be selected with special reference to the specific duty to be performed.

As there is a possibility of alternating-current motors being developed the committee feels, in view of the experiments now being made both in this country and abroad, that it is advisable to await the outcome of these experiments before any recommendation on this subject is made.

TRUCKS

Your committee is of the opinion that the time is inopportune for recommending any particular design of trucks for motor-car service, especially for single-truck cars, except such parts of trucks as wheels, axles, bearings and journal boxes.

For interurban service the committee recommends that the standard dimensions, as given in this report for wheels, axles, bearings and journal boxes be followed, and also that the M. C. B. practice in the construction of trucks for double-truck cars be adhered to as closely as possible.

AXLES, JOURNALS, JOURNAL BOXES

In view of the great demand on the part of the traveling public for a more frequent and rapid service, not only in large centers of population, but in suburban and interurban service, and in view of the increased weights of the equipment required to safely perform this service, your committee recommends the standard axle adopted by the M. C. B. Association, which is the result of developments and improvements covering a period of fifty years. This standard axle can be applied to all electric railroads, which are now performing practically the same service as steam railroads.

We recommend for adoption an axle of the size and form shown in Fig. 4 for all motor cars weighing under 15 tons, including in such weight trucks, motors and car bodies and full load; also the M. C. B. standard journal brasses, journal boxes, dust guards and key seats, as shown in Figs. 4, 5, 6 and 7.

For all cars weighing from 20 tons to 28 tons, including in such weight trucks, motors and car bodies and full load, the M. C. B. standard axle, also journal brasses, journal boxes, dust guards and key seats shown in Figs. 8, 9, 10 and 11.

For all cars weighing up to 30 tons, including in such weight trucks, motors and car bodies and full load, the M. C. B. standard axle, also journal brasses, journal boxes, dust guards and key seats shown in Figs. 12, 13, 14 and 15.

For all cars weighing up to 40 tons, including in such weight trucks, motors and car bodies and full load, the M. C. B. standard axle, also journal brasses, journal boxes, dust guards and key seats shown in Figs. 16, 17, 18 and 19.

For all cars weighing up to 50 tons, including in such weight trucks, motors and car bodies and full load, the M. C. B. standard axle, also journal brasses, journal boxes, dust guards and key seats shown in Figs 20, 21 and 22.

CAR WHEELS FOR SUBURBAN AND INTERURBAN SERVICE

Your committee has taken up with operating managers the subject of car wheels for suburban and interurban service to centers of population over public streets, and finds that their views accord with those of your committee.

We recommend for adoption as standard a steel-tired wheel and a cast-chilled wheel, as shown in Figs. 23 and 24.

With a view to safety and economy we recommend for motor cars used in suburban and interurban service a steel-tired wheel of the dimensions shown:

For use with an axle as shown in Fig. 4, wheel to weigh 640 lbs.; in Fig. 8, wheel to weigh 695 lbs.; in Fig. 12, wheel to weigh 790 lbs.; in Fig. 16, wheel to weigh 840 lbs., and a cast-chilled wheel of the same dimensions: For use with an axle as shown in Fig. 4, wheel to weigh 440 lbs.; in Fig. 8, wheel to weigh 490 lbs.; in Fig. 12, wheel to weigh 590 lbs.; in Fig. 16, wheel to weigh 640 lbs.

Car wheels of the weights mentioned conform to the M. C. B. standards.

BRAKE-HEAD AND BRAKE-SHOE

Your committee recommends for adoption as a standard the brake-head and brake-shoe shown in Figs. 25 and 26.

* Adopted by the American Street Railway Association, Detroit, Oct. 10, 1902.

NOTE.—The illustrations are presented in convenient form in the supplemental sheet which faces this page.

PAINTING

As a standard method of painting cars your committee would recommend the following: All grease and rust should be removed from the ironwork and the car body should be rubbed down to a smooth surface; then thoroughly paint the ironwork with pure red lead and raw linseed oil. Then the outside of car body should be painted as follows: First, pure lead and oil priming thoroughly rubbed in; second, one coat of flat lead, egg-shell gloss; third, white lead putty; fourth, three coats of flat lead; fifth, two coats of rough stuff; sixth, scour to smooth surface; seventh, two coats of ground color; eighth, special color to cover; ninth, ornament on flat color; tenth, two coats of best finishing varnish.

No coat is to be applied until the preceding coat is thoroughly dried.

The roof canvas should have three coats of lead and oil, and no glue size or patent filler should be allowed on the roof.

For the inside or standing finish, we would recommend that one coat of lead and oil and one coat of Prince's metallic be put on back of same before finish is put in place.

All standing or inside finish, if of open grain wood, such as ash, oak or mahogany, we would recommend to be thoroughly filled with Silex filler. If the wood is of open grain nature, such as cherry, maple or birch, we would recommend a good oil stain instead of the filler. Then thoroughly sandpaper, after which apply two thin coats of absolutely pure grain alcohol shellac, either bleached or orange, according to the wood. Then sandpaper and apply two coats of varnish. All inside work should be rubbed to a dead finish, and all outside or exposed work should be left in the gloss.

In car floors, the under or lining floor should have one good coat of oil before the upper or corrugated floor, which has received a coat of oil, is laid. When finished it should receive one coat of bleached shellac and one coat of good floor varnish.

RETURN CIRCUIT

The committee believes that one of the most important factors in the construction and operation of an electric railway is to provide for a standard return circuit in such manner as to give the least resistence and largest and most reliable carrying capacity, thus avoiding loss of power and increased cost of maintenance. We, therefore, recommend a supplementary return, in addition to the usual practice at the present time, in all congested sections, crossing all special work and in the vicinity of the power plants.

STANDARD OVERHEAD CONSTRUCTION AND CAR BODIES

Owing to the inability of the committee to obtain any report from the members to whom were assigned the subjects, "Standard Overhead Construction for High-Speed City and Suburban Service, Including Trolley Wheels," and "Car Bodies for City and Suburban Service, including Ventilation; also the question of the Oval Roof," we are unable to present any report embodying recommendations on these subjects.

CONCLUSION

We earnestly recommend that the incoming officers of the association be authorized and directed to appoint successors to the undersigned committee to carry on the work for which they were appointed, as we feel that the recommendations here made are only preliminary to much work that can be done in this direction.

Railroad Commissioners of Massachusetts Investigate Railways

The Railroad Commissioners of Massachusetts will be occupied during the two weeks beginning Monday, Nov. 10, with the further pursuit of the inquiry which they were directed by the Legislature of last winter to make into methods of dealing with the suburban railroad service, the application of electricity as a motive power upon railroads and street railway equipment. Members of the board will cover different fields of investigation, W. Bishop visiting St. Louis, Chicago, Detroit and Cleveland and other cities, and Clinton White going to Philadelphia, New York and other cities. Chairman James F. Johnson will join Mr. Bishop in Chicago, with the special view to the inspection of the Aurora, Elgin & Chicago Railway, equipped with electric power, returning in season to accomplish certain work upon the annual report of the Board. Hearings by the board will be resumed Monday, Nov. 24.

Annual Report of the Montreal Street Railway Co.

The annual report of the Montreal Street Railway Company, submitted at the annual meeting of the company, held in Montreal on Nov. 5, shows the net earnings for the year just ended to have been $911,052, as compared with $795,413 last year. After providing for the percentage on earnings accrued to the city, and interest on bonds and loans, the company declared four quarterly dividends, amounting to $600,000. In view of the company maintaining its own fire risk there has been placed to the credit of the fire insurance fund an additional sum of $100,000, leaving a surplus of $465, which has been transferred to the general surplus account of the company. As the operating report shows the company's earnings continue to increase in a satisfactory ratio, while the percentage of operating expenses to gross receipts shows a substantial decrease. The company issued during the year $1,500,000 4½ per cent debenture bonds to pay off the loan incurred by the purchase of the Montreal Park & Island Railway. Several new extensions to the company's lines, amounting to 14 miles of new track, have been constructed and put in operation during the year, and the rolling stock has been increased by the addition of twenty-nine motor cars. During the year the company paid the city the following amounts: Tax on earnings and other taxes, $127,258; on account of snow clearing, $50,772. The operating report of the company follows:

	1902	1901
Gross receipts	$2,046,208	$1,900,680
Operating expenses	1,135,176	1,105,267
Earnings from operation	$911,032	$795,413
Passengers carried	49,947,467	46,741,660
Transfers	15,077,511	14,215,784

The general balance sheet of the company shows:

ASSETS

	1902		1901	
Cost of road and equipment:				
Construction, etc.	$3,539,822.91		$3,239,814.03	
Equipment, etc.	3,063,067.58		2,839,764.42	
Real estate and buildings	1,616,925.27		1,588,739.01	
Montreal Park & Island Railway Company's stock and bonds	1,159,297.40		1,105,485.06	
		$9,379,113.26		$8,773,802.52
CURRENT ASSETS				
Stores	$76,065.61		$76,619.60	
Accounts receivable	57,277.12		61,789.49	
Montreal Park & Island Railway Company	122,501.02		....	
Cash in bank and in hand	95,382.58		325,957.98	
Cash on deposit with city of Montreal	25,000.00		25,000.00	
Cash (fire insurance fund)	100,000.00		....	
Balance new stock call unpaid	....		57,193.75	
		476,246.33		546,560.82
		$9,855,359.59		$9,320,363.34

LIABILITIES

	1902		1901	
Capital stock	$6,000,000.00		$6,000,000.00	
Bonds:				
5 % payable March, 1908	292,000.00		292,000.00	
4½ % payable Aug., 1922	681,333.33		681,333.33	
4½ % payable Nov., 1922	1,500,000.00		......	
Mortgages	6,034.51		6,034.51	
		$8,479,367.84		$6,979,367.84
CURRENT LIABILITIES				
Bank of Montreal loan	....	....	$1,100,000.00	
Accounts and wages payable	$100,807.78		103,915.77	
Accrued interest on bonds	33,275.00		5,150.00	
Accrued tax on earnings	101,747.72		93,006.21	
Employees' securities	8,489.60		7,026.60	
Unclaimed dividends	1,964.57		1,956.57	
Unredeemed tickets	20,400.80		18,338.22	
Suspense account	62,490.23		63,608.08	
Montreal Park & Island Railway Company	....		9,267.41	
Dividend payable Nov. 1, 1902	150,000.00		139,300.00	
		479,167.70		1,542,068.87
Contingent account	$183,766.22		$191,056.42	
Fire insurance fund	204,221.92		....	
Surplus	508,835.91		607,870.21	
		896,824.05		798,926.63
		$9,855,359.59		$9,320,363.34

Car Roof Treatment

BY A MASTER PAINTER

The failure sufficiently to protect the roof of a street car by the proper treatment of the canvas which eovers it, must be attended by a variety of disastrous results, whose far-reaching influenee is not always apparent at first. That the importance of this work is not fully appreciated has frequently been demonstrated in a most deplorable manner, where whole head-linings have been seriously injured by the unnecessary introduction of water through the canvas, which, if properly treated when first applied, could have been made absolutely impervions even to dampness.

The energy displayed by a small quantity of water in forcing itself through a seemingly impenetrable surface is indeed remarkable. Every practical car builder has attempted to trace to its source and explain the mysterious appearance of this unwelcome visitor, which has necessitated the painting of the entire roof, and even then without the assurance of any material success.

Prevention has the advautage of cure in many respects, but in no case is the wisdom of precautionary measures more clearly apparent than in insuring a long life to the canvas of a car roof, whereby its porosity will be absolutely sealed against any moisture whatever. The inclination to regard one's ideas as authority is prevalent among painters to marked extent, and this has been the cause of so many different methods being employed in the details of car painting. Much attention has been directed to the subject of body roofs, and there are a variety of opinions in regard to proper methods of their treatment. Many of these methods will act as a protection when the paint is first applied, but after the car has been in service ten or twelve years, many successive coats of paint, united into one homogeneous body, are exposed to the merciless rays of a natural destroyer—the sun; and as thiscovering fails to retain sufficient elasticity to allow for the contraction and expansion of the car roof, cracks appear which gradually expand as the oil in the paint becomes decomposed. This allows water to penetrate to the canvas, which, if not properly treated in the beginning, will absorb it with disastrous results.

As the conditions leading up to the cracking of the paint in time are absolutely unavoidable, it is evident that it remains for the canvas to furnish the protective qualitics to some extent, and unless it is properly applied and filled it will certainly be incapable of doing so.

During a long period of experimental activity the writer has been rewarded by discovering—accidentally and otherwise—a few practical methods of car painting, which include the subject in question. In the course of these experiments on this particular subject many different pastes were compounded with a variety of ingredients for the purpose of uniting the canvas to the boarding. Among these were white lead and oil—the first material that would naturally suggest itself to a painter. While there conld be no question regarding the protective qualities of lead when used for this purpose, still, it was evident, that it had not the adhesive properties which are reqnired for this important operation. The failure of the lead to join wood and canvas is caused evidently hy the facility of oil to desert carbonate of lead upon the least provocation, and when placed between two absorbent bodies the result obviously will be that the intervening space will be occupied by an inert substance which has very little adhesive value. Yet, notwithstanding this fact, it is used to a considerable extent, presumably from a desire to let well enough alone—a chronic mental disease that is very prevalent among painters. This may be accepted as an explanation for the lack of progress in this department compared with other branches of car construction, and may also account for using such absurd mixtures for this purpose as glue, flour paste, and some others which are soluble in water, and of which the least said the better.

One method which I will describe here may possibly he of some benefit to those working along similar lines. The compound for fixing the canvas to the boards is prepared by uniting fine bolted whiting with japan, mixed to the consistency of a thick paste, to be applied with a brush. One of the principal points to be commended is that time does not seem to extract any of its tenacions virtues nor impair its remarkable elasticity. Forming as it does a sort of cement it firmly anehors itself into the pores of the wood, and at the same time penetrates into the eanvas, forming virtually one body. Again, the nature of the combination and the consistency to which it is mixed prevent its oozing throngh the cracks in the boarding of the bonnets. This is a very inconvenient feature of the "lead and oil" method, and the stains thus made are difficult to erase when the inside of the bonnets is to be finished in natural color.

Before applying the canvas the boarding should be thoroughly eleaned of all shavings and sawdust, and the canvas cut and fitted, as it is of vital importance that the operation should be performed as rapidly as possible. The paste should be applied to the boarding as thick as a brush will allow, care being exercised in spreading it out evenly and quickly. Then after the canvas has been laid on it should be smoothed out and fastened, and allowed to dry forty-eight hours before proceeding with the filling.

The importance of the first coat, or, perhaps, the term "filling" would better describe it, cannot be too forcibly emphasized, when it is remembered that as the canvas that covers an electrie car is daily walked upon by men engaged in oiling and repairing the trolley apparatus, an ordinary coat of oil paint, applied directly to the canvas, would act only as a superficial foundation for subsequent coats, and this foundation being insecurely anchored into soft, spongy material, would have a tendency to let go upon the slightest contact with the heel of a boot. An abrasion of this description would leave a weakness, which ultimately is bound to expose the canvas. So, in view of this fact the paint must be induced to penetrate deeper into the fabric, and this can be done by reducing the oil paint with turpentine in the proportion of one quart of turpentine to one gallon of ordinary mixed lead, oil and dryer, which, if used freely under the brush, will penetrate through the canvas to the paste-cement below, thereby uniting the whole into one solid body, sufficient in itself, if called upon later in its life, by reason of accident or nndue exposure of the other coats of paint, to withstand successfully any water that might reach it. This filling, which could be applied with good results forty-eight hours after the canvas had been placed, ought to stand and dry until the car is ready for the first coat of color, and thus give it ample time thoroughly to harden.

The second coat of paint is in reality the first "anchor coat." Penetrating as it does into a vast number of infinitesimal eells, formed by the coagulation of the paint and canvas, it gradually secures itself permanently into these cells, as the oil in the paint becomes oxygenated. This paint should be mixed like the filling, with the exception that a pint of turpentine should be added instead of a quart. This coat should be allowed to dry until the car is finally varnished, when it will be ready for its last and protective coat, which is prepared with lead, oil and as small an amonnt of drier that will conform with the existing conditions in regard to time allowance. It should be thoroughly "brushed out," thereby avoiding the danger of wrinkling, which will result if applied in an uneven manner. Where this condition exists, however, the failure of the paint to adhere properly to the preceding coat must be expected and regarded as a matter of course.

A majority of modern street cars have for the ceiling in their interiors what is termed three-ply woods, finished natural, whieh is composed of very thin boards pressed together and fastened with glue. The grain of the two outside pieces runs parallel with each other, while the grain of the inside one is arranged so as to be at right angles with that of the other boards. The peculiarity of this construction, together with its position, when placed in the car exposes it to certain ruin if the protecting point on the outside of the top fails to exclude water. A leak of any extent will admit enough water in a short time to impregnate the first layer of this head-lining that it meets, which will cause it to swell and part from the middle one. This in turn will part from the last, which is the most important, being often expensively decorated and finished, and as the wood becomes saturated with water the result will be that a bulge will appear, which will necessitate the removal of the section of lining in which the injury appears as it is beyond repairing. This condition is produced without warning, as the mischief is done when the first indication is apparent. Even if the bulge is pressed back when thoroughly dried the union of the water and wood creates a stain which is absolutely impossible to obliterate.

Too much stress cannot be laid upon this danger. All other accidents and damages in street car painting can, in a measure, be rectified and put into presentable shape, but the danger of water, silently and surreptitiously entering a car through unprotected canvas cannot be too fully realized when the chances of numerous injuries are revealed, whose origin might be traced directly to it. Decomposed wood around joints, interrnpted electric connections, defaced interior and exterior finish are a few that might be mentioned which are mostly to be feared. Yet these may all be avoided if the treatment of the canvas is properly conducted in the beginning.

Report of the Cape Electric Tramways

The annual meeting of this company was held in London Nov. 12. The company owns all the stock of three street railways in Cape Town and in Port Elizabeth, South Africa, and its report shows a net balance as a result of the last year's operation of £81,498. Sixteen per cent in dividends were paid last year on the capital stock.

Annual Convention of the Electric Storage Battery Company

The annual convention of the Electric Storage Battery Company was held in Philadelphia, on Oct. 13-16, the sessions being held at the Colonnade Hotel. On Monday, the thirteenth, the managers of the sales offices throughout the United States met at the factory and a tour through the works was made. A luncheon was served at the factory, after which the staff of the Battery Company and the visiting managers of the sales department adjourned to the Colonnade Hotel, and after an address of welcome by the president, Herbert Lloyd, papers were read by Charles Blizard, manager of the sales department; Walter G. Henderson, secretary and treasurer, and A. B. Stoughton, general counsel of the company. In the evening a reception was held by the president at his residence, which was attended by the visiting members and officers of the company.

At the Tuesday session papers were read by engineers of the staff. On Tuesday evening a theater party was given at the Chestnut Street Theater.

On Wednesday papers were read by the different members of the staff. On Wednesday evening a banquet was given at the Germantown Cricket Club, Manheim, Philadelphia.

The banquet hall was almost completely filled by one large oval table, the surface of which was hidden beneath a mass of choicest cut flowers and beds of ferns. Three electric signs, reading "The E. S. B. Co.," "1888"—"1902," were placed on the walls, and a menu card having for its cover a small fac-simile of the company's price list, together with an embossed card bearing the Manheim Cricket Club's design and the guest's name, was at each plate. Between the several courses songs were rendered and marvelous telegraphic despatches from Siam, Afghanistan, Turkey and the Sandwich Islands were received on a special wire. Brief addresses by the president, vice-president, secretary and manager of the sales department were made.

Meetings continued on Thursday until noon, when the convention ended.

These annual conventions of the staff of the Electric Storage Battery Company are not only most thoroughly enjoyable in bringing together the different sales managers and the corps of engineers stationed throughout the United States, but have been found to be most thoroughly instructive, and it is a feature that is looked forward to annually with growing interest, bringing in touch, as it does, the representatives and enabling them to discuss the numerous problems which are met with in their work in different localities.

No small measure of the successful growth of the Electric Storage Battery Company can be attributed to the loyalty and earnestness of the staff of the company in their several fields of work and their devotion to the company's interests.

A graceful tribute of personal appreciation by his corps was made to Charles Blizard, manager of the sales department, in the presentation to him of a handsome watch.

London Railway Problems

There have been no practical developments in the London railway situation, but many plans have been proposed, some of which are receiving serious consideration. It is reported that the Parliamentary committee which has been considering the question of making provision for the construction of municipal tube railways will submit a report to the London County Council, recommending that the most effective method of dealing with the question would be to invite the assistance of the government to provide municipal tubes. The report suggests that the London County Council approach the president of the Board of Trade and urge the appointment of a commission, which shall be empowered to hold a complete inquiry on the subject and consider proposals for the construction and secure authorization for such tubes as are deemed necessary for the public benefit. The report also advises the County Council to ask the president of the Board of Trade to use his influence to obtain the suspension of any London tube bills that may have been introduced in Parliament, as the Council considers that the discussion of such measures will be detrimental to the interests of London until a full inquiry is held.

Commenting on the announcement that the London County Council is once more considering seriously the "tube" question, and that it will introduce a bill in Parliament on the subject next session, the London Electrician says: "The County Council's views on the subject of the tube railways before Parliament next session will doubtless have weight, but it is highly improbable that, in view of the number of trading undertakings the Council has now on its hands, Parliament would sanction a London County Council tube railway. We trust, therefore, that the London County Council will rather try and assist Parliament in its deliberations as to the relative merits of the various schemes submitted to it, instead of opposing company undertakings indiscriminately, as some of its members advocate." The same journal considers it a significant fact that the House of Commons cheered when Mr. Ashton said: "Why should London wait simply because the County Council, some few years hence, might be enabled by a different House of Commons, under different circumstances, to make tube railways?"

Another plan that has been exploited during the last week provides for five large railways having terminals in London, the Great Western, the Great Eastern, the London & Southwestern, the London, Brighton & South Coast, and the London & Southeastern, jointly constructing an underground line to link their respective terminals by a circular route, which might be intersected by cross underground lines and connected with others radiating to the suburbs.

The plans involve large expenditure, but if they should mature they will have a most important influence on the existing projects. Meanwhile the Central London Railway, the owner of the existing underground line, has decided to apply again to Parliament for permission to extend the system in the direction of the proposed scheme of 1901, which Parliament rejected. It is understood that an announcement is impending in Parliament foreshadowing an arrangement by which the London County Council will get important powers in locating the underground lines.

Prime Minister Balfour announced in the House of Commons Nov. 11 that the government was considering the appointment of a commission which shall be empowered to hold a complete inquiry into the subject of underground railways. The appointment of such a commission, according to the view of the solicitor of Messrs. Speyer and Yerkes and chairman of the District Railway, will involve the hanging up of Mr. Morgan's and other schemes yet unsanctioned for two or three years, as a commission is not likely to report in less than that time. Meanwhile the Yerkes and Speyer schemes will go ahead. The matter was also discussed at a meeting of the London County Council. John Burns declared that the tube system was already obsolete, and that the solution of traffic congestion lay in electric surface lines connected with congested points by shallow underground tracks. It is declared that the present indications point to the eventual establishment of central control of all the lines, which will have an important influence in the pending schemes.

Important Suburban System for St. Louis

James D. Houseman, general manager of the St. Louis, St. Charles & Western Railway Company, has obtained a franchise in Clayton to build cross-country railroads and to consolidate them with the other electric railway lines in St. Louis County. The roads included in the proposed consolidation are the Suburban Florissant line, 17 miles long; the St. Louis, St. Charles & Western, 17 miles; the Midland, 14 miles; the Clayton division of the St. Louis Transit Company, 8 miles, and the new cross-county railroads, which are to be about 14 miles long. The Webster, Kirkwood and Meramec Highlands divisions of the St. Louis & Suburban Railway are not included in this estimate, although these lines may be taken in later. The St. Louis County Railway Company, which has a franchise to build a railroad along the Olive Street road from the city limits to Creve Coeur Lake, and the St. Louis, Kirkwood & Manchester Railway Company, which has a franchise to build a road from Forest Park to Kirkwood and Manchester, along the Manchester road, will also be asked to join the consolidation.

J. D. Houseman, who is promoting the consolidation, states that he is representing only himself in the deal. He said recently that he was not authorized to speak for the Suburban and Transit management, but felt justified in thinking that his proposition would receive favorable consideration.

Mr. Houseman promised the judges of the County Court that he would organize a company immediately to accept the franchise, and would give the county 2 per cent of its gross earnings for ten years. The other roads will not be purchased outright but will be leased, and the directory of the new company made up of representatives of each company.

The cross-country roads will be used as feeders. The first to be built will be to Ferguson, from the junction of the Lucas & Hunt and Natural Bridge roads. The St. Louis County Railway tracks now run to that point from Wellston. These tracks have already been leased by the St. Louis, St. Charles & Western, and the new branch will really be an extension. The route will be over a private right of way. The next line will be a branch from

the main line of the St. Louis, St. Charles & Western Railway to Kinloch Park. The branch will begin near the Marvin Camp Grounds, on the St. Charles rock road. It will be built to intersect the Suburban Florissant line at Kinloch. Another branch will be built south from the Marvin Camp Grounds to intersect the Midland tracks near the Woodson road. This line will be extended to connect with the proposed tracks on the Olive Street road. Another branch will be built to run to Clayton. If the Suburban-Kirkwood lines cannot be secured and the Transit-Clayton division can, the tracks of the latter will be extended from the present terminus at the Log Cabin Club on the Clayton road to Kirkwood. This would enable one line to go from Kirkwood to Florissant, or vice versa, through the county seat in an almost direct line, and would obviate the necessity of going first to St. Louis. The Ferguson Avenue division of the Transit Company in St. Louis County will complete the chain. The route runs from the Midland tracks west of Delmar Garden to the St. Vincent's Asylum for the Insane. This has always been known as a jerk-water branch, but it will be valuable to the new company, as it will give it a line to the World's Fair grounds.

The Massachusetts Railroad Commissioners' Hearing of the Southboro Petition

The efficacy of the informal method of the Railroad Commissioners of Massachusetts of getting at the points in a given case were shown once or twice in the important hearing occasioned by opposition from Southboro to locations for the Boston & Worcester Street Railway, which is to extend from Worcester to Boston. The company was before the board for approval of a location through Southboro, largely over its private right of way, but involving three crossings of town highways. The company wants to cross overhead; the Selectmen (who imposed such conditions on a location previously granted by themselves that the railway company would not accept it) thought the railway should cross underneath, although the overhead crossing involved grades of about 2½ per cent, and the underneath crossing grades of about 6 per cent. William A. Butler, for the railway, had put on several witnesses by whom he wished to show that the sentiment of Southboro people was against an underneath crossing. When he asked them what they considered the town sentiment to be, the board was about to let the questions go on, when C. F. Choate, Jr., for the Selectmen, objected strenuously, on the ground that the replies would be merely hearsay evidence. Chairman Jackson, of the board, then said that although such evidence would hardly pass under a strict procedure, the board had been accustomed to allow it, with the understanding that its members would place no more than the proper value on it. "But," said he, "the board has never been accustomed to allow this kind of evidence against an objection that was pushed." He went on to say that hearings would be interminable if testimony should be taken as strictly in accordance with the rules of legal procedure as in the regular courts. Mr. Choate did not push his objection at first, but for the later witnesses he again objected, urging that each side should bring in representative men to testify, if it was desired to show what the public sentiment was. The point was not regarded as of enough importance to go into very exhaustively, and the line of testimony was dropped.

Another instance showing how time is saved by the informal method was near the opening, when the railway company's lawyer was trying to bring out at length the difference in form and expense and safety to the public of the crossings proposed by the opposing parties. It would have been a long matter if allowed to continue to the end; but before it had proceeded far Chairman Jackson cut it short by announcing that the question was so largely one of an engineering nature that the board would feel it necessary to have its own expert, Mr. Turner, look into the matter and make an independent report, after which the board would go out and take a view of the crossings and hear any suggestions which either party might care to make, on the ground. The effect of this statement thus early is to be judged by the way in which it was received by the opposing lawyers. Mr. Butler said: "I think the statement of the chairman may shorten this hearing to a material extent, and am very glad to hear that the board is to look over the ground for itself."

Mr. Choate, for the Selectmen, said: "I shall be very glad to have the board take the action suggested."

Although Southboro is opposing the Boston & Worcester Street Railway in a measure because the line runs north of the villages, which are the town centers of population, the only question actually up is as to the safest and best way of crossing the three highways mentioned, the so-called Parkerville, Cordaville and Center Roads. They come under the law requiring the Railroad Commission to approve locations of street railways as to their safety for operation. The railway asks the board to grant it the entire location in Southboro under the so-called "missing link law," allowing the board to grant to a railway which has secured locations on each side of a town where a location is refused, a location in that town over the heads of the local authorities.

An interesting point in the hearing last week was the statement by one of the railway company's agents that the company had discussed the double-tracking of the line eventually, and the transportation of milk, fruit and farm products to the large cities at its termini as a part of its business. The agent said that the company had planned to carry no heavy freight, but that it expected to carry parcels and packages of light merchandise and express matter if there was a demand for it.

Official Report on Connecticut Roads

An electrical engineering expert, who made an inspection of the electric railways in Connecticut in company with the Railroad Commissioner, by whom he was employed, has made his report to the commission. He says, in part:

"The railways as a whole are in an efficient condition for public service as at the time of last inspection, and show a continued tendency toward improvement, by the use of more substantial materials in constructions and renewals.

"The extension into interurban territory of railways constructed originally as a local enterprise and operated as single track with turnouts, with heavy cars run at high speeds, has produced a condition which must soon, if it does not now, require these lines to be operated by a simple, efficient and visible signal, located at each turnout, and not liable to be easily deranged.

"I have observed also during the inspection, that with one exception, the railways have a very crude method of notifying their motormen and conductors of the running of two or more cars on the same time. This information should be conveyed to the motormen and conductors, waiting on turnouts, by a conspicuous signal carried by each car, except the rear one, the rear car not carrying a signal would indicate that it was the last car running on the same time."

Ground Broken for Brooklyn Tunnel

Ground was broken Nov. 8 for the extension of the rapid transit tunnel system from the City Hall in Manhattan to Flatbush Avenue in Brooklyn. The ceremony marked the beginning of actual work, and by the time night fell considerable excavating had been accomplished. In front of the Chesebrough Building, 17 State Street, the first opening for the new tunnel was made by Calvin W. Hendrick, engineer of sewers for the Rapid Transit Commission. Immediately afterward Francis D. Fisher, engineer for the Degon-McLean Construction Company, which holds the sub-contract for the first section of the extension, set laborers at work. The first work that confronts the sub-contractors will be the removal and reconstruction of several trunk sewers under State Street. This will take three months. In the meantime work will be continued south from the City Hall, and preparations will be made for boring under the East River and for the construction of the tunnel from the Flatbush Avenue terminal to the water front.

Poor's Manual for 1902

Poor's Manual of Railroads for 1902 has just been published, and, as usual, gives a large amount of ve y interesting data in regard to railway enterprises. An important feature of this manual is the tabulation of statistics of various years, which, in most cases, are carried back to 1889, and in some instances still farther. An analysis of the passenger earnings for the entire country, for instance, shows a minimum in average receipts per passenger, per passenger per mile, per passenger train mile, and per mile of road, extending from 1894 to 1898, and an increase in all items since that date. The same table also shows the significant fact that the average distance travelled per passenger has almost constantly increased since 1895, being at its maximum, in the thirteen years under consideration, in 1901. To what extent consolidations have affected this figure it is impossible to state, as the method of calculating the number of passengers carried is not given, but the competition of electric roads must also have exercised an influence on increasing this average. The grand average earnings per mile of road for 1901 are given as $8,270 gross and $2,668 net, the average interest paid on bonded debt as 4.24 per cent, and average dividend on total share capital 2.62 per cent.

Cincinnati Suburban Lines Consolidated

Following closely the announcement that a traffic agreement had been entered into between the Cincinnati Traction Company—the Widener-Elkins syndicate—and the Pomeroy-Mandelbaum syndicate comes the announcement of the consolidation of the Interurban Rapid Railway, Suburban Railway, the Cincinnati & Eastern Railway, all of which are building suburban lines to extend from Cincinnati, and the Interurban Terminal Company, now building a terminal station at Cincinnati to provide the three roads with ample terminal facilities within the city. The consolidation was effected at a meeting of the stockholders of the several companies, held Nov. 3. The consolidated company, known as the Interurban Railway & Terminal Company, is capitalized at $2,500,000. There is on this basis a reserve in stock of about $700,000, which is to be taken up by shareholders, as the money is needed to complete the various roads and the interurban depot. Thus far each share of stock issued to the shareholders represents its face value expended in building the properties. It is found that the Cincinnati & Eastern will cost fully $150,000 more than was at first anticipated. The reason of this is that a double track has been laid to Coney Island and the rolling stock increase from six to eighteen cars.

The agreement of consolidation provides for a $2,500,000 bond issue of 1500 $1,000 denomination and 2000 of $500 denomination. Bonds to the value of outstanding bonds, with additional bonds covering accrued interest, are to be issued to bondholders in the companies. Bonds in the sum of $205,200 are set aside to acquire terminal facilities in Cincinnati, and $150,000 in bonds are to cover all expenses of the consolidation, including counsel fees. The sum of $250,000 in bonds is to be reserved to the treasury of the new company, to be used for extensions and improvements. Additional bonds are authorized to pay for construction work.

For every share of stock held by the stockholders in the various interurban companies they are to receive an equal amount of the new consolidated shares. The capitalization of the old companies was: Rapid Railway, $700,000; Suburban, $600,000; Cincinnati & Eastern, $500,000; Terminal Company, $150,000, making a total of $1,950,000. There has been thus far expended on the new Sycamore Interurban depot $55,000. This amount was taken up by the stockholders, who are more or less interested in all the properties affected by the deal.

The combined mileage of these interurban lines is 96 miles, being as follows: Cincinnati & Eastern, which will be in operation in a few days, 28 miles, between Cincinnati and New Richmond, Ohio; Suburban, which will not be ready until next February, to Bethel and Batavia, 32 miles; Rapid Transit, about completed to Mason, a distance of 22 miles, and will be completed through to Lebanon by next March, a distance of 36 miles from this city. The terminal depot is expected to be ready by Jan. 1.

The officers of the Interurban Railway & Terminal Company are: G. R. Scrugham, president; Lee H. Brooks, first vice-president; Ellis G. Kinkead, secretary, vice-president and general counsel; John M. Kennedy, treasurer; William E. Hutton, secretary. The above also, together with the following: Charles H. Davis, Guy W. Mallon and George H. Worthington, compose the board of directors.

Heavy Damages Claimed from Yonkers Railway

Eight actions for damages, aggregating $90,000, have been commenced against the Yonkers Railroad Company, in behalf of persons who claim to have been seriously injured in the accident caused by the collision between a trolley car and automobile at Yonkers, Oct. 26. Papers in seven more suits are being prepared, it is said, and the total amount of damages claimed in the fifteen actions will aggregate $150,000. The chauffeur in charge of the automobile has already been convicted of reckless driving, and has been sentenced to six months' imprisonment. The responsibility for the disaster was fixed at the time of this conviction, but an appeal has been taken, and the present movement against the railway company, it is believed, is for the purpose of shifting the blame upon the corporation. The claim is made that the cars were operated at a dangerous rate of speed, and that the track was defective at the point where the accident occurred.

It is announced that settlement has been made, out of court, of the suit brought against the Union and Consolidated Traction Companies by Sutro Brothers, bankers, of New York, to set aside the mortgage covering an issue of $6,750,000 in bonds by the Union Traction Company for securing possession of the Consolidated Traction Company. The terms of the settlement are not made public.

Large Brass and Motor Bearing Works

The Brady Brass Company, of Jersey City, has been known for a long time in the steam railroad field, where the company has achieved a high reputation as a manufacturer of journal bearings, and in fact bearings for machinery of every description. Some time ago the company decided, in view of the extensive development of electric railway work, to establish an electrical department for the manufacture or armature bearings, axle bearings and trolley wheels. The success achieved by the company in this department has been so great that it is thought some particulars of the works would be of interest.

They are located on Tenth Street, in Jersey City. The ground floor of the building is devoted to the moulding and casting of the metal and the cleaning and finishing department, while the second floor is given up to the offices of the company, storage rooms, laboratory and an auxiliary machine shop. The works are laid out so that the progress of the metal through the shops in the process of manufacture from the raw material to the finished bearing is continuous. Passing in by the main entrance, the visitor first sees the large storage rooms devoted to the copper, tin, zinc, aluminum and other materials used in the works. Directly to the left are three furnaces, two for Babbitt metal, with a capacity of 10,000 lbs. a day, and one for battery zincs, with a capacity of 800 zincs a day. The engine and boiler room occupy the center of the works. Directly adjoining them are twelve brass furnaces, having a total capacity of 20,000 lbs. a day. All of these furnaces, it should be stated, were especially constructed for the works under the personal supervision of President Daniel M. Brady, who has had many years experience in this class of work, and who is generally admitted to be one of the leading experts in brass and bronze business in the country. A pneumatic hoist carries the molten metal from the furnaces to the casting room, where the metal is cast into the different shapes required. Adjoining the casting room, which is also equipped with the pneumatic hoist, are the machine tools for finishing the bearings, the chipping hammers for cutting the oil grooves, etc. This portion of the plant is especially complete, as perfect work in this department is recognized as a necessity for obtaining good results in service. The boring machines used are capable of boring journal bearings for 2½ in. to a 5½-in. journal.

The Brady Brass Company was the originator of the well-known "Cyprus bronze" for railway journal bearings. This material is a scientifically prepared alloy of copper, tin and lead, treated by a special process while in the furnace, which renders it perfectly fluid in the molten state, and gives it a remarkably fine-grained fracture. This material has a number of features which especially adapt it for the manufacture of bearings, such as a strength in compression equal to 50,000 lbs. per square inch under a compression of 10 per cent; a coefficient of friction of 0.5, as compared with some of the best bearing metals taken as 1.00, and no tendency to crystallize. It is not claimed that Cyprus bronze is a self-lubricating metal or that it is frictionless, but that it requires less oil than ordinary bronzes and that it practically eliminates the question of hot boxes. This metal has been used on railroads for truck journal bearings for many years, and according to Mr. Brady is now being employed on 20,000 street railway cars throughout the world.

Cyprus bronze has also been found extremely valuable for trolley wheels, and a recent visit to the works showed a large number of these wheels ready for shipment to many parts of the country. The standard wheel has a diameter of 4 ins., and a weight of 2½ lbs.

For armature bearings the company recommends cast-iron shell babbitted bearings and solid bronze for main motor axle bearings, according to the preferences of the consumers. The former bearings are made of a fine quality of grey iron, lined with the genuine babbitt metal, and in all sizes to fit the different types of standard electric motors on the market. The bronze used for the main motor axle bearings is of a special composition, which the company has found, after many years' trials, to be well adapted for this particular purpose, and these also are finished in all sizes.

It will be impossible in this article to take up all the different branches of the work of this company, which include the manufacture of other types of bronze, such as phosphor and manganese bronze, brass, babbitt metals, solder, battery zincs, etc. A reference will be made, however, to the shipping facilities of the company, which could hardly be excelled. Situated as it is in Jersey City, it is at the terminus of all of the trunk lines which enter that city, and in this way material can be forwarded easily to every part of the world.

The postal officials of Washington are considering a plan to equip all of the cars of the Washington Traction & Electric Company with letter-boxes.

Report of the Manhattan Railway Company

The annual meeting of the stockholders of the Manhattan Elevated Railway Company, of New York, was held on Wednesday, Nov. 12. In the absence of President Gould, Vice-President Skitt read the following report:

"The statement of operations for past year, showing an increase of over 29,000,000 in the number of passengers carried and a decrease in the operating ratio, is an encouraging indication that the results which were predicted when the stockholders decided to equip the system with electricity will be more than realized, particularly as only one-half of the line had been under full operation since Sept. 15 last, and that the high cost of fuel has materially increased expenses.

"Since the last annual meeting substantial progress has been made with the new equipment. The Second Avenue and Third Avenue lines have been completed, with 608 cars in operation. The Sixth Avenue and Eighth Avenue lines, on which eighty cars are now running, should be finished not later than April 1, 1903.

"The electric apparatus, method of generating and transmitting power, and the equipment of cars, has proved highly satisfactory, having met our expectations and generally exceeding them.

"Among other improvements the new extensions and station in Bronx Park, the stations and elevators at 110th Street, new yards and shop facilities are being pushed as fast as material can be secured, and another year should see their completion."

The directors were re-elected.

The report for the year ended Sept. 30, which was presented at the meeting, shows:

	1902	1901
Gross receipts	$11,067,746	$9,620,564
Operating expenses	5,545,395	5,328,649
Earnings from operation	$5,522,351	$4,291,915
Receipts from other sources	515,800	835,308
Gross income	$6,038,151	$5,127,223
Interest and taxes	2,712,089	2,683,132
Net earnings	$3,326,062	$2,444,091
Dividends (4 per cent)	1,920,000	1,920,000
Surplus	$1,406,062	524,091
Previous surplus	4,966,356	4,442,265
Total surplus	$6,372,418	$4,966,356
Operating per cent (exclusive all tax)	50.10	55.38
Operating per cent (inclusive all tax)	58.25	64.46
Passengers carried	223,427,283	194,152,316

Funeral of the Late Prof. S. H. Short

The funeral of the late Professor Short was held in New York, on Nov. 11. Services were conducted in the afternoon at the Church of the Messiah by the Rev. Minot J. Savage, the pastor, after which the remains were taken to Woodlawn Cemetery, and deposited in the receiving vault. The pall-bearers were Judge William B. Saunders and Howard H. Burgess, of Cleveland; Benjamin Graham, H. McL. Harding, Ralph W. Pope, T. C. Martin and James H. McGraw, of New York.

Special Franchise Tax Arguments

The Appellate Division of the Supreme Court has decided to hear arguments, on Dec. 2, in the special franchise tax litigation growing out of the appeals by New York city corporations from the decision of Referee Robert Earl declaring the law to be workable and enforceable. The arguments will take two or three days, it is believed, and a decision is not expected inside of several months.

The United Railways & Electric Company, of Baltimore, is putting into service some of the new double-truck winter cars. One hundred and ten were ordered. They are of about the same size as the large cars used on some of the lines during the summer. The seats, however, are longitudinal. The ventilators are similar to those used on steam railroad coaches and arranged so as to prevent draft. The cars have electric bells, with a button in each post, by which passengers can give a signal to stop.

Topics of the Week

Nearly 1,500,000 more fares were collected by the St. Louis Transit Company in October, 1902, than in October, 1901, showing the city's increased activity. The T ansit Company's monthly report puts the total earnings of October, 1902, at $604,403, as against $551,510 for October, 1901, a gain of $71,893.

Manchester's municipal electric cars, as well as those of Liverpool, are also likely to enter into competition with general goods carriers, and plans are at present under consideration for running express cars on the railways during the night to the towns with which the Manchester and Liverpool systems are respectively linked.

Recognition for faithful services in the form of pecuniary reward is promised the employees of the New London Street Railway Company, which has already distributed among its employees a share of the profits on last year's business. A gift of $10 is made to each old employee, and of $5 to each new one. The policy of the company is highly appreciated by the employees, and it is expected to promote cordial relations and secure higher efficiency throughout the system.

It is said that as a result of the controversy between Yerkes and Morgan for control of the underground roads of London the government will now appoint an expert commission to look into the matter, which will be treated as a whole by adopting a general scheme to which whoever undertakes the enterprise will be bound down by Parliament. Mr. Yerkes, if the published interviews with him are to be believed, welcomes the establishing of some public body to control the general "tube" system, but objects to intrusting that duty to the London County Council.

An unusual traffic arrangement has been perfected between the Erie Railway (steam) and the Dayton, Springfield & Urbana Railway (electric). The main line of the Erie passes through Durbin, several miles from Springfield, Ohio. The steam road is planning to build a spur line into the city, but until it is completed the steam company will operate a special car into the city over the electric railway. A new car is being built for the purpose. It will be a regular steam passenger coach, so far as size and accommodations are concerned, but it will be equipped as an electric car. It will connect with all Erie trains.

The discussion of the 3-cent fare proposition at Cleveland has called forth an expression of opinion by W. D. Mahon, president of the Amalgamated Association of Street Railway Employees of America, which may have some interest for other communities when the same topic is under consideration. President Mahon spoke on the attitude of his organization, saying: "Three-cent fare is a political question. We oppose it as a business policy. We don't want 3-cent fare. Figures from New York State show that that State carries more passengers than any other State in the Union, and it also shows that the average cost of carrying passengers is over 3½ cents a passenger. We want wages and conditions that we would not get if we had 3-cent fare."

In the STREET RAILWAY JOURNAL for March 22, 1902, attention was called to the relatively large amount of new construction work planned in Maine by new companies and companies then operating lines, and such information as was at hand at that time was given concerning these new projects. According to the official returns of the Railroad Commissioners of the State, just made public, plans are now under way for the construction of over 200 miles of new line during 1903, the most important system planned being those to connect Augusta and Rockland, Augusta and Waterville, and York, Oxford and Cumberland Counties. Figures have been compiled relative to the business of the eighteen electric railways now in operation in the State. In the last five years the mileage has increased from 143 to 347. The reports of all the roads show that a total of 25,480,000 passengers were carried during the year ending June 30, 1902. The gross earnings for that time were $1,449,043, an increase of $678,000 in five years. The net earnings were $413,849, or about 4 per cent on the cost of construction.

The extreme to which labor leaders carry their high-handed practices is shown in the causeless and senseless attack by the presidents of trade unions and labor councils of New Orleans on Mayor Capdevielle of that city, who by his fairness of action and fearlessness of purpose has proved

himself to be a man of exceptional fitness for the position which he occupies. The attack on the Mayor was provoked because he refused to countenance wild and foolish schemes ranging from the confiscating of the property of the New Orleans Railway Company to using $6,000,000 of the water and sewerage funds of the city to purchase the property of the company as a means of settling the strike. As the New Orleans Picayune fittingly says: "The Mayor acted the part of a public benefactor, and for this has the most shameful abuse been heaped on him. This, however, is the fate of all benefactors. They are sure to suffer at the hands of those they seek to benefit. The Divine Master of all of them suffered the worst."

An interesting question was settled in the police court at St. Louis recently when an irate citizen was charged with disorderly conduct by the conductor of a street car, who had failed to stop his car for a passenger who wanted to alight until the latter retaliated by ringing up cash fares. The passenger who was desirous of alighting at Cass Avenue and Jefferson Avenue, according to his testimony on the witness stand, pressed the button to notify the conductor to stop the car at that point, but although the conductor heard the bell he failed to have the car stopped. Becoming angered at the treatment accorded him the passenger then pulled the register of the car, thinking, he claimed, that he was pulling the bell cord. In doing so he rang up several fares, which so angered the conductor that he summoned the police officer, who arrested the passenger. The police justice, in dismissing the suit, said: "I think you were justifiable in ringing the register cord, or any other citizen would have been under the circumstances. The testimony of various passengers on the car that you first pushed the button for the conductor to stop, and that your request was ignored by him, causes me to believe that you were in the right in the difficulty. You are discharged."

Proposed Electric Railway for Melbourne

The Australian government is considering a plan proposed by the engineer-in-chief for railways in Australia for the construction in Melbourne of a system of electric roads to take the place of the present cable and horse system. The existing lines consist of about 44 miles of cable and 4 miles of horse railways, and have been in operation now for nearly fifteen years. Under the scheme proposed there will be 50 miles of line when the substitution of electric traction is completed, and extensions of the system will be made from time to time. On account of its comparative cheapness it is recommended that the railway department adopt the overhead trolley system. The cost, including all equipments and substantial construction of track, is estimated at between £7,000 for the lightest traffic lines to £12,000 for the more heavy and important lines per mile of single line. In preparing his scheme of electric tramways, Mr. Rennick, the engineer, has had due regard to the effect they would have on the suburban lines of railways in Melbourne, and his conclusion is that the best method of working an electric suburban system would be to operate them in conjunction with the suburban railways, which, to keep up with the progress of the times, must be converted from steam to electric traction in the near future. He, therefore, recommends that any road to be constructed from this time on shall be dealt with as part of a general electric suburban railway and tramway scheme.

Brooklyn Tunnel Awards

It is announced that the Rapid Transit Construction Company, successful bidder for the Brooklyn extension of the city's subway system, has awarded sub-contracts for two sections of the extension.

The first section, extending down Broadway, Manhattan, from Ann Street to the center of Bridge Street, will be built by the Degnon-McLean Contracting Company, of New York, which is the holder of sub-contracts for three sections of the Manhattan-Bronx subway.

The third section of the Brooklyn extension has been turned over to Cranford & McNamee, Brooklyn contractors. The limits of the section are as follows: From a point near Clinton Street, Brooklyn, along Joralemon Street, Fulton Street and Flatbush Avenue to the intersection of Flatbush Avenue and Atlantic Avenue. At the last-named crossing is to be the terminal of the extension.

These two awards of sub-contracts leave only Section 3 of the extension to be given out. This is the river section, and it is said that bids for it will be opened and the award made next week.

New York to Philadelphia by Trolley Accomplished

The opening of the Trenton & New Brunswick Railroad, placed in operation Nov. 9, makes possible a trip from New York to Philadelphia by trolley. Bound Brook is reached from New York via Newark, Elizabeth, Plainfield and Dunellen, and thence from Bound Brook to New Brunswick via the Middlesex & Somerset Traction Company's line, to Milltown, to Interstate Fair Grounds, Trenton, via Trenton & New Brunswick Railroad; to State and Clinton Streets, Trenton, to Broad and Stanton Streets, via Trenton Street Railway; Stanton Street, Trenton, to Burlington, via Camden & Trenton Railway; ferry to Bristol; Philadelphia, Bristol & Trenton Railway to Red Lion Inn, thence over the Philadelphia Rapid Transit lines to the center of Philadelphia.

Bascule Bridge Again Saves a Car

The efficacy of the bascule type of bridge for preventing terrible drawbridge disasters was again demonstrated in Chicago the morning of Oct. 30, when a train on the Metropolitan West Side Elevated Railway attempted to cross the river with the draw open, with results that caused a shaking up of the passengers. But for the insurmountable obstacle offered by the bascule of the bridge the train must have gone into the river. The bridge is of the Scherzer rolling lift type. This is the second time this bridge has saved a train from going into the river.

An Extensive Interurban System for Texas

Fort Worth is to be the center of a great electric interurban system, to be built by the Northern Texas Traction Company, the lines to extend to Dallas, Cleburne, Weatherford and Denton, making a total mileage of over 125 miles. It is said that the company has already decided on building from Fort Worth to Weatherford, 31 miles; Denton, 35 miles, and Cleburne, 28 miles. The preliminaries incident to construction, it is learned, are to be taken up at once. The total expenditure for the construction and equipment of these lines is estimated at about $3,000,000.

COMMUNICATION

Tractive Effort and Draw-Bar Pull

Nov. 12, 1902.

Editors Street Railway Journal:

We are selecting the equipment for a new road, and in the proposals received from the manufacturing companies and in the specifications of the engineers frequent reference is made to the "tractive effort" and "draw-bar pull," but there seems to be a confusion of these terms. Will you kindly explain their meaning and the distinction that should be made in their use?

Manager.

Briefly, tractive effort is the pull exerted at the rim of the driving wheels, whereas, the draw-bar pull is the pull which a locomotive is capable of exerting at its draw-bar. A locomotive can exert a tractive effort under favorable conditions of 22.5 per cent of its weight without slipping the wheels. The draw-bar pull varies with the grade. The steeper the grade the greater will be the tractive effort required to move the locomotive itself, and, consequently, the less will be the draw-bar pull. The draw-bar pull required to move a given train is figured as being equal to the train resistance per ton multiplied by the weight of the train in tons. There are many conditions to be taken into consideration in determining special cases. For instance, the full load running draw-bar pull is based on the one-hour horse-power rating of the motors, whereas the starting or maximum draw-bar pull is the pull the locomotive can exert at the draw-bar momentarily or for short intervals, and is generally limited by the slipping point of the wheels. The maximum starting draw-bar pull on a level track bears a fixed relation to the weight of the locomotive, and is estimated at one-fifth of the weight. The relation of the full-load draw-bar pull on a level to the total weight of a locomotive varies from about one-sixth in the largest class of locomotives to one-eighth in the smaller sizes. This variation is explained by the fact that it is not practicable to construct the smaller classes of the minimum weight necessary.

It will, therefore, be readily understood that in ordinary street railway practice where single cars are used the tractive effort is an important factor, and that on elevated railways and in suburban and interurban service where trains are run or electric locomotives employed, the draw-bar pull must also be considered.

Street Railway Patents

UNITED STATES PATENTS ISSUED NOV. 4, 1902

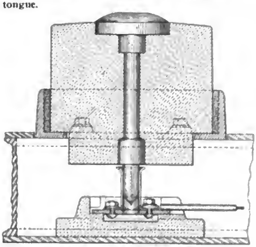
[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

712,539. Trolley; N. Hublinger, Berberton, Ohio. App. filed July 3, 1902. The wheel is mounted on a vertical axis so that it will yield when passing curves.

712,654. Brake Beam and Attachment; G. B. F. Cooper, Detroit, Mich. App. filed April 24, 1902. A segmental I-brake beam combined with a fulcrum, which is comprised of two parts, each having interlocking members adapted to be swaged over the beam.

712,768. Beam for Car Trucks and Cars; S. A. Crone, New York, N. Y. App. filed May 16, 1902. Consists of an I-beam having a section thereof, intermediate its ends, slit on lines parallel with the flanges, the web comprising this slitted portion being bent downward, both flanges along said portion being bent upward and laterally from each other.

712,779. Street Railway Switch; W. R. Dunham, Jr., Providence, R. I. App. filed June 30, 1902. A rod connects the switch tongue to a sliding frame located in a box by the side of the track, said sliding frame being engaged by a crank having an operating slot in its end, in which the switch bar is inserted to move the switch tongue.



PATENT NO. 713,015

712,845. Electric Switch Actuator; J. Y. Porter, Detroit, Mich. App. filed Aug. 14, 1901. The tongue of the switch is shifted by a current of electricity, which passes through a coil arranged as a solenoid, the core of which reciprocates under the influence of the current and is connected to mechanism which alternately pushes and pulls the linkage which is connected with a tongue, and which actuates the tongue.

712,981. Supporting Device for Electric Motors; B. R. Van Kirk, Philadelphia, Pa. App. filed July 18, 1902. The combination of two motors and a supporting shaft for each, with a link connecting the frames of the motors and extending from a point on one motor above its shaft to a point on the other below its shaft, whereby the tendency of one motor to rotate as a whole around its shaft is made to oppose the similar tendency of the second motor.

712,994. Method of Operating Electric Brakes; F. E. Case, Schenectady, N. Y. App. filed June 30, 1897. Electrically actuated brake-shoes provided with means whereby any one can be released whenever the speed of rotation of its axle is substantially less than that of another axle.

713,015. Surface Contact Structure; W. B. Potter, Schenectady, N. Y. App. filed Oct. 11, 1897. The contact button can be lifted out of its solid support and easily replaced, there being a conducting socket into which the lower end fits.

ENGINEERING SOCIETY

THE ENGINEERS' CLUB OF PHILADELPHIA.—The twenty-fifth anniversary of the Engineers' Club of Philadelphia will be celebrated by a banquet at the Union League, on the evening of Saturday, Dec. 6, at 6:30 o'clock. A business meeting of the club will be held on Saturday, Nov. 15. At this meeting John E. Codman will present a paper entitled "Philadelphia High-Pressure Fire Service."

PERSONAL MENTION

MR. HENRY A. EVERETT and his family are now in New York, where they will remain for about a month.

MR. JOHN H. SWINERTON, formerly president and manager of the Staten Island Electric Railway Company, of Staten Island, N. Y., has sailed for Europe for a prolonged visit.

MR. C. S. POWELL, manager of the Cleveland office of the Westinghouse Company, who very recently returned from Europe, where he had been in the interests of his company, will sail again for England early next month.

MR. R. K. HOWARD, formerly superintendent of the Knoxville Traction Company, of Knoxville, Tenn., has been appointed general superintendent of the Dayton, Springfield & Urbana Railway, with headquarters at Springfield, Ohio.

MR. C. BROOKE JOHNSON, formerly vice-president of the Norfolk Railway & Light Company, will take charge of some construction work for the Railways & Light Company, of America, which is controlled by the Middendorf-Williams syndicate, whose offices are in Richmond, Va.

MR. E. E. STODDARD, representing Charles C. Moore & Co., engineers of San Francisco, is making an Eastern business trip. Mr. Stoddard's firm has installed some of the largest and most important electric railway power stations on the Pacific Coast, and represents a number of prominent eastern manufacturers of steam appliances.

MR. JILSON J. COLEMAN has resigned as president of the New Jersey & Pennsylvania Traction Company, of Trenton, N. J., and Mr. J. A. Barry, who has been connected with the Johnson interests for some time, has been elected to succeed Mr. Coleman.

MR. E. H. BEACHAM, of New York, recently connected with Messrs. Sanderson & Porter, in the construction of the new street railway and electric lighting plant for the Peekskill Lighting & Railroad Company, has accepted an engineering position with the the Levering & Garrigues Company, of New York, engineers and contractors for bridges, buildings and general structural iron work. Mr. Beacham secured his early training in the shops of the Thomson-Houston Company, at Lynn, and for the last twelve years has been engaged in construction work in both the street railway and electric lighting fields.

MR. W. H. STOCKS, who has been master mechanic of the Chicago, Rock Island & Pacific Railroad for several years, has resigned from that company to accept an appointment as representative of the Gold Car Heating & Lighting Company, of New York, Chicago and London. Mr. Stocks has been associated with the mechanical departments of the Minneapolis & St. Louis Railway, Great Northern Railway and Chicago, Rock Island & Pacific Railway for twenty-five years, during which time he has held the position of foreman, general foreman and master mechanic of the roads mentioned.

MR. FRANK J. SPRAGUE, who has been enjoying a trip abroad, has been "interviewed" by the London reporters and made to say some very funny things about the transportation situation in the English capital. The conclusion which he has reached, from a study of the problem, is probably correctly reported, for in that he says that the general adoption of electricity by English railways is coming much more quickly than most people realize. This will introduce a new condition of life, and one which will make for the health and happiness of the millions who earn their living in the big cities of the United Kingdom.

MR. ALBION E. LANG, for many years at the head of the street railway and lighting interests of Toledo, has retired from business, and his position of president of the Toledo Railways & Light Company will be filled by Mr. Henry A. Everett, of Cleveland, who was elected to the office at a recent meeting of stockholders. Mr. Lang has been head of the traction interests of Toledo since 1881. He effected the consolidation of several lines in 1885, and in 1888 became president of the consolidated system. Mr. Lang will take an extended European trip. Mr. Everett will assume charge at once, but as he will retain his headquarters in Cleveland, the active management will fall on Mr. L. E. Beilstein, vice-president and general manager of the company. Mr. Lang does not retire from the receivership of the Lake Shore Electric Railway Company, since it is probable that the receivership will be terminated in the near future.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR

Liability for Negligence Under Modern Conditions

About a year ago there was a discussion by some of the newspapers upon the question of the proper test of liability for negligence of common carriers of passengers under modern conditions. One of the leading New York papers took the following ground, and its views elicited a certain amount of approval elsewhere:

It is within the history of the law to say that new rulings, and possibly new statutes, are demanded to meet the conditions which result from the creation and operation of new public conveniences. The public demands rapid transit, and what is satisfactorily rapid to-day may be deemed intolerably tedious a few years hence. Population naturally becomes more and more dense along lines of travel, and to meet the public requirement we must have rapid transit on the surface as well as underground and in the air. A code of laws which imposes heavy penalties upon corporations for doing what they must do to meet the public needs, as well as they can be expected to do it, is more favorable to the class of lawyers popularly known as "ambulance chasers" than to anyone else; and the time would not seem to be far distant when the impossibility of operating railroads without casualties in the way in which the public wants them operated will necessitate a material change in the legal point of view as to the proper limitations of liability for damages which result largely from the neglect on the part of the public to take reasonable and proper precautions for its own safety. What was substantial justice as between individuals and corporations when the maximum speed of street vehicles was such that it took an hour to go from the City Hall to Fifty-Ninth Street becomes injustice when it is necessary to cover this distance in half that time.

Such views are not unexpected on the part of one viewing the situation only casually.

Undoubtedly, the average man in the stress to "get there" will avail himself of any appliance which is offered with a plausible assurance of safety. On the other hand there is the constant temptation on the part of inventors and carriers to utilize more expeditious and convenient appliances for "getting him there," although at the risk of accident. The passenger cannot and should not be held responsible for an investigation of the methods of transportation; the carrier who assumes to put appliances and methods into operation very obviously should be held so responsible. The questions of negligence and contributory negligence are always, in a measure, dependent upon the facts and circumstances of a particular case. The trial court and the appellate court of first instance are charged with the duty of revising verdicts upon the ground of excessive damages. The writer deems the present general condition of the law of negligence not only just as between carrier and passenger, but, indeed, indispensable for the protection of the individual and the public. If the demand for the best facilities for "hustling" were accorded preponderating weight in determining whether carriers had or had not been negligent, their obligation to exercise due care would soon be very substantially abrogated.

The courts very naturally observe a conservative policy in dealing with accidents that happen through the operation of new conditions or the employment of new appliances. Two recent cases in the New York Supreme Court by the contrast in their results are illustrative of the judicial attitude. In Whitaker vs. S. I. M. R. Co., before the Appellate Division of the Supreme Court, Second Division, in May, 1902 (72 App. Div., 468), it appeared that the plaintiff was riding in an open trolley car, her little son being on a seat just in front of her. She had notified the conductor, and expected the car to stop at a certain point, and just before the car reached there she arose, and placed her arm around the child, as she said, to better protect him from falling out when the car stopped. The car did not stop, and in going around a curve just beyond plaintiff was thrown out and injured. It was held that the question of contributory negligence should have been left to the jury. The Court said in part:

It certainly was not negligence, as matter of law, for the mother, about to leave the car, to stand up for that purpose, and to hold her infant child. The learned trial justice stated that the court has to take judicial notice of the fact that it is not easier to hold a child standing up in a rapidly moving car than sitting down firmly on the seat. It may be assumed that the question with the plaintiff at the time was not one of ease, but one of safety. The case, as has been seen, presented other features besides the fact that she was standing, and which tended to make the question of her care and prudence, under the circumstances, peculiarly one for the consideration and determination of practical men. She had some reason to expect that the car would stop at its customary stopping place, and no good reason appears why it did not. In preparing to alight, it was natural that she should follow what she says was her best judgment with a view to the protection of her child from possible injury, and, whatever conclusion as to her conduct a jury may reach, it is certainly beyond the scope of judicial vision to see negligence in the instinctive promptings of maternal solicitude.

In Merrill vs. Metropolitan St. Ry. Co., decided by the Appellate Division of the New York Supreme Court, First Department, in June, 1902 (73 App. Div., 401), it was held that the mere fact that while a street car is rounding a curve a passenger is injured by reason of another passenger being thrown upon her is insufficient, in the absence of excessive speed or of the application of more power than necessary to round the curve, to justify a recovery against the company for the injuries thus received.

It was further held that where the complaint in an action against a street railroad company for injuries to a passenger, caused by another passenger being thrown upon her while the car was rounding a curve, contained no allegations that the roadbed was out of order or improperly constructed, or that the car was not a proper one or not properly equipped, and there was no evidence that the conductor did not warn the passengers of the approach of the curve, the refusal to admit testimony of peculiar motions of the car in going around the curve at other times was not error.

It was also decided that in an action against a street railroad company for injuries to a passenger caused by another passenger being thrown upon her while the car was rounding a curve, wherein there was no evidence that the conductor did not notify the passengers of the approach to the curve, there was no error in excluding evidence that it was customary to give such notice.

The Court furthermore took the position that in an action against a street railroad company, for injuries to a passenger caused by another passenger, who was about to enter the car, being thrown upon her while the car was rounding a curve, the fact that the passenger who was so thrown upon plaintiff was talking to the conductor just before the accident was immaterial.

The decision in the last named case was by a bare majority of the Court, two of the judges dissenting. This decision, therefore, in connection with the one previously cited, illustrates the conservative tendency of the courts in administering the rules of liability of a common carrier. It is a matter of common knowledge that the street trolley railroad companies are subjected to embarrassment through the inability to round curves at a normal or low rate of speed. The two judicial decisions cited would seem to administer the law with a sufficient comprehension of the physical situation involved. The position that the common carrier is bound to provide safe appliances for transit and to be watchful in their operation is not abrogated; at the same time the rule of liability is not extended beyond the fair bounds of common sense and justice.

Note.—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York City.

LIABILITY FOR NEGLIGENCE

ALABAMA.—Street Railroads—Injury to Passenger—Safe Landing Place—Duty to Provide—Damages—Hospital Fees—Pleading—Complaint—Harmless Error—Evidence.

1. The refusal of the court to strike out immaterial and irrelevant averments in the complaint does not constitute reversible error, unless it affirmatively appears that such refusal was prejudicial.

2. In an action against a street railway company for injuries received by a passenger on alighting from a car, a complaint alleging the failure of the defendant to provide a safe place for alighting is not demurrable in not averring what constitutes a safe place, nor in giving a minute description of the place where the stop was made and of the alleged injuries.

3. A plea attempting to set up contributory negligence by alleging that "when the car stopped, the lights from the car shone for 10 ft. or 12 ft. on either side of the track, and that plaintiff could have seen the alleged lumber and débris before he stepped thereon, by the exercise of ordinary and reasonable care on his part," was defective in not alleging that the plaintiff failed to exercise ordinary and reasonable care or that he saw the lumber.

4. A plea assuming that it was the duty of a passenger to inquire of a street railway company or its agent as to whether the place of stopping is a reasonably safe place for him to alight was properly overruled.

5. Plaintiff became a passenger on defendant's street railway on

a dark night, and on alighting from the car at his destination tripped on taking his first step over a pile of lumber left at the place by the defendant the day previous while reparing a bridge. Held, that the defendant was liable in failing to provide a reasonably safe place for the landing of its passengers.

6. Hospital fees for the expense of a nurse and a ward in the hospital are proper elements of damage in a personal injury action.

7. A deposition taken by one of two commissioners to whom the commission was jointly issued is invalid in the absence of a waiver of the presence of the other commissioner.

8. Evidence of the jurors as to the manner of arriving at the verdict is not admissible on a motion or a new trial.—(Montgomery St. Ry. vs. Mason, 32 Southern Rep., 261.)

ALABAMA.—Waters and Water Courses—Overflowing Lake—Outlets—Unprecedented Rainfall—Burden of Proof.

1. In an action for injuries alleged as the result of an overflow from a lake controlled by defendant, and not having a proper outlet provided, it was not error to refuse to instruct that if the water came from the lake, because of an unprecedented rainfall, defendant was not liable; there being evidence that if the outlets had been maintained in proper condition the injury would not have occurred.

2. The burden was on plaintiff to show that the lake was controlled by defendant.—(Birmingham Ry. & Electric Co. vs. Dorse, 32 Southern Rep., 493.)

CALIFORNIA.—Passenger on Street Railroad—Action for Injuries—Instruction—New Trial—Review—Conflicting Evidence.

1. Where, in an action by a passenger against a street railroad company for personal injuries alleged to be due to defendant's negligence, it was conceded that plaintiff was not at fault, and there was substantial evidence, though conflicting, to show that the injury was incurred through the negligence of a motorman, an instruction that, under the case and proofs, no presumption of negligence arose against defendant from the mere fact that an accident had occurred, violated the constitutional provision forbidding a charge "with respect to matters of fact."

2. Where the action of the trial court in granting a new trial is based on a substantial conflict in the evidence, it will not be disturbed.—(Sullivan vs. Market St. Ry. Co. (S. F. 2154.) 69 Pacific Rep. 143.)

CONNECTICUT.—Negligence—Pleading—Demurrer.

1. Parts less than the whole of a complaint stating but a single cause of action, though in several paragraphs, are rarely, if ever, demurrable on the ground of insufficiency, in the proper sense of the word, as distinguished from immateriality or irrelevancy.

2. Where plaintiff predicates the actionable negligence on which he relies on a course of conduct in the progress of which are several acts, all closely connected together, and leading up to and culminating in the accident, the allegation as to each act, that it was improperly and negligently done, does not make each act a separate cause of action, which must be sufficient in itself.

3. Allegation in a complaint, as to acts otherwise not wrongful, that they were done negligently, is not a conclusion of law, but a proper statement of fact.—(Hill vs. Fairhaven & W. R. Co., 52 Atlantic Rep., 725.)

DELAWARE.—Street Railroad—Crossing Accident—Negligence—Speed of Car—Failure to Give Signals—Rights to Street—Contributory Negligence—Damages—Burden of Proof.

1. Plaintiff in a street car crossing accident case has the burden of showing defendant's negligence by a preponderance of the evidence.

2. A street car company has a right superior to other travelers to the use of the portion of the street included within its track.

3. A street car company must operate its cars at a reasonable rate of speed, and slow up, and stop, if necessary, when danger is imminent, and may, by the exercise of ordinary care, be seen or known in time to prevent an accident.

4. A street car, on approaching a crossing, must give proper warning.

5. The degree of care required in operating a street car in order to prevent accidents to persons on the streets increases with the increase of danger.

6. A person approaching a street car crossing with which he is familiar is bound to avail himself of his knowledge of the locality to prevent an accident to himself; and if he attempts to cross the track when his view is not obstructed, and fails to look for an approaching car, he is guilty of negligence.

7. A person injured in a street railroad crossing accident through the negligence of the company is entitled to damages which will compensate him for his injuries, including loss of time and wages, past and future suffering, and loss of earning power resulting from any permanent injury.—(Adams vs. Wilmington & N. Electric Ry. Co., 52 Atlantic Rep. 264.)

DELAWARE.—Street Railroads—Crossing Accident—Negligence—Speed of Car—Failure to Give Signals—Rights to Street—Contributory Negligence—Imputed Negligence—Negligence of Driver—Burden of Proof.

1. Plaintiff in a street car crossing accident case has the burden of showing defendant's negligence.

2. A street car company has a superior right to the use of the portion of the street included within its track.

3. A street car company must operate its cars at a reasonable rate of speed, and slow up and stop, if necessary, when danger is imminent.

4. A street car on approaching a crossing must give proper warning.

5. The degree of care required in operating a street car, in order to prevent accidents to persons on the streets, increases with the danger.

6. A person approaching a street car crossing with which he is familiar is negligent if he attempts to cross, when his view is not obstructed, and fails to look for an approaching car.

7. The negligence of the driver of a vehicle in colliding with a street car can not be imputed to a person riding in the vehicle by invitation of the driver, and having no control over the latter.

8. A gratuitous passenger riding in the vehicle of another must use due care to avoid being injured by a collision with a street car, even though not chargeable with the driver's negligence.—(Farley et al. vs. Wilmington & N. Electric Ry. Co. (No. 28.) Farley vs. Same, 52 Atlantic Rep., 543.)

GEORGIA.—Contract—Consideration—Compromise.

1. Where a disputed claim, depending upon a legal question, is settled and adjusted by the parties, and a contract between them is accordingly made, whereby one promises to pay to the other a sum of money, the promisor is bound thereby, though such question be really free from doubt, and, properly resolved, would have absolved him from all liability.

2. There was no error in admitting evidence.—(City Electric Ry. Co. vs. Floyd County, 42 S. E. Rep., 45.)

ILLINOIS.—Street Railways—Injury to Passengers—Evidence—Sufficiency—Appeal—Questions Reviewable.

1. Where, in an action by a passenger against a street railway company for injuries, it appeared that the car was so crowded that he had to stand in the aisle, and hold onto one of the straps, and that the car stopped suddenly, throwing a number of passengers against him with great force, causing the injuries, the declaration was sufficiently supported to make the question one of fact for the jury, and hence not reviewable after affirmance by the appellate court.

2. The question whether the case made by such evidence should be submitted to the jury was sufficiently doubtful as to justify an appeal by defendant without incurring the statutory penalty for delay.

3. The question whether the damages awarded are excessive is one of fact, and not reviewable by the supreme court after affirmance by the appellate court.—(Chicago City Ry. Co. vs. Morse, 64 N. E. Rep. 304.)

INDIANA.—Street Railway Conductor—Turning Car on Turntable—Overexertion—Assumption of Risk.

A street railway conductor was required, as part of his duty, to assist the motorman in turning the car on a turntable at the end of the line. The turntable got out of repair, so that the turning was hindered by the rails scraping against the sides of the turntable pit. The conductor was aware of this condition the day before the accident, and on the day in question had assisted in turning the car three times, but had been assisted in so doing by passengers. In attempting to turn the car with only the motorman's assistance, he overexerted and strained himself. Held, that he was under no obligation to do this, and, in so doing, assumed the risk.—(Roberts vs. Indianapolis St. Ry. Co., 64 N. E. Rep. 217.)

INDIANA.—Master and Servant—Personal Injuries—New Employment—Hazard Pleading.

A complaint alleged that plaintiff was employed by defendant to work in its barn and care for its mules, and for no other service, and that without cautioning him defendant directed him to assist in moving some iron frogs; that the work was dangerous, as defendant knew, to one unskilled; and that plaintiff was ignorant of the danger, and without his fault or negligence, while attempting to assist in such work, he "was pulled over," his hand caught, etc. Held, that it did not appear that the work was hazardous, and, as no facts showing danger were alleged, or anything showing that the work was negligently done, no cause of action was stated.—(Citizens' St. Ry. Co. vs. Brown, 64 N. E. Rep. 98.)

INDIANA.—Street Railways — Negligence — Complaint—License—Withdrawal—Evidence.

1. In an action against a street railway company, a complaint alleging that it was the custom of defendant to permit boys to board the cars to sell papers when signaled to by a passenger;

that plaintiff, a newsboy of 12 years, was signaled to by a passenger who wished a paper, and stepped on the car, but before plaintiff reached the passenger the car started, and when going at great speed the conductor ordered plaintiff off, and approached him with such threatening language as to frighten him, and cause him to fall off, receiving severe injury—states a cause of action.

2. Where it has been the custom of a street car company to permit newsboys to board its cars to sell papers to passengers, it is not negligence to revoke such license, and order such boys off the cars when standing still, or moving so slowly that they can get off with safety.—(Indianapolis St. Ry. Co. vs. Hockett, 64 N. E. Rep., 633.)

INDIANA.—Action Against Street Railroad—Complaint—Sufficiency on Appeal—Negligence—General Verdict and Answers to Interrogatories.

1. A complaint questioned for the first time on appeal will be held sufficient if it states facts sufficient to bar another action.

2. A general verdict for plaintiff in an action against a street railway company for injury received by walking into a rope stretched across the street by defendant while repairing a broken feed wire is not overcome by answers of the jury to interrogatories, though one of them is that the method used by defendant in fixing its broken wire was reasonably prudent, others being that the method was such as to have probably caused the injury to careful persons, that it could have better given warning of the rope by a guard and danger signal, that the light from the headlight of a car was not sufficient to reveal the presence of the rope to every one, and that plaintiff did not see it and could not have seen it by the exercise of ordinary care.

3. An instruction that when a person is about to cross a street he is required to exercise ordinary and reasonable care to observe any obstructions or danger in the street, and to look out for passing vehicles or such permanent obstructions as would ordinarily be expected therein, but not to anticipate and guard against obstructions which are unusual and not ordinarily to be observed in the exercise of reasonable and ordinary care in passing along or crossing a street, does not relieve a traveler from observing anything but vehicles and permanent obstructions.

4. An instruction that in estimating plaintiff's damages the jury may consider the nature and extent of her injuries, whether they were temporary or permanent, also any physical or mental pain or suffering, and, from all the facts shown by the evidence, may give her such damages as will fully compensate her for the injuries she has sustained, not exceeding the amount claimed, fairly informs the jury as to the facts they may consider.—(Indianapolis St. Ry. Co. vs. Walton, 64 N. E. Rep., 630.)

LOUISIANA.—Street Railroads—Injury to Person on Track.

1. Where urchins have been stealing rides by hanging on to the rear end of a gravel train on the street of a city, the employee in charge of the train, who has in vain tried to make them desist by warnings and threats, is entirely justified in catching hold of one of them and lecturing him.

2. If the employee's lecture has been temperate, and he has not rough-used the boy, but has merely held him, and no longer than was necessary for the purpose of the lecture, he or his employer is not responsible if the boy (a child eight years, lacking three months, old), on being turned loose, runs blindly in a direction converging with that of a coming car, and collides with the car and is injured.—(Palmisano et ux. vs. New Orleans City R. Co., 32 Southern Rep., 364.)

MARYLAND.—Street Railways—Negligence—Persons Near Track—Evidence.

1. Where plaintiff was employed in filling in a trench in a street, the side of the trench next to a street car track being about 3 ft. from the track, and he was injured by being struck by the body of the conductor of a street car, the conductor being on the side footboard of a car and engaged in collecting fares, there was no negligence on the part of the street railway.—(United Railway & Electric Company of Baltimore City vs. Fletcher, 52 Atlantic Rep., 608.)

MICHIGAN.—Street Sprinkling—Compensation.

No intention to curtail the free use of water for public purposes, including street sprinkling, as allowed by Pub. Acts 1853, p. 182, which, by section 8, provides for the water board erecting jets and fire hydrants, is indicated by Act No. 359, 3 Loc. Laws 1873, p. 123, which merely requires the water board to provide fire hydrants when required by the council or fire commissioners.—(Board of Water Commissioners of City of Detroit vs. Detroit Citizens' St. Ry. Co., 91 N. W. Rep., 171.)

MICHIGAN.—Street Railways—Collision with Traveler—Negligence of Motorman.

While plaintiff was driving along the street her buggy was struck by a car coming up from behind. One witness testified that, when she turned toward the track to avoid a buggy standing by the side of the road, the car was about 250 ft. away. Plaintiff offered to show that the car could be stopped within 100 ft. Another witness, on cross-examination, stated that she was struck almost instantly after turning in, and a third that she was pretty well past the other buggy when struck. Held, that the question whether plaintiff was in position to have been seen by the motorman a sufficient time to have enabled him to stop the car should have been left to the jury.—(Boettcher vs. Detroit Citizens' St. Ry. Co., 91 N. W. Rep., 125.)

NEW JERSEY.—Street Railroads—Injury to Passengers—Instructions.

1. In the case of a plaintiff two years and nine months old, who was thrown down by the starting of a street car, which she had boarded, before she had time to be seated, and while she was, for the moment, out of the reach of her attendant, who was also boarding the car, it is not error for the court to refuse to charge the jury "that the starting of a car before a passenger is seated is not negligence."

2. When the trial judge has stated to the jury in concrete terms the legal principles applicable to the case, it is not error for him to refuse to charge the abstract principles.—(Herbich vs. North Jersey St. Ry. Co., 52 Atlantic Rep., 357.)

NEW JERSEY.—Street Railroad—Injury to Passenger—Evidence—Res Ipsa Loquitur.

1. A mere fall from a street car, without any evidence to show how the fall was occasioned, raises no presumption of negligence on the part of the operators of the car.

2. The doctrine of res ipsa loquitur is applicable only when the thing shown speaks of the negligence of the defendant, not merely of the happening of the accident.—(Paynter vs. Bridgeton & M. Traction Co., 52 Atlantic Rep., 367.)

NEW JERSEY.—Street Railways—Passengers—Personal Injuries—Contributory Negligence—Proximate Cause.

1. Plaintiff, while riding on defendant's street car, signaled the conductor to stop the car, and the speed decreased, and plaintiff got on the running board at the side of the car, when the conductor signaled to go ahead and the speed was increased. Plaintiff turned to again signal the conductor, and, leaning outward, his head struck a wagon overtaken by the car. Held, that a non-suit was proper, as plaintiff was guilty of contributory negligence.

2. The accident was not the natural result of the conductor's negligence, and defendant was not liable.—(Flynn vs. Consolidated Traction Co., 52 Atlantic Rep., 360.)

NEW JERSEY.—Bill of Particulars—Right to Demand.

In an action by an attorney to recover for professional services, where defendants denied the employment and rendition of services, and pleaded limitations, they were entitled to particulars specifying: (1) Whether the agreement was verbal or in writing, and, if in writing, a copy thereof, and, if oral, the terms and names of the persons claimed to have acted as agents of the defendants; (2) an itemized statement of the services rendered; (3) the name or names of the person or persons at whose instance the services were rendered, and a copy of the request for such services if in writing, and, if oral, the terms thereof, together with the time and place of making the same.—(Dempsey vs. Bergen County Traction Co. et al., 77 N. Y. Supp., 456.)

NEW JERSEY.—Street Railroads—Injury to Prospective Passenger—Contributory Negligence.

1. Deceased and her sister went to defendant street railway company's track in front of their residence to take a car. Deceased returned for a wrap, and her sister signaled an approaching car to stop. As deceased returned, the sister called to her not to cross ahead of the car, which was but 1½ car lengths away. It was night, and the car was brightly lighted and making considerable noise. Deceased attempted to cross ahead of the car, tripped over the first rail, fell, and was run over. Held, guilty of contributory negligence as a matter of law.—(Gilliland vs. Middlesex & S. Traction Co., 52 Atlantic Rep., 693.)

NEW YORK.—Street Railroads—Injury to Person on Track—Instructions—Unexpected Peril.

Where, in an action against a street railroad company for the killing of a person crossing its track, the court instructed that, if deceased "were suddenly placed in a situation of unexpected peril, the jury were at liberty to say that he need not have exercised the same nice discrimination as if he were not in such peril," though defendant was entitled to an instruction, if it had asked it, that the motorman was not called upon any more than deceased to exercise the same discrimination as though no danger had unexpectedly arisen, an instruction that, if the jury found that both deceased and the motorman were in the same position of unexpected peril, they must find for defendant, was properly refused.—(Hock vs. New York & Q. C. Ry. Co., 77 N. Y. Supp., 200.)

NEW YORK.—Trial—Election of Ground of Recovery—Acts Constituting Election—Operation and Effect.

In an action for injuries in consequence of the wheel of plaintiff's wagon having slipped into the slot between the tracks of a cable railroad, the plaintiff was asked by defendant, at the close of plaintiff's case, except as to formal proof of a certain measurement, to state whether he calimed to recover on the ground of defendant's negligence, or its maintaining a nuisance. His counsel stated that a recovery was sought on the ground of negligence, whereupon several motions were made by defendant, one being for dismissal for failure to prove negligence. An adjournment was taken, and on the adjourned day, after some formal proof had been taken, defendant renewed its motions. Held, that it was then too late for plaintiff to shift his ground, and recover on the ground of maintaining a nuisance.—(Bowsky vs. Metropolitan St. Ry. Co., 74 N. Y. Supp., 863.)

NEW YORK.—Attorneys—Authority—Stipulations Respecting Depositions—Street Railways—Injury to Passenger—Contributory Negligence—Evidence—Sufficiency.

1. An attorney for the defendant in an action against a street railway company for personal injuries had authority to stipulate that plaintiff's deposition should be taken in advance of the trial, and that, in the event of his death before trial, it should be read on the trial of another action brought against the defendant by his personal representatives.

2. In an action against a street railway company for the wrongful death of a passenger, decedent's deposition tended to establish that he signified his intention to get off; that the conductor rang the bell, and the motorman thereupon stopped the car; and that it was suddenly started while he was getting off, causing his injury. Two disinterested witnesses corroborated his testimony. Several witnesses for defendant testified that the car had not stopped. Others testified that decedent, immediately after he was injured, stated that he attempted to get off while the car was in motion, in order to get a train, and that it was not the fault of defendant's servants. Held, that a verdict for decedent's administratrix would not be disturbed—(Ludeman vs. Third Ave. R. Co., 76 N. Y., Supp. 128.)

NEW YORK.—Street Railways—Collision—Contributory Negligence—Negligence.

1. One is not negligent in attempting to drive across a street railway track at a street crossing when an approaching car is 75 ft. distant.

2. The motorman of a street car has the duty of approaching a crossing with the car under control—the more so where his view of the crossing is obstructed by another car; and he cannot give such obstruction as an excuse for his rapid approach.—(Schoener vs. Metropolitan St. Ry. Co., 76 N. Y., Supp. 157.)

NEW YORK.—Misconduct of Counsel—Improper Argument—Ground for Reversal—Cure of Error—Exceptions—Necessity.

1. Conduct of plaintiff's counsel in an action against a street railway company for personal injuries, in persistently insisting that the conductor had taken the names of numerous passengers who were not produced as witnesses, and whose names the company refused to disclose to him on application, and in denouncing the company as a corporation, and in asserting that the trial was conducted on defendant's part at an unnecessary personal expense to the members of the jury as taxpayers, was reversible error, where there was no evidence whatever that the conductor or any one else took the name of a single passenger not produced by the company as a witness on the trial.

2. The misconduct of plaintiff's counsel was not cured by an instruction, given at plaintiff's instance, that "in case either counsel, in summing up, stated facts that were not proven upon the trial, or in case either counsel gave a recollection of the facts which disagree with the recollection of the jury, the jury may disregard these statements, and take their own recollection of the facts."

3. No exception is necessary to justify the reversal of an order denying a new trial, if in furtherance of justice.—(Stewart vs. Metropolitan St. Ry. Co., 76 N. Y., Supp. 540.)

NEW YORK.—Street Car Companies—Persons Crossing Tracks—Liability for Electric Shocks—Negligence—Question for Jury

A person who, while crossing a street car track, stepped on a rail and received an electric shock, was entitled to recover for his resulting injuries, in the absence of any explanation from the company, where it was clearly established that the shock would have been impossible if the track was in good order, and, further, that close to the place where he was walking was a joint where two rails met, which, if not properly welded, would permit a shock, and there was some evidence that the rails at the time were not laid so as to allow in the usual manner for expansion and contraction, and that such manner of laying rails was calculated to result in imperfect joints.

2. Where a person crossing a street car track stepped on a rail and received an electric shock, and his evidence at the trial made a prima facie case in his favor, testimony by an employee of the company, whose duty it was to keep the tracks in order, that they were in order at the time and place of the accident, did not show the company to be free from negligence, as matter of law.—(Braham vs. Nassau Electric R. Co., 76 N. Y., Supp. 578.)

NEW YORK.—Appeal from Non-Suit—Presumptions—Statements of Witness—Recollection—Street Railroads—Injury to Passenger—Negligence—Contributory Negligence.

1. On an appeal from a judgment of non-suit the plaintiff is entitled to the most favorable inferences deducible from the evidence, and all disputed facts are to be treated as found in her favor.

2. When a witness, a trolley car conductor, on being asked if he did not go to one who had been injured by falling from his car, and say that the accident was due to his fault, and that he should have stopped the car, testified that he did not remember making such statements, and could not swear whether he so stated or not, the jury was justified in concluding that, if he could not deny making them, he might have made them, and therefore they might be true.

3. Plaintiff was injured by falling from defendant's open trolley car. When she got on she told the conductor that she wished to get off at a certain point, where it was customary for the cars to stop without signal. As the car approached the point, the plaintiff, with her little son, got up, but the car, instead of stopping, as she supposed it would, ran past and around a curve just beyond, at a rate of speed which both the motorman and the conductor testified was dangerous under the circumstances. The rapid motion of the car around the curve caused plaintiff to be thrown out. The motorman knew that the plaintiff was occupying a position which made it dangerous to run the car at such a speed, and the conductor saw her get up in anticipation of alighting. Plaintiff's husband testified that the conductor admitted to him that the accident was due to his fault. The conductor testified that he did not remember making such statements, but would not swear either way. Held, that the question of defendant's negligence should have been submitted to the jury.

4. Plaintiff was riding in an open trolley car, her little son being on a seat just in front of her. She had notified the conductor and expected the car to stop at a certain point, and just before the car reached there she arose, and placed her arm around the child, as she said, to better protect him from falling out when the car stopped. The car did not stop, and in going around a curve just beyond plaintiff was thrown out and injured. Held, that the question of contributory negligence should have been left to the jury.—(Whitaker vs. Staten Island Midland R. Co., 76 N. Y., Supp. 548.) Accident—Contributory Negligence.

NEW YORK.—Death of Fireman—Street Railway Collision—Contributory Negligence—Negligence—Damages—Widow's Pension—Evidence—Prospects of Deceased—Salaries of Higher Positions.

1. Where a fireman, riding on a hook and ladder truck to a fire, sees, when the truck is about half-way across the tracks of a street railroad, that there will be a collision between the truck and a car, and jumps, but is killed by the truck being precipitated on him, the jury is warranted in finding no contributory negligence.

2. Where, in an action for the death of a fireman, owing to a collision, at the intersection of streets, between a hook and ladder truck and a street car, there was evidence that if the car had been under control, or the motorman had been keeping a proper lookout, the accident would not have happened, and that the truck should have been allowed to pass first, a verdict for plaintiff should not be disturbed.

3. In assessing damages for the death of one employed in a city fire department, the jury should not consider the pension his widow is receiving from the city.

4. In an action for the death of one employed in a city fire department, it appearing that deceased had risen four grades in the service, and was strong and of steady habits, evidence showing the different grades of advancement above the position held by deceased was admissible, it being proper for the jury to consider the prospects of his being advanced and earning a greater salary.

5. Advancement in the department being based on competitive examinations, and advanced positions requiring other qualifications than those required by deceased's position, it was error to admit evidence as to the salaries of higher positions in the department.—(Geary vs. Metropolitan St. Ry. Co., 77 N. Y. Supp., 54.)

NEW YORK.—Action for Death—Parties—Damages—Evidence — Admissibility — Damages — Instructions — Damages — Amount—Admissibility of Evidence—Mortuary Tables.

1. Where a passenger was killed in a collision between a street car and a brewery wagon, caused by the concurrent negligence of both, a joint action could be maintained against the street railroad company and the brewery company, notwithstanding the different degrees of care owed deceased by the two defendants.

2. In an action for death, plaintiff introduced evidence of deceased's habits in regard to his family life, the attention bestowed by him on his family, and the interest he took in their social entertainment; that he was a "home body"—spending much time at home; and that he took great interest in the education of his children. The court instructed that the word "pecuniary," as used in the statute prescribing the damages recoverable in an action for death, excluded injuries to the affections and sentiments arising from the death of relations, and also losses arising from the deprivation of society and companionship of relatives, but that infant children might sustain a loss from the death of their parent of a different kind—such as loss of nurture, and of intellectual, moral, and physical training, and of parental instruction. Held that, as limited by the instruction, there was no error in the admission of the testimony.

3. In an action for death, the court instructed that, in measuring the pecuniary loss to deceased's wife and children, the jury could consider the loss of monetary support which deceased would have given, and the amount, if any, which he might have added to his inheritable estate, provided that they found that such increase would have actually occurred from sources other than profits from capital invested, and that the widow and children would have been alive to inherit it, but that the jury must consider deceased's age, his losses and earnings, if any, his expectancy of life, prospective activity, expense of his own living, and all the circumstances surrounding it; that they were not to speculate on the subject, but must base their finding on the reasonable probability of his earnings, based on the evidence. Held, that there was no error in refusing to charge that the jury must consider the possibility of deceased's becoming poor, and his children being compelled to support him in his old age.

4. In an action for death, it appeared that deceased was sixty-two years old, in robust health, and had a life expectancy, according to mortuary tables, of thirteen years; that he had been a successful business man, having risen from a clerk to a partner in a large department store, and had accumulated considerable property, and expended for his own and family's support about $5,000 a year. Held, that a verdict of $25,000 was not excessive.

5. In an action for death, mortuary tables are admissible as evidence of the life expectancy of deceased.—(Sternfels vs. Metropolitan St. Ry. Co. et al., 77 N. Y. Supp., 309.)

NEW YORK.—Wrongful Death—Damages—Evidence—Admissibility—Exclusion—Prejudicial Error—Presumption.

1. On the issue as to the damages in an action for the wrongful death of a cab driver, evidence as to whether he, at times, came in intoxicated at the end of a day's drive was improperly excluded.

2. In an action for the wrongful death of a cab driver, where the jury awarded a verdict of $10,000, a rejection of material evidence on the issue of damages must be presumed to have been prejudicial.—(McIlwaine vs. Metropolitan St. Ry. Co., 77 N. Y. Supp., 426.)

NEW YORK.—Appeal—Condemnation Proceedings—Award of Commissioners.

Where commissioners of appraisal in condemnation proceedings viewed the premises, and the estimates of witnesses as to value differed materially, the award will not be disturbed, although it might be more satisfactory if smaller, where it does not appear that the commissioners proceeded on an erroneous principle, or were influenced by passion or prejudice, or overlooked or disregarded the evidence, and for that reason injustice has been done.—(Manhattan Ry. Co. vs. Comstock et al., 77 N. Y. Supp., 416.)

NEW YORK.—Street Railway—Personal Injuries—Negligence—Contributory Negligence.

1. In an action against a street railway for personal injuries the evidence showed that plaintiff, after alighting from a car at a frequented crossing, went behind it, and in attempting to cross the street was struck by a car coming in the opposite direction. The car was coming faster than usual, and no effort was made to stop it until after the accident. No gong was sounded, or warning of any kind given. Held sufficient to sustain a finding that the motorman was negligent.

2. Plaintiff, on alighting from a car, passed behind it, and, after looking up without seeing another car in sight, attempted to cross the other track, and was struck by a car coming in the opposite direction. Her vision in that direction was obscured by the car behind which she had passed. Her companion preceded her by about 6 ft., and, without hastening, crossed in safety. No gong was sounded or warning given by the approaching car. Held, that plaintiff was not negligent.—(Pelletreau vs. Metropolitan St. Ry. Co., 77 N. Y. Supp., 386.)

NEW YORK.—Street Railroads—Crossing Accident—Negligence of Gripman—Evidence—Admissibility.

1. Evidence that a cable car approached a street crossing at a high rate of speed without sounding a gong, though a woman struck by the car was approaching the track, and that the car went about 45 ft. after the accident, was sufficient evidence of the gripman's negligence to sustain a recovery.

2. A witness for defendant in a street car crossing accident case, who testifies that the injured person was warned by shouts of the approach of the car, can not testify whether the accident would have occurred if the injured person had stopped when so warned, as such question is for the jury.—(Cosgrove vs. Metropolitan St. Ry. Co., 77 N. Y. Supp., 624.)

NEW YORK.—Street Railways—Personal Injury—Child on Track.

In an action for personal injuries to a child by being struck by a street car while she was running across the street, the court properly refused to charge that "the motorman was not obliged to apply his brake before he observed that the child was in danger," as the instruction eliminated any question of negligence on the motorman's part in failing to discover the danger sooner than he did.—(Colabel vs. Metropolitan St. Ry. Co., 77 N. Y. Supp., 584.)

TENNESSEE.—Trial—Instructions—Presentation of Theory of Case.

Where there is conflict in the evidence on a material issue, submission thereof without any instruction as to defendant's theory of the case as based on that issue is reversible error.—(Memphis St. Ry. Co. vs. Newman, 69 S. W. Rep., 269.)

TENNESSEE.—Street Railroads—Collision at Crossing—Action for Injuries—Defenses—Contributory Negligence—Instructions—Control of Car at Crossings.

1. An action against a street railroad company for injuries received by plaintiff in a collision between his wagon and defendant's car at a street crossing can not be maintained if plaintiff's own negligence proximately contributed to his injuries.

2. In an action for injuries received in a collision between a wagon and a street car at a street crossing, the court instructed that it was the duty of defendant's motorman, on approaching the crossing, to have his car under such reasonable control as to be able to avoid colliding with persons using the crossing; that it was his duty to be on the lookout, and to have seen what any ordinarily careful motorman would have seen, but that, if no one was near enough to make a collision probable, he had the right to assume that persons approaching would use ordinary care to avoid a collision; that no mistake in regard to these assumptions would be negligence; and that, if the motorman complied with the law as charged, he was not guilty of negligence, unless he was running his car at an excessive rate of speed, so that he could not stop when danger became apparent. Held not erroneous, as placing on defendant the responsibility of an insurer.—(Memphis St. Ry. Co. vs. Wilson, 69 S. W. Rep., 265.)

TENNESSEE.—Street Railways—Passengers—Injuries—Collision with Vehicle—Degree of Care—Instructions.

In an action by a passenger against a street car company for injuries sustained by a collision with a dray at a cross street, the court instructed that the drayman and motorman had equal rights, and each owed the duty to approach the crossing at a speed enabling him to stop if necessary to avoid collision; that, if either failed to do so, he was guilty of negligence, and if it caused the injury plaintiff must look to such negligent party; that if the car, running at a high speed, ran into the dray as it was attempting to cross and was almost across the track, and whirled it around, so that the shafts were thrust into the car, injuring plaintiff, defendant was liable though the drayman was negligent; but if the dray dashed into the rear of the car, and the shafts protruded and injured plaintiff, then the drayman was liable, and verdict should be for the defendant. Held that, while portions of the charge might be construed as requiring the motorman to have his car under absolute control, as a whole it was not erroneous as requiring too high a degree of care of defendant.—(Memphis St. Ry. Co. vs. Norris, 69 S. W. Rep., 325.)

TEXAS.—Street Railway Companies—Duty to Passengers.

It is the duty of a street railway company to exercise the highest degree of care in operating its cars to prevent injury to passengers, and failure of its servants in that respect is its negligence.—(Citizens' Ry. Co. vs. Craig, 69 S. W. Rep., 239.)

FINANCIAL INTELLIGENCE

THE MARKETS

WALL STREET, NOV. 12, 1902.

The Money Market

One or two very important developments have occurred in the money market during the past week. The Secretary of the Treasury has discontinued the deposits of internal revenue in the national bank fund, and has said that no more State and municipal bonds will be received in lieu of United States bonds as security for government deposits. Secondly, the leading New York banks, acting apparently under an agreement, have fixed 6 per cent as the minimum at which time loans will be made for the present. The meaning of this latter step has been construed, with good reason, to be a warning to speculators in stocks that they need expect no consideration for any plans for fresh borrowing. It is part of the general policy, of which many evidences have recently appeared, to force a contraction of speculative liabilities, and put bank resources in a sounder position. Withdrawal of the Treasury relief offers presumably reflects the belief of the officials at Washington that the extraordinary remedies applied during the last month and a half are no longer needed. Still the immediate effect is to greatly increase the strain upon the local market. The Treasury becomes once again a heavy creditor against the banks, and as money is still flowing out in quantity to the interior, we are likely to see for several weeks a considerable decrease in the banks' cash holdings. This will be offset, so far as the next Saturday bank statement is concerned, by the natural results of extensive speculative liquidation on the Stock Exchange. The problem of gold exports remains in statu quo. Demand sterling, which rose to 4.87¼ at the close of last week, has eased off, as the money market has given signs of hardening. It is an interesting question, but one which is by no means easy to answer, whether local bankers are not as much concerned with checking an outflow of gold as with reducing the inflated loan account at home. Their purpose may be to accomplish the gradual settlement of foreign obligations by use of domestic credits forcibly released, rather than by shipments of gold, which would only trench still further upon the much-talked of scant margin of cash reserve. Summing up the best judgment of the situation is that money rates will continue to be held at their present comparatively stiff level until the end of the year.

The Stock Market

The period of violent decline and enormous liquidation which has occupied the Stock Exchange this week, is generally referred to the conditions which have been outlined in the money market. The banking community have evidently decided to make a clean job of it, and to force the big speculative syndicates, which have been borrowing immense sums in their various deals, to disgorge enough of their holdings to put the loan accounts in a sound condition again. This process has had an extremely disastrous effect upon the active share list. The circumstances demanding urgent liquidation, those securities having the readiest market, are naturally the ones that have been first pressed for sale. On such occasions, of course, no account has been taken of actual values. Securities have been thrown over simply for what they would bring, and the standard shares of recognized merit have suffered fully as much as the rest. Judged by all the teachings of experience such a reaction is bound to be overdone. The market will right itself eventually in all probability on a higher level of prices than the present. But it takes time for the investment demand to digest such a tremendous outpouring of speculative holdings as has been witnessed during the past week. The majority of the dividend-paying stocks are now selling at figures where the rate of return is attractive to the investment interest. Inasmuch as there is no sign of any falling off in earning capacity or in the general business of the country, it is plain that for those who use their own funds for the purpose, the market offers many tempting opportunities. For the speculator on margin, however, the path is as yet by no means clear, simply because there are no accurate means of gauging whether the forced contraction of speculative credits has yet reached its limit. The best judges of the situation are inclined to think that even with further liquidation the decline cannot go much further.

The local traction group has not felt the shock of the general decline to the extent that other departments have. Both Brooklyn Rapid Transit and Metropolitan have touched the lowest prices of the season, but pressure even on them has been considerably lighter than elsewhere. On the other hand, Manhattan has distinguished itself by a remarkable display of resistance to the general selling movement. The buying in this stock has been steady enough to absorb all offerings, at comparatively slight recessions, and there is little doubt that it comes from people who have received their inspiration from sources close to the management of the property. Those who are in a position to known what is going on talk in glowing terms of the present earnings of the company.

Chicago

Liquidation and lower prices have been the rule in Chicago during the last week. Union Traction common is off to 15, and there is no market for the preferred above 46. City Railway shares have fallen to 210, from 212½ a week ago. Metropolitan common is down more than a point to 39, while the preferred broke sharply from 88 to 86. Lake Street has been very weak at 9½, Northwestern common at 34, the preferred at 81, South Side at 106, while West Chicago Street Railway, selling ex-dividend, dropped from 90½ to 89. These declines have not, on the whole, had any reference to actual property conditions. Unfavorable comment is heard about the increase in Union Traction's operating expenses, owing to the recent advance in wages and the adverse transfer decision. It is said, however, that the increased cost of operation on these accounts is not equal to the increase in present gross earnings over those of a year ago. Meanwhile earnings of the elevated lines continue to make the same excellent comparisons that they have during the last few months. Those of the Northwestern are 17 per cent larger, so far this month, than in the corresponding period last year, and in the case of the Metropolitan the increase amounts to 20 per cent. An important plan is reported to be under way by which the South Side Elevated will acquire an outlet to the Stock Yards. The matter is now before the Mayor for approval.

Philadelphia

The leading Philadelphia stocks have been depressed in sympathy with the general speculative demoralization of the last week, but their losses, as compared with other stocks, are only trifling. Rapid Transit, after holding up around 18 for most of the time, broke sharply on Monday and Tuesday, closing on the latter day at 16 bid. Union Traction meanwhile dropped a point to 46. But the liquidation in both stocks was not at all heavy. American Railways was exceptionally firm, and moved directly against the rest of the market, rising from 53½ to a new record price of 54½. It looks very much as if all offerings of this stock were being absorbed by people who know the inside conditions of the company. There is no doubt but that earnings of all the constituent properties are steadily increasing, and the market advance is simply reflecting the opinion that this fact in time means higher dividends on American Railways stock. Bond sales for the week include Indianapolis 4s at 86¾, Consolidated New Jersey 5s at 110½, Electric-People's Traction 4s at 98¾, and People's Passenger 4s at 105.

Other Traction Securities

The general speculative depression has been felt in the Boston traction market, more in curtailing the volume of business than in causing liquidation. Massachusetts Electric common has yielded the most of any, selling down 2 points to 36¼. The preferred has held steady around 96, Boston Elevated around 153, and West End common around 93½. In Baltimore the United Railway issues are weaker, the common stock dropping fractionally to 13¾, and the income bonds to 68. Nashville Railway 5 per cent certificates have held exceptionally strong at 77¾, although the shares of the same company continued heavy around 4. Other Baltimore transactions include United Railways 4s at 95, Anacostia and Potomac 5s at 104, and Charleston Consolidated 5s at 93½. On the New York curb New Orleans common dropped, on sales of about 800 shares, from 16¼ to 15½, and the preferred from 53 to 51. Other sales for the week comprised American Elevated at ⅞ and ¾, New Orleans 4½s at 85, San Francisco subscription from 47½ to 48¼, and United Railways of St. Louis 4s at 84¾. Practically nothing doing in traction stocks on the Cleveland exchange last week; or any other stocks for that matter. Sales numbered only 460 shares. Aurora, Elgin & Chicago common sold down from 37¾ to 36¾ on 100 shares. A lot of 100 Cincinnati, Dayton & Toledo sold at 40, a decline of ¾ from last sales. Western Ohio receipts sold at 29½, a fractional decline. Monday matters brightened somewhat. The formal announcement that the Cincinnati "community of interests" plan has been signed up to the good advantage of the Miami Erie Canal sent that stock up ½ point. Three lots sold at 33, and then came news of New York's tumbling market, which brought the offer down to 30 and the bid to 25. A small lot of

Syracuse Rapid Transit sold at 32, the first of this sold in some weeks. Lake Shore Electric was considerably weaker, only 12 being bid and 15½ asked for the common. On Monday the guaranteed stock of the Cincinnati & Hamilton Traction Company was placed on the market, the preferred being quoted at 112½, while the common was sold from 35½ to 39, closed the day at 37½. The preferred stock draws 5 per cent dividend, and the common for two years draws no dividend, and after that advances one-half of one per cent annually, until it reaches 4 per cent. Dividends on the stocks are guaranteed by the Cincinnati Traction Company. The road is a combination of the old Mill Creek Valley system.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Nov. 3	Nov. 10
American Railways Company	53	53½
Aurora, Elgin & Chicago	38	a37
Boston Elevated	152	152½
Brooklyn R. T.	62¾	59
Chicago City	212	210
Chicago Union Tr. (common)	16½	15
Chicago Union Tr. (preferred)	47	a49
Cleveland Electric	85¼	85
Columbus (common)	55¾	57
Columbus (preferred)	105½	106
Consolidated Traction of N. J.	69¾	68½
Consolidated Traction of N. J. 5s	110½	110¼
Detroit United	87	86½
Electric People's Traction (Philadelphia) 4s	98¾	98¾
Elgin, Aurora & Southern	a59	a60
Indianapolis Street Railway 4s	88	86¾
Lake Shore Electric	13½	12½
Lake Street Elevated	9¾	9⅝
Manhattan Railway	136⅞	133
Massachusetts Elec. Cos. (common)	37½	36¾
Massachusetts Elec. Cos. (preferred)	95½	96
Metropolitan Elevated, Chicago (common)	40	38
Metropolitan Elevated, Chicago	88½	85½
Metropolitan Street	140⅛	136
New Orleans Railways (common)	—	15¾
New Orleans Railways (preferred)	—	50
North American	123⅜	120
Northern Ohio Traction (common)	a66	—
Northern Ohio Traction (preferred)	93½	93½
North Jersey	—	22¾
Northwestern Elevated, Chicago (common)	34⅜	34
Philadelphia Rapid Transit	18	17⅛
Philadelphia Traction	98	98
St. Louis Transit (common)	28½	28
South Side Elevated (Chicago)	108	106
Syracuse Rapid Transit	32	31½
Syracuse Rapid Transit (preferred)	a78	76
Third Avenue	126	125
Toledo Railway & Light	a40	a38
Twin City, Minneapolis (common)	118	113
United Railways, St. Louis (preferred)	—	—
United Railways, St. Louis, 4s	—	84¾
Union Traction (Philadelphia)	47⅝	46½
Western Ohio Railway	27	28⅛

a Asked.

Iron and Steel

The iron situation continues to hang on the question whether supply is not beginning to overtop demand. As yet, however, it is only in some of the higher forms of the industry that reaction has really appeared. Tin plate, wire and nails, and sheets are the principal products affected. Elsewhere in all the lower and middle grades, including pig iron and steel billets, and in many of the higher grades, including steel rails and structural material, the conditions are unchanged from what they have been for a long while past, namely, production is running well behind consumption, and the output is sold a good ways ahead. Quotations are as follows: Bessemer pig iron, $21.75 and $22.00; steel billets, $30.00 and $31.50; steel rails, $28.00.

Metals

Quotations for the leading metals are as follows: Copper, 11½ and 11¾ cents; tin, 26¼ cents; lead, 4⅛ cents, and spelter, $5.30 and $5.40.

CHICAGO, ILL.—The stockholders of the Metropolitan West Side Elevated Railway met Nov. 5 and voted to amend the charter of the company so as to permit the building of the new downtown terminal spur and depot for which real estate was purchased some months ago. The cost of the improvement will be paid for out of an issue of $2,500,000 extension bonds bearing 4 per cent, which were underwritten some time ago. Real estate purchased for the improvement purposes cost $850,000. Work on the building of the new station will commence soon after Jan. 1. The new terminal will be for the purpose of affording downtown terminal facilities in addition to the Union loop, as the capacity of the loop is beginning to be taxed by the large number of trains put upon it by the Metropolitan and the South Side companies.

DAVENPORT IA.—An amendment to the articles of incorporation of the Tri-City Railway Company has been filed with the Secretary of State of Iowa increasing the capital stock from $1,200,000 to $1,500,000. The increase in the stock is to be used in improvements and in extending the lines of the company.

BOSTON, MASS.—The Railroad Commissioners, as petitioned, have authorized the Boston & Worcester Street Railway Company to issue at par 7500 shares of original stock, giving the company $150,000 to pay, in part, floating indebtedness incurred in construction and equipment of its lines and in the acquisition of real and personal property.

BOSTON, MASS.—The Railroad Commissioners have approved an issue of $750,000 in capital by the Boston & Worcester Street Railway Company, the originally fixed capital of the company, to be sold to subscribers at par, that amount being reasonably necessary for paying in part floating indebtedness properly incurred in the construction and equipment of the road.

DANVERS, MASS. The Middleton & Danvers Street Railway Company has petitioned the Railroad Commissioners for approval of an issue of $32,000 original stock.

BROOKLYN, N. Y.—The directors of Brooklyn Union Elevated have declared a regular dividend of 1½ per cent and ½ per cent extra on preferred stock, payable Dec. 31 to stockholders of record Dec. 23. The last regular dividend declared on the preferded stock was 1 per cent. Hereafter the dividend will be declared semi-annually.

NEW YORK, N. Y.—Application has been made to the New York Stock Exchange by the Twin City Rapid Transit Company to list $1,501,000 additional common stock.

NEW YORK, N. Y.—The annual meeting of the stockholders of the Metropolitan Street Railway Company will be held on Monday, Dec. 1, 1902, at 621 Broadway. A special meeting of the stockholders will also be held for the purpose of voting upon a proposition to adopt a by-law of the company prescribing a period of ten days prior to meetings of the stockholders of the company during which no transfers of stock on the books of the company may be made, and also for the purpose of voting upon a proposition to alter the certificate of incorporation of the company by an amended certificate, providing that the directors shall be classified into three classes of three directors each, holding office respectively for one, two and three years, so that three directors shall be elected annually, and to amend the by-laws accordingly; and also for the purpose of transacting such other business as may lawfully come before the meeting. The notice calling the annual meeting is signed by W. L. Elkins, the new president.

AKRON, OHIO.—The gross earnings of the Northern Ohio Traction Company for October were $54,822, a gain of $12,062 over the same month last year.

TOLEDO, OHIO.—The passenger receipts of the Toledo Railways & Light Company for October were $86,839, a gain of $7,240 over the some month of last year. This is a daily gain of $233.

CLEVELAND, OHIO.—The stockholders of the Toledo & Western Railway will meet Nov. 29 to ratify the action of the directors, who have decided to assume the bonded indebtedness of the Toledo, Fayette & Western Railway, which was organized a short time ago to build an extension of the Toledo & Western Railway from Fayette to Alvordton and Pioneer, a distance of 14 miles. The Toledo, Fayette & Western Railway Company owns a 60 ft. private right of way over the route. It is expected that next year the line will be further extended to connect with lines in Indiana.

CLEVELAND, OHIO.—About 29,000 shares out of 35,000 shares of the Northern Ohio Traction Company have been deposited with a trustee, insuring the reorganization of the company as the Northern Ohio Railways & Light Company under terms outlined recently in the STREET RAILWAY JOURNAL. No change in the officers is contemplated.

CLEVELAND, OHIO.—The gross earnings of the Cleveland Electric Railway Company have increased $158,000 thus far this year, and it is estimated that the earnings for the year will be $200,000 more than last year.

CLEVELAND, OHIO.—The Cleveland, Elyria & Western Railway Company is considering the advisability of increasing its capital stock from $1,000,000 to $2,000,000. It appears that the construction of the Norwalk extension cost more money than originally estimated. It is probable that each stockholder will be permitted to subscribe to the extent of 25 per cent of his holdings, at $50. At the present time the stock is held at about $80, although a small sale was made recently at $70.

CLEVELAND, OHIO.—The syndicate of banks which proposes to assist in the refinancing of the Lake Shore Electric Railway Company held several meetings last week to formulate a plan to remove the obstacles which at present prevents the immediate removal of the receiver. Several plans for raising the money necessary to pay off pressing claims which amount to between $400,000 and $800,000 have been suggested. One plan provides for the issuing of $1,000,000 preferred stock to be sold present stockholders at $60, the new stock to be a first preferred. Another plan contemplates increasing the present preferred stock by $1,200,000, instead of making a first and second preferred stock. It is officially denied that any plan for assessing the stock from $6 to $10 per share is contemplated. It is now proposed to call a special meeting of the stockholders to settle the matter.

PHILADELPHIA, PA.—The American Railways Company has declared a quarterly dividend of 1½ per cent. This increases the dividend basis from 5 per cent to 6 per cent. The dividend is payable Dec. 15 to stock of record Nov. 29. The surplus of the company now amounts, approximately, to $380,000, or about 10 per cent of the capital without allowing for quarterly dividend of 1½ per cent just declared. The gross earnings for the three months ending Sept. 30 were $353,193, an increase over the same quarter of the preceding year of $80,251.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition. *b* All capital stock owned by Detroit United Ry.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., Sept. '02	67,402	35,997	31,405	12,907	18,598
	1 " " '01	59,212	31,396	27,816	12,031	15,815
	6 " June '02	318,185	185,802	133,373	77,356	56,018
	6 " " '01	268,907	161,428	104,510	63,494	41,016
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	518,732	*317,478	196,249	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., Sept. '02	132,606	81,990	50,616	23,866	26,750
	3 " " '02	414,633	251,730	162,907	71,508	91,399
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., Sept. '02	18,432	10,460	7,972	......	......
	1 " " '01	18,430	9,960	8,470	......	......
	3 " " '02	65,253	33,983	31,270	18,024	13,246
	3 " " '01	65,160	31,024	34,136	14,988	17,148
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,406	7,336,507	3,532,899	2,896,350	636,549
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,837	4,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., Sept. '02	1,124,384	607,581	516,802	......	......
	1 " " '01	1,080,158	664,611	415,548	......	......
	3 " " '02	3,587,738	1,881,774	1,705,965	......	......
	3 " " '01	3,411,101	2,032,246	1,378,855	......	......
	12 " June '02	12,780,316	*8932214	3,857,400	......	......
	12 " " '01	12,101,158	*7970095	4,130,503	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., *a* Sept. '02	321,856	161,525	160,831	77,502	82,329
	1 " " '00	255,322	109,934	146,388	81,931	64,457
	3 " " '02	1,019,518	506,664	512,854	235,741	277,113
	3 " " '00	791,470	344,745	446,725	245,793	250,932
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., Aug. '02	45,217	31,191	14,026	13,387	639
	1 " " '01	45,474	28,296	17,178	18,027	8,481
	6 " " '02	358,984	203,200	155,784	81,054	74,730
	6 " " '01	246,438	163,143	83,293	82,618	674
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Sept. '02	19,847	6,988	12,859	......	......
	1 " " '01	19,197	6,548	12,649	......	......
	9 " " '02	147,407	59,847	87,560	......	......
	9 " " '01	132,159	56,118	76,041	......	......
CLEVELAND, O. Eastern Ohio Traction Co.	1 m., Sept. '02	21,375	10,808	10,567	6,035	4,532
	1 " " '01	17,761	8,413	9,348	5,128	4,220
Cleveland, Elyria & Western	1 m., Sept. '02	30,464	14,999	15,464	......	......
	1 " " '01	27,430	12,347	15,083	......	......
	9 " " '02	219,908	122,051	97,919	......	......
	9 " " '01	185,092	101,787	83,305	......	......
	12 " Dec. '01	249,300	136,865	112,394	67,083	55,871
	12 " " '00	179,098	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Sept. '02	18,499	10,085	8,461	......	......
	1 " " '01	18,882	9,649	9,174	......	......
	9 " " '02	144,464	76,906	67,499	......	......
	9 " " '01	124,181	63,243	60,941	......	......
	12 " Dec. '01	161,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*89,592	71,530	72,500	†980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.	1 m., Aug. '02	96,118	*58,295	42,823	22,238	20,585
	1 " " '01	74,525	*45,741	38,784	15,807	12,977
	8 " " '02	596,156	*344,026	252,130	131,230	120,899
	8 " " '01	595,764	*327,613	209,109	125,328	82,841
DETROIT, MICH. Detroit United Ry	1 m., Sept. '02	323,618	178,933	146,685	......	......
	1 " " '01	282,311	153,298	129,013	......	......
	9 " " '02	2,578,696	1,449,499	1,129,197	......	......
	9 " " '01	2,245,842	1,228,862	1,016,980	......	......
	12 " Dec. '01	2,919,171	*1500785	1,352,046	682,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,408	519,751
Detroit and Port Huron Shore Line *b*	1 m., Sept. '02	39,771	23,491	16,281	......	......
	1 " " '01	35,687	21,576	14,111	......	......
	9 " " '02	323,130	188,809	134,321	......	......
	9 " " '01	285,917	169,856	126,061	......	......
DULUTH, MINN. Duluth-Superior Tr.	1 m., Sept. '02	46,763	23,091	23,672	9,619	14,053
	1 " " '01	39,185	19,941	19,244	9,150	10,051
	9 " " '02	396,278	206,994	189,284	86,819	102,445
	9 " " '01	335,886	181,551	153,776	82,379	71,398
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., Sept. '02	37,806	20,273	17,533	8,233	9,300
	1 " " '01	34,169	17,089	17,080	8,333	8,747
	9 " " '02	308,241	179,124	129,117	75,000	54,117
	9 " " '01	275,564	153,324	122,240	[illegible],000	47,363
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., Aug. '02	24,340	12,033	12,307	......	......
	1 " " '01	16,849	9,025	7,824	......	......
	6 " June '02	111,972	60,838	51,136	......	......
	6 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O. The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Oct. '02	41,747	22,648	19,099	16,512	2,587
	5 " " '02	226,249	112,854	112,895	81,353	30,042
LONDON, ONT. London St. Ry Co.	1 m., Sept. '02	18,157	8,648	9,509	2,110	7,399
	1 " " '01	15,034	7,854	7,179	1,873	5,306
	9 " " '02	115,661	70,812	44,849	20,284	24,565
	9 " " '01	106,709	65,919	40,790	17,848	22,942
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Sept. '02	259,591	110,736	148,854	70,591	78,263
	1 " " '01	210,689	93,587	117,045	68,996	58,047
	9 " " '02	2,014,941	946,509	1,068,432	596,611	471,821
	9 " " '01	1,765,217	858,339	906,878	561,402	345,507
	12 " Dec. '01	2,442,312	1,185,534	1,256,808	755,159	501,609
	12 " " '00	2,220,098	1,129,787	1,090,911	884,065	206,247
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Sept. '02	339,638	130,611	209,059	60,233	148,825
	1 " " '01	306,394	123,131	183,263	57,573	127,886
	9 " " '02	2,667,096	1,191,380	1,475,776	530,733	945,042
	9 " " '01	2,340,105	1,068,846	1,271,318	508,272	768,044
MONTREAL, CAN. Montreal St. Ry. Co.	12 m., Sept. '02	2,046,290	1,135,170	911,082	......	......
	12 " " '01	1,900,681	1,105,267	795,413	......	......
NEW YORK CITY. Manhattan Ry. Co.	12 m., Sept. '02	11,583,546	5,545,395	6,038,151	2,712,090	3,326,062
	12 " " '01	10,455,872	5,328,649	5,127,223	2,683,132	2,444,091
Metropolitan St. Ry.	3 m., Dec. '01	3,997,986	1,753,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786,030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '02	15,908,641	7,383,883	8,490,758	4,913,421	3,665,337
	12 " " '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y. Olean St. Ry. Co.	3 m., Sept. '02	18,401	8,135	10,266	4,088	6,208
	3 " " '01	16,372	6,967	9,405	4,200	5,296
	12 m., June '02	56,053	29,118	26,937	16,318	10,619
	12 " " '01	54,018	28,228	25,790	16,755	9,035
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co	3 m., Sept. '02	9,400	5,212	4,200	2,098	2,186
	3 " " '02	28,674	16,881	12,793	6,250	6,543
	12 " June '02	86,793	*56,392	30,400	23,126	7,277
PHILADELPHIA, PA. Union Traction Co	12 m., June '02	14,118,159	6,402,339	7,715,830	*6637781	1,078,048
	12 " " '01	13,431,681	5,826,186	7,605,494	*6734828	861,966
American Railways	1 m., Oct. '02	98,875	......	......	......	......
	1 " " '01	82,190	......	......	......	......
	4 " " '02	440,068	......	......	......	......
	4 " " '01	345,132	......	......	......	......
	12 " June '02	1,000,349	......	......	......	......
	12 " " '01	841,208	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., Sept. '02	93,762	46,063	47,699	24,833	22,866
	1 " " '01	82,489	45,854	36,573	24,942	11,682
	9 " " '02	821,852	433,691	388,161	223,361	164,800
	9 " " '01	758,110	449,254	308,856	222,016	86,840
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., Sept. '02	61,164	33,545	27,619	19,025	8,594
	1 " " '01	53,964	29,694	24,300	19,025	5,275
	3 " " '02	184,314	101,254	83,060	57,075	26,015
	3 " " '01	168,308	91,526	76,842	57,081	19,821
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., Sept. '02	127,640	62,001	65,639	28,921	36,717
	1 " " '01	114,667	50,512	64,156	27,813	35,343
	9 " " '02	1,069,059	546,588	522,470	342,759	179,708
	9 " " '01	959,099	460,885	498,214	301,730	196,484
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,192,517	*616,945	565,572	409,051	156,521
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,270	133,288	53,987	......	......
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	1 m., June '02	56,635	35,622	21,013	25,000	†3,986
	1 " " '01	56,936	35,600	22,336	25,000	†2,663
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co.	1 m., Sept. '02	39,618	*22,401	17,217	......	......
	3 " " '02	116,522	*63,040	51,482	......	......
	6 " June '02	198,050	*110,391	87,659	......	......

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Advertising of Interurban Electric Railways

Advertising of interurban, and even of city electric railways, is now becoming so general and so much thought is being given the preparation of attractive folders and other advertising matter that it is the belief of the editors of the STREET RAILWAY JOURNAL that it would be of value to those in charge of advertising of interurban roads in one part of the United States to know what those in other localities are doing. A great many excellent and original ideas in the advertising of interurban roads may be found in different parts of the country, but because of the necessarily local circulation of the advertising matter of an electric railway, the advertising men of roads in other parts of the country seldom see what their distant brethren are doing. It is with the hope that some helpful ideas in this class of advertising will receive greater circulation that the STREET RAILWAY JOURNAL will, from time to time, reproduce as nearly as possible pages from the most attractive or striking advertising folders, timetables or other matter published by various electric railways over the country, together with such comment as may seem advisable to make clear the local conditions under which the advertising matter is published, and to call attention to the principles of advertising exemplified in the matter reproduced. Unfortunately, it is not possible in the pages of technical journals of this kind to reproduce timetable folders in the original colors, and much of the effect is therefore lost in some cases; but even if the full effect is not obtained from the reproduced pages, sufficient idea will be given of the nature of the advertising matter so that those interested can write to the company publishing the matter and obtain the originals if desired.

A set of folders issued by the Aurora, Elgin & Chicago Railway is published elsewhere as the first of the series of advertising literature alluded to.

Manhattan Report

The annual report of the Manhattan Railway Company, which was published in our last issue, contains some statistics that cannot fail to be of interest to those who are studying the transportation problems of New York. During the year the company carried 223,427,283 passengers, as against 194,152,316 in 1901, showing an increase of 29,274,967 in twelve months, and 2,020,086 over the best previous year in the history of the company. The increase in the gross receipts during the last year amounted to $1,447,182, while the operating expenses for the corresponding period were increased only $216,746, although the cost of fuel had advanced considerably during the year. This improvement is attributed to the introduction of electricity, and it is confidently predicted by the management that a much better showing will be possible next year after the entire system is electrically equipped. April 1, 1903, is named as the extreme date, when, in the opinion of the management, the last locomotive should be discarded on the L roads of New York. In the meantime the gradual transformation will be accomplished with as little inconvenience to the public as possible, and without disturbing traffic conditions any more than is absolutely necessary. It is not to be expected, of course, that a system carrying nearly a quarter of a billion passengers annually can make such a radical change as that of substituting electricity for steam locomotives on its lines with absolutely no confusion or interruption whatever, yet the record of the Manhattan in this respect approximately attains this result.

An examination of the reports of the last ten years suggests the thought that even with the improved facilities of the Manhattan Company the capacity of the present elevated system must soon be reached if the present rate of growth is maintained in the Harlem and Bronx districts. Previous to last year, as has already been noted, the highest passenger movement was reached in 1893, when 221,407,197 passengers were carried. In this period the reports show the following totals by years: (1893) 221,407,197, (1894) 202,751,532, (1895) 187,614,958, (1896) 184,703,639, (1897) 182,964,851, (1898) 183,360,846, (1899) 174,342,575, (1900) 184,164,110,

(1901) 194,152,316. The drop recorded in 1894 was due to the introduction of improved methods on the surface lines. With the betterments in this service much of the short haul traffic was diverted from the elevated to the surface system, but of late years the increase of population in the outlying districts has more than offset this loss, and the reports have been very favorable. The remarkable showing in the elevated passenger movement last year is due partly to the uptown movement of population, and the growth of the districts too remote from the business centres to be quickly reached by surface lines, but the fact must not be overlooked that much of the gain must be attributed to the progress in the substitution of electricity for locomotives, thus giving new and more comfortable cars, better lights, longer trains, higher speeds, and a much better provision for the public comfort in every way than was possible with steam locomotives. The extension of these improvements to the entire system will doubtless result in further gains. It is a significant fact that even the partial electrical equipment of the system has resulted in a reduction of the operating expenses (exclusive of all taxes) from 55.38 in 1901, to 50.10 in 1902.

Interurban Terminals

On another page of this issue will be found a reference to the traffic arrangement just in force between the Boston Elevated and the Lexington and Boston companies, whereby the cars of the latter are now run through from Lowell, Mass., to the Sullivan Square terminal in Charlestown. Up to the present time the only foreign cars to enter Boston have been, as far as we are aware, those operated on the Scollay Square loop of the Boston Subway by the Lynn and Boston branch of the Massachusetts Electric Companies. The new line soon to be operated by the Boston & Worcester Street Railway Company will also bring foreign cars into Boston, the plan being to terminate the route at the Park Street subway station, which is the traffic focal point of the entire Boston Elevated system.

It is evident to the most casual student of transportation that the terminal facilities thus to be enjoyed by these roads, with their superb transfer privileges, and provision for protection against inclement weather, are no small advantage when their influence upon traffic is considered. No progressive manager can well afford to ignore the problem of adequate terminal accommodations, as the speeds of interurban roads climb steadily up to the level of steam railway practice. It is manifestly impossible for many roads to make much terminal provision unless their resources are considerable, but it must be borne in mind that some kind of terminal facilities is almost indispensable to any road which has the comfort of its patrons under consideration. Many of the street railway waiting rooms, which to-day abound in cross-country trolleying, are quite unfit places for ladies and children to wait for cars, and offer comparatively unattractive shelter from the storms and wind of a rainy day.

In our issue of Aug. 30, 1902, there was described a large interurban terminal station which has been built in Cincinnati. While many roads are utterly without the means to build and operate such a station as this, or are geographically unable to secure such terminal facilities as the lines centering in Boston are about to enjoy, we feel assured that it is within the power of every electric interurban railway worthy of the name, to provide suitable, clean, well lighted, sheltered and protected waiting rooms for the benefit of its passengers, who are to travel from city to city over its lines. It is a fortunate line, indeed, which can secure accommodations like these in Boston and Cincinnati.

Some of the greatest advantages enjoyed by the present steam railways are the terminal facilities which have been erected at large expense, and as the days of electric suburban equipment of steam roads approach, the electric railway manager who provides waiting places, rooms or some sort of terminal accommodations, modestly suitable to the needs of his road's patrons, is going to gain traffic which would otherwise be lost to the electrically-operated steam road, and not be left behind in the march of transportation progress.

High Speed on Electric Lines

Car No. 18 of the Lake Shore Electric Railway, which has several times been referred to in these columns by reason of its speed performances, recently made a run from Cleveland to Toledo which proves conclusively that electric interurban roads are fast approaching a stage of perfection which will enable them to compete with steam roads for long-distance traffic. The running time from Cleveland to Toledo for the Lake Shore (steam) trains is three and one-half hours. The road is famous as being one of the finest in the country, and the fast trains make but one stop in the 110 miles. The Lake Shore Electric takes a longer route, nearly 120 miles, and passes through the centers of a dozen large villages and towns where high speed is impossible. Added to this handicap are the facts that the road is practically new, much of it unballasted and that it requires forty-five minutes to follow the city cars out of Cleveland and twenty-five minutes into Toledo. Yet the actual running time for Car 18, on the run mentioned, was three hours and twenty-two minutes. The car was a special and was heavily loaded with a party of Eagles returning from a convention in Cleveland, but it made remarkable time between certain points. The run from Bellevue to Clyde, 8 miles, was covered in nine minutes, and the next 8 miles, to Fremont, in ten minutes. Between Monroeville and Norwalk the running time was slow, owing to the present unsatisfactory condition of the track. The run out of Cleveland, 7½ miles on city tracks, took twenty-two minutes. The car which made the Toledo-Cleveland run on the previous day was equipped with the standard Lake Shore equipment of four 75-hp motors, and its elapsed time was four hours, including a thirty-minute stop at Norwalk. No. 18 has four 125-hp motors, with multiple-unit control. It is now proposed to cut the regular schedule down to four and one-half hours, and possibly to four hours, when improvements now under way are completed. This will certainly be a radical innovation.

Coincident with the performance at Cleveland the announcement is made from Berlin that recent experiments with electric trains on the Zossen-Berlin military railroad have resulted in demonstrating that a speed of 75 miles an hour can be maintained without destructive wear of motors or roadbed. It is not known whether the results referred to were obtained with the Siemens & Halske locomotive, described in these columns Nov. 8, but it is stated in the despatches that the motors were modified preparatory to the tests just held, and this would seem to indicate that the new electric locomotive had been tried. It is added, however, that the trials have been suspended in order to change the machinery and the roadbed further.

New Transfer System of the Chicago Union Traction Company

The Chicago Union Traction Company put in operation a new system of transfers Nov. 16 which enables a passenger to ride from any point on the North Side and West Side of Chicago to any other point without limit to the number of transfers, provided he does not attempt to travel back toward the point from which he started. This transfer system was adopted in compliance with the recent decision of the Illinois Supreme Court, which has been previously noted and commented upon in these columns. The problem before the management of the Chicago Union Traction Company was to provide practically a universal transfer system, but to prevent a person from making a round trip from one point to another and back again on one fare.

The transfer which has been adopted is illustrated and explained on another page. It has the merit of simplicity and involves little labor in punching on the part of the conductor. It is one thing for a transfer system to be theoretically perfect without a loophole for misuse, and quite another to be practically so simple as well that fraud or misuse will be easily detected by the conductors and auditing department. An elaborate transfer ticket, no matter how refined in theory, is sure to open the door to abuses in heavy city traffic, where conductors have time neither to punch such a ticket nor to examine it minutely upon acceptance. The simplicity of

the Chicago transfer is therefore admirable, considering the conditions under which it is used, and as long as the transfers are properly punched and examined before acceptance by the conductors there is no opportunity for abuse of the transfer privilege.

The principle of the system is that when once a passenger has established his general direction of travel he cannot change that direction. The transfer slip given passengers on the West Side, for instance, bears the names of the West Side lines. On the North Side a different slip is used, containing the names of North Side lines. The placing of all the lines on one transfer slip would make too crowded a transfer. Besides, since the issuing line only is punched on a transfer there is no necessity of having all lines enumerated on one slip. When a passenger paying a cash fare asks for a transfer he is given one upon which the hour, route and direction of travel of the car at the time the transfer was issued are punched. The date is printed on the ticket and the conductor stamps his badge number upon it, opposite the date line. The direction is punched in one of the four spaces at the top, adjacent to the date line, and also in the space reading "for cash to any intersecting line." The operation of the system is fully explained in the company's instructions to the conductors, which are printed elsewhere in this issue, together with sample tickets. Transfers are issued at the time fare is paid.

A strict compliance with the plan as described permits a passenger to make a zigzag course from one side of the city to another, but there is always the check of the direction punched on the previously issued transfer to prevent him from going back in the direction from which he came.

There are special cases where a passenger might need to travel in the direction in which he started for a short distance, in order to reach a given point on the opposite sides of a rectangle, where the cross-town lines are not frequent. In such a case he is given a "special" transfer, which is the regular transfer slip punched in the space reading "special," and showing the direction in which it is good. These tickets are good going back toward the direction from which the passenger originally started, but are good for passage only to the next intersecting line.

The working of the new plan will be followed with interest by street railway men generally, as the conditions in Chicago are not at all favorable to a universal transfer system. The effect on the receipts of the company will also be carefully noted.

The Union and the National Guard

One result of the strike on the Hudson Valley Railway lines, the expulsion of William Potter, of Schenectady, from the Painters and Decorators' Union because he was a member of the militia, has attracted wide attention during the last week. The immediate reason for this action was the fact that Mr. Potter was a member of the company which was called out last month to protect the property of the Hudson Valley Railroad Company during the recent strike on that road, so the incident possesses an unusual interest from a railway standpoint. There is a State law which provides a severe penalty to any employer who discharges an employee for doing jury duty or belonging to a labor union, but there seems to be no statute by which the persons responsible for the expulsion of a member of a union for serving the State in the militia can be reached. Nevertheless, the offense is one which is a most serious offense against the safety of the State, and one which constitutes at the same time a defiance of the right of the State lawfully to protect property.

As may be imagined, the act of the Schenectady union is being denounced by the reputable press of the country and all right-minded citizens. Nevertheless, a few representatives of labor unions are quoted as justifying the action and as being opposed to members of trades unions joining the National Guard They do not openly come out in defense of riot, but their sentiments admit of no other construction. If a member of a trades union is debarred from joining the National Guard, it simply means that the unions favor disorder and the destruction o. the property of those who will not be governed by any arbitrary fiat which they may issue. This is very much farther than most labor leaders have ever gone before. Even the most radical, when it has served, or has seemed to serve, their ends, have at least openly taken the ground that they disapprove of unlawful acts, and that all disorder is generally performed by persons outside of the union. But the action taken by the union at Schenectady conclusively proves that those who are responsible for it, at least, are willing to go on record as enemies of the State itself.

It is said that under the present laws of the State of New York action of this kind cannot be punished as treason, although it is somewhat difficult to imagine how a more treasonable act could be committed by a body of citizens than the expulsion of a member because he obeyed the laws of the State and volunteered for its defense, except, possibly, that of actually levying war upon it. The labor leaders have tried the patience of the public on more than one occasion, almost to the snapping point, and they should take warning. The American public is very good natured, too much so sometimes, and is too apt to give its sympathy to the "under dog," whether the canine deserves any sympathy or not. But when the dog proceeds to bite everybody within a radius of half a mile it does not take long for the bystanders to conclude that he has hydrophobia and should be despatched with the least possible delay.

The Schenectady Boycott

Coincident with the Potter incident, the Schenectady trades unions have further distinguished themselves by declaring a boycott against the Schenectady Railway Company. This company employs about 250 motormen and conductors, who are perfectly satisfied with their work, and who do not want to form a union. This, however, did not satisfy the committee of the Trades Assembly, and to compel the railway company to force the employees to form a union a boycott was instituted Nov. 18 against the railway. The anomalous condition is thus presented of organized labor declaring war against a body of men who have no dispute with their employers, for the sole purpose of dragging them into a union for which they have no use. The threat is made that if any union workman rides on the cars he will be expelled, and if they are patronized by trades people the latter will lose their union custom. An effort has even been made to compel the City Council to cancel a contract made with the railway company for street lighting, as punishment for not bringing pressure to bear upon the employees to give up their freedom.

The reports of the boycott, as we go to press, indicate that it will fail as dismally as it was fated to, and as it should, on account of the absurd grounds upon which it was instituted. Attempts of this kind and of the nature indicated by the attack on the National Guard in the Potter incident do more to put back the interests of labor, and even of the unions themselves, than can be recovered in a good many years. The cause of labor has had no greater enemies than its own leaders. Made seemingly great by a little brief authority, and having no sense of responsibility, the president or governing officers of a labor union are more than apt to assume some absurd position which they cannot possibly sustain, and so are ignominiously defeated. A reform will not come until the men themselves recognize the fact that they must elect as executive officers men who have a profound sense of the responsibility of their office, who are loath to take any position which is not fundamentally sound, which does not interfere with the rights of others, and which will be sustained by the public, who will, in other words, exercise the same caution, conservatism and regard for contracts as would be exhibited by the management of a large business corporation. These qualities cannot be found in the radical, froathy minority which now usually dominates the councils of a trades union and secures control of all the principal offices.

Nottingham Corporation Tramways

In the STREET RAILWAY JOURNAL for May 4, 1901, a short description was published of the plans of the Nottingham Corporation for the conversion of its tramway system to electric traction. At that time only one section had been opened—from the Market Place to Sherwood—which consists of 2⅛ miles of double track. This section was opened for traffic on Jan. 2, 1901. A second section, of about 4½ miles, was put in operation on July 23, 1901, and other sections have been added to the system, which now includes about 30 miles, measured as single track.

The first two sections were laid with the rail and joint, described in the issue of May, 1901. An alteration was made in the other sections, and the accompanying engraving shows the section of rail now being used. The rails weigh 107 lbs. per yard, and are in 60-ft. lengths. The groove in the rails, as shown, is 1⅛ ins. wide and 1¼ ins. deep. The fish plates weigh 77½ lbs. per pair, are 31 ins. long, and are secured to the rail by eight 1-in. bolts. The joints are fitted with Cooper's patent anchor joint plates, which, as shown in the section, consist simply of a piece of rail 30 ins. in length, inverted and secured to the bottom flange of the rail by eight ⅞-in. bolts. In addition to this joint brace there are in every 60-ft. length of rail two cross anchors, each 2 ft. long, placed at right angles to the rail and bolted to the bottom flange of it by two ⅞-in. bolts. The joint rail and the cross anchors are carefully laid with 6 ins. of concrete underneath and around them, and the fine bedding is carefully rammed under, so as to make a thoroughly sound bed. The object of the cross anchors is to guard against the creeping of the rails, especially on the steep inclines which are so frequent in Nottingham. Lock nuts are used throughout. Great satisfaction has so far been expressed as regards the use of the anchor joint plates; they give a much easier running joint than with the ordinary sole-plate.



SIDE BRACKET, CENTER AND SPAN POLES

The paving consists mainly of 6 ins. x 3 ins. granite blocks, the greater portion of which were obtained from the Leicestershire quarries, but Norway and Aberdeen granite blocks have also been used. A considerable quantity of Jarrah and Karri wood paving has been laid down in some of the main thoroughfares in the center of the city.

The tramways committee has adhered principally to the double-deck, single-truck car, with the reversed stairway, as built by the Electric Railway & Carriage Works, of Preston. The single truck was adopted in consequence of its being well known as a good hill climber, as some of the grades in Nottingham are from 7 per cent to 9 per cent. Owing to a popular demand for eight-wheel cars, however, an order was placed for sixteen of this type,

EXTERIOR OF BULWELL CAR HOUSE

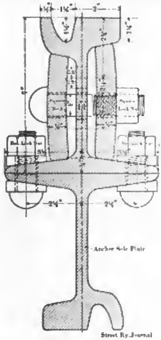
EXTERIOR OF TRENT BRIDGE CAR HOUSE

with maximum traction trucks, with only two motor equipments to each car. Six of the cars were put on the road, but with a greasy rail they often became stalled on moderate grades, or say one of 4 per cent, and it was not an unusual sight to see one of these cars, unable to proceed, being compelled to wait to be pushed along ignominiously by a well-filled four-wheel car. It was then decided to change the equipments of the remaining ten cars to have equal-wheel double trucks and four motor equipments. This work is being carried out by the British Westinghouse Company, and it is hoped that these cars will mount any hill in Nottingham in any weather. All the eight-wheel cars are fitted with the Newell magnetic brakes, and so far this brake has exceeded all expectations. The seating capacity of the eight-wheel cars is seventy-four persons.

The British riding public shows a decided preference for double-deck cars, as passengers have the option of traveling either inside or outside, as weather permits, and the upper deck provides accommodation for smokers, who form a good proportion of the riding public.

The poles and fittings have been supplied principally by Spencer & Co., of Wednesbury. The Mannesmann Tube Company supplied some poles, and R. W. Blackwell & Co. have also supplied some poles and fittings. Where the road is sufficiently wide center poles have been adopted, as shown in one of the engravings. Elsewhere span and single bracket construction has been employed.

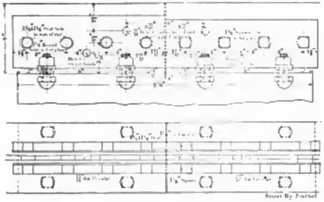
The car house at Sherwood was illustrated in the previous article; another car house has been erected at Bulwell, which is 284 ft. long and 77 ft. wide, and will accommodate forty cars. This building was built in remarkably quick time, only twelve weeks being occupied in its construction. The car house and repair shops forming the Trent Bridge Depot, shown herewith, were completed in May of this year, and altogether form a very convenient and imposing set of buildings. The car house proper is 266 ft. long and 126 ft. wide, and contains spaces for eleven tracks and accommodation for from eighty to ninety cars. The steel roof is in three spans, the center one being 54 ft. 8½ ins., and the two side spans 36 ft. ¾ in.; the height from rail level to springing of roof is 21 ft. 6 ins. At the front there are nine entrance openings for cars, fitted with the B. & S. Folding Gate Company's revolving shutters. On the right-hand side on entering the building is a two-story office, and on the left-hand side a mess room and conveniences for motormen and conductors. At the other end of the building is a transfer table. All of the track space is "pitted," and is admirably adapted for its purpose.



SECTION OF JOINT


SPECIAL WORK, CORNER OF LENTON BOULEVARD AND DERBY ROAD

Adjoining the car house is a repair shop for motors, etc., 120 ft. x 63 ft., roofed over in two bays, each 31 ft. 6 ins. span. The height from the rail level to springing of roof is 24 ft. 6 ins., and 19 ft. from rail level of shop to rail level of traveling cranes. There are two tracks in the shop, "pitted" so as to give access underneath the cars. The repair shop contains the following machinery: Two 5-ton electric traveling cranes, hack saw, vertical and radial drills, lathes, emery wheel, wheel grinding machine, shaping machine, wheel borer and wheel press. The machinery in the repair shop will be driven by two motors, and the shop is fitted with an oven heated by gas for drying armatures, etc.



PLAN AND SIDE ELEVATION OF JOINT


END VIEW OF LARGE SPECIAL WORK

The carpenter shop is 66 ft. long x 32 ft. wide. It contains two

tracks, and is equipped with the necessary woodworking machinery for economically dealing with repairs and maintenance of cars. It is not the Corporation's intention at present to undertake the building of cars. The paint shop is the same length as the carpenter shop, but is 27 ft. 9½ ins. wide, and has also two tracks. This, as well as the carpenter shop and repair shop, is well heated with hot-water pipes. A blacksmith's shop with two

INTERIOR OF BULWELL CAR HOUSE

forges adjoins the repair shop, with convenient access from one to the other. In the blacksmith's shop is the boiler for heating the building, and adjoining this shop is the sand drying furnace.

At the back of the repair shop are situated the stores. On the ground floor there are two store rooms, each 31 ft. 6 ins. x 30 ft. On the upper floor there is another store room 31 ft. 6 ins. x 30 ft. There are also oil stores, salt stores, carriage house, cart shed, stable for three horses and a residence for the superintendent in charge of the depot.

The comforts of the men when off duty have been carefully and considerately looked after. Over one of the ground floor stores before mentioned there is a recreation room, supplied with papers, books, chess, draughts and other games, and over the carriage house and cart shed is an exceedingly well arranged and lighted billiard room to hold two full-size tables with benches on one side. It is believed that these rooms are very much appreciated by the men.

The whole block forms a group of buildings which show that they have been carefully planned and thought out, and are a credit to those who have been connected with the work. The buildings do not display any undue or lavish expenditure of money to obtain architectural effect, but are plain and substantial. There is also a yard of large area, in which stores of rails, etc., can be kept.

The tramways committee of Nottingham has not adopted the principle of having one huge car house to hold all the cars in use, but to have three or four at points near the termini, where land is cheap, and so that a large proportion of the cars can start their journeys immediately on leaving the house, and not have to run empty for miles before they commence carrying passengers.

The traffic carried on the tramways has exceeded all anticipations. Until the sections are all completed and opened for traffic it is impossible to say what the possibilities are as regards the tramways undertaking; it may be said, however, that for the fifty-two weeks ending March 31, 1902, 16,170,613 passengers were carried, and the total income was £78,-753. The passengers carried per week usually number about 450,000, or about twice the population, and it is the hope of those interested in tramway management that when the system is fully completed at least three times the population will be carried in one week. During the week ending Oct. 9 the number of passengers carried was 628,302. So far, as the result of having a good road and good management, there have been few accidents. For nine months the cars have run without one single case of derailment.

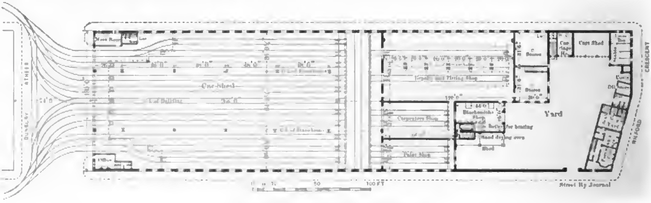
POWER STATION

The power for the tramways up to the beginning of August, 1902, was supplied from the electricity station in Talbot Street. As the demand for electric light and power for ordinary motors was so rapidly increasing this was only a temporary expedient until a new power station could be completed and equipped. This station will provide not only the power for working the electric tramways, but will also be used for the supply of current for ordinary lighting purposes, and is under the control of the electricity committee. The charge made to the tramways committee for current at the present time is 1¼d. per unit. The amount now required is about 50,000 units per week.

The new station is situated in a fairly central position, the site being chosen on account of its accessibility. The area is about 7520 square yards, only about half of which is occupied by the buildings about to be described.

The buildings were commenced in November, 1900, and were practically completed by October, 1901. The chimney, however, was not completed until early in January of this year.

The boiler house is a very commodious room, 239 ft. 6 ins. long, 53 ft. wide, and is 25 ft. high to the springing of the roof. The principals are of steel, and are 11 ft. 7 ins. and 10 ft. 7 ins. centers. The whole of the interior walls, where exposed, are faced with glazed bricks. At present eight boilers only are being installed (or half the capacity of the house). These boilers are each 30 ft. long and 8 ft. diameter; they are designed for a working pressure of 160 lbs. per square inch, and have been supplied by Yates & Thom, of Blackburn. The boilers are equipped with Vicar's mechanical stokers, with elevators and automatic conveyors to feeding hoppers, and the coal is not handled after being tipped into the pits in which the elevators work. The boilers are fed by Weir's pumps, through a Berryman heater, which is capable of heating 4000 gals. of water per hour from 60 degs. to 212 degs. The economizer was supplied by E. Green & Sons, Ltd., of Manchester, and contains 256 tubes, arranged in two sections. The



PLAN OF TRENT BRIDGE CAR HOUSE

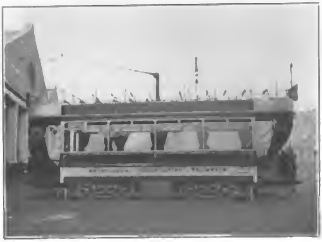
scrapers are driven by an electric motor. The feed water is always delivered to the boilers about 212 degs. temperature. There is space in the boiler house for eight more boilers, with feed pumps, heater and economizer of the same capacity as arranged for the eight boilers already fixed.

Provision is made for water storage in case the water from the mains is cut off for a few hours, by means of an underground tank with arched top, 60 ft. long x 9 ft. wide, and 15 ft. to summit of arch. This tank has a capacity of about 50,000 gals.

The chimney is a very fine structure, 220 ft. high from ground level, and 252 ft. from bottom of foundations to top of iron cap. The concrete bed upon which the chimney stands is 39 ft. square, and is laid upon hard sandstone rock. The chimney is of octagonal shape, and the inside is 15 ft. at the bottom and 13 ft. 6 ins. at the top. It is surmounted by an iron cap, 9 ft. high and weighing 25½ tons, and is lined with firebrick to a height of 65 ft. above ground level. Two exhaust pipes are carried up inside the chimney, each 30 ins. diameter, for carrying away into the atmosphere the exhaust steam from the engines. The weight of these two pipes is 80 tons. The total weight of the chimney, including exhaust pipes, concrete foundation, etc., is 4050 tons, and the weight on the rock foundation is only 2.66 tons per square foot. The number of bricks used in the construction of the chimney is 745,000

BILLIARD ROOM FOR EMPLOYEES

CHIMNEY OF POWER STATION



DOUBLE-TRUCK CAR

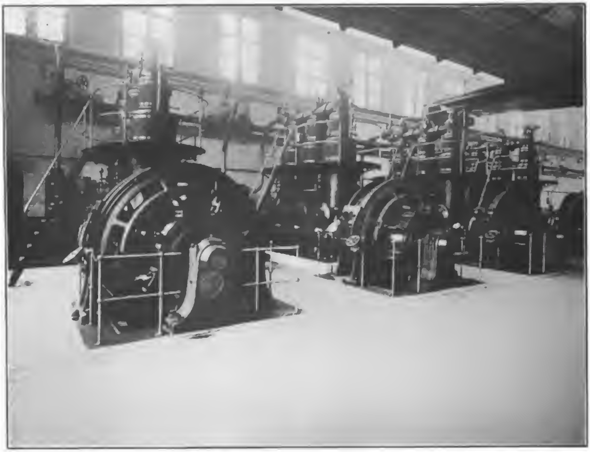
INTERIOR OF REPAIR SHOP

INTERIOR OF TRENT BRIDGE CAR HOUSE

The flue at the back of the boilers is 12 ft. x 6 ft., and the main flue is 12 ft. x 7 ft., which divides into two flues, 12 ft. x 5½ ft., entering the chimney on opposite sides. The main flue is carried under the engine house as a reserve flue, as it is expected in the near future that the whole of the plant will require to be doubled, in

which case another chimney would be built for the second boiler house, but the arrangement of the flues and dampers is such that the gases could all be turned into one chimney while the other underwent examination or repairs.

Brown, M. I. C. E., the city engineer to whom this paper is indebted for the particulars from which this article was prepared. Mr. Brown has been very ably assisted by T. Wallis Gordon, the assistant engineer. Herbert Talbot, M. I. E. E., the city electrical



INTERIOR OF ENGINE ROOM, NOTTINGHAM TRAMWAYS

The engine house is 206 ft. long by nearly 40 ft. wide, and is 27 ft. to springing of roof, and 18 ft. to traveler rail. It is roofed with steel principals, 9 ft. 10 ins. centers, and, like the boiler house, the whole of the interior faces of the walls are lined with glazed bricks. The floor of the engine house is 10 ft. above the level of the boiler house floor. This difference in level is desirable in any case, but here the configuration of the ground rendered it necessary. One side of the engine house is carried on steel stanchcons, and is at present temporarily filled in with timber framing, boarded on the inside and covered with corrugated iron on the outside. When the demand for power for tramways and current for electric lighting exceeds the capabilities of the buildings described, it is proposed to practically double the size of the engine house by having one of equal size alongside, thus forming one room 206 ft. long x 80 ft. wide. The traveling crane is of 15-ton capacity, and was supplied by Marshall, Fleming & Jack, of Motherwell. Six 700-hp or 440-kw Willans compound valve engines have been ordered. Four of these are practically finished, and it is expected that the other two will be in running order in a couple of months. The engines are direct-coupled to Siemens's multipolar generators, of the latest type, contain all the latest improvements, and are fitted with Sankey's patent automatic expansion gear. The traction switchboard has been supplied by Siemens Bros. & Co., Ltd., of Woolwich, and consists of four dynamo panels, each fitted with an automatic circuit breaker, ammeter, shunt regulating switch and single-pole switch, one board of trade panel, carrying the necessary recording and testing instruments, and six feeder panels, each fitted with a circuit breaker, recording ammeter and single-pole switch and fuse.

The panels are of white marble, and are carried in wrought iron frames.

The buildings are of a substantial character, principally of brick with stone dressings, and have been well thought out and every point apparently well considered.

The whole of the engineering and constructional (except electrical) work in connection with the tramways, including the power station, car houses and depots, has been carried out by Arthur

engineer, is responsible for all the electrical work in connection with the tramways and the power station.

The manager of the tramways is John Aldworth, whose previous

BOILER ROOM, NOTTINGHAM TRAMWAYS

large experience eminently fits him for dealing with the large and rapidly increasing traffic in Nottingham.

The St. Louis Transit Company has disposed of its old power house at Broadway and Lami Street to parties who propose to convert it into a vaudeville theater.

New Transfer Regulations of Chicago Union Traction Company

Under the recent decision upon the transfer question the Chicago Union Traction Company has organized a comprehensive system of transfers to meet the requirements of Judge Magruder's ruling.

It is the intention of the company to comply fully with the spirit as well as the letter of the law, and give passengers who desire it a ride from one point to any other point on the company's lines for a 5-cent fare and any number of transfers he may require to make the trip, but an effort will be made to prevent the abuse of the privileges thus extended, and not issue transfers to passengers that will allow them to return in the direction from which they started without paying an additional fare. The new order was issued by T. A. Henderson, general superintendent, on Nov. 14, and went into effect on Sunday, Nov. 16. It was accompanied by the following instructions to conductors to guide them in this work:

For a cash fare you will issue a transfer, punching the direction the car is going, the time, the name of the line issuing and the section reading "For cash to any intersecting line." This transfer will be accepted on any intersecting or connecting line except on a line which would carry the passenger back in the direction from which he started.

When passengers present a cash transfer and in exchange for it request another transfer, the conductor issuing the second transfer will punch the direction in which his car is going, time, the line issuing the transfer and the section at the bottom of the transfer which contains the words north, south, east or west only. In regard to the direction in which the passenger will be entitled to go, these transfers are to be punched as follows:

A cash transfer issued by south-bound cars when presented on to a west-bound car will entitle the passenger to a ride south on any intersecting line west of the receiving point on a transfer to be punched "south only." When this transfer is presented on a south-bound car and another transfer is requested the conductor will punch "west only." Should this transfer be presented to a car going west which receives transfers from the issuing line, the conductor will, on demand, issue another transfer punched "south only." There shall be no limit to the number of transfers on transfers this passenger may receive, provided the transfers that he uses are presented onto the lines properly receiving transfers from the line issuing it, and that his direction of travel continues to be south and west. This zig-zag system of transfers will be allowed for any other direction and from any other starting point.

A passenger may go north and west, and north and west again repeatedly, to the end of the system. He may go north and east, and north and east again, until he reaches the end. He may go west and south, or he may go west and north as many times as he chooses. He may go east and south, or he may go east and north, and will be entitled to a transfer to any intersecting line which carries him in that general direction.

Conductors will readily see that it will be necessary to carefully punch the direction in which their car is going and the direction in which the passenger is entitled to ride.

In order to assist in showing conductors what is desired, four transfers are herewith submitted, showing the proper way to punch transfers to carry a passenger over different lines of road.

It will be readily perceived by the sample that the passenger paid a cash fare on a Halsted Street car, south bound, at 7 a. m., north of North Avenue, for which he received transfer No. 1. This he presented to a west-bound North Avenue conductor, who, by looking at the direction in which the Halsted Street car was going, could readily see that the passenger came from the north and was entitled to a transfer punched "south only." The North Avenue conductor therefore issued a transfer similar to sample No. 2. This was given to a conductor going south on Milwaukee Avenue, who gave in return for it sample No. 3, which he punched "west only," because the North Avenue transfer was issued by a car going west. The Milwaukee Avenue transfer was given to a west-bound Division Street conductor, who looked at the direction in which the Milwaukee Avenue car was going, and punched (sample No. 4) the same direction in the transfer section at the bottom of his transfer, thus allowing the passenger to continue his journey on any line going south of Division Street. It would seem that a conductor could readily handle these transfers by simply looking at the top of the transfer received for the direction of the car issuing it and punching out the same direction in the bottom of the transfer to be given in exchange.

Sample No. 1. Sample No. 2. Sample No. 3. Sample No. 4. Sample No. 5. Sample No. 6.

NEW TRANSFER TICKETS ON UNION TRACTION COMPANY'S LINES, CHICAGO

SPECIAL TRANSFER PRIVILEGE

For the purpose of taking care of a class of patrons of this company whose requirements do not seem to be provided for in the general system of transfers, a special rule is hereby placed in effect, which shall be carried out by conductors, as follows:

To a passenger presenting a cash transfer who requests of a conductor a transfer back in the same direction from which he started, the conductor will issue the regular transfer slip showing the direction in which he is going, the time of day and the name of the line, and will also punch the section reading "special, to next cross line only." The conductor who takes up such transfer shall allow the passenger to ride as far as the next street railway crossing, and if he desires to go beyond that point will collect another fare.

This special privilege is intended for the purpose of taking a man around three sides of a square without his paying a double fare.

For instance, the passenger starts on Chicago Avenue, between Western Avenue and California Avenue, and desires to go to a point on North Avenue, between Western Avenue and California Avenue. Our regular transfer on a transfer system would not take him to that point for one fare, hence this special rule.

A man who boards a Chicago Avenue car going west and pays a cash fare, for which he receives a cash transfer, would present this transfer north on California Avenue. Upon requesting a "special" transfer the conductor will issue the transfer punched "special, next cross line only," and also marked "east only." This will entitle the passenger to a ride east after he had started on a car going west, but it would not be good for another transfer, nor would it be good for a ride east of Western Avenue.

If the passenger so desired he could make the same ride by going east in Chicago Avenue to Western Avenue, north in Western Avenue to North Avenue and west in North Avenue to any point he desired to reach as far as California Avenue.

Transfers necessary to make this round trip are submitted herewith properly punched as samples. The same will apply to a great many other places in the system and are the only occasions at present where the special section in the transfer shall be used and also under the only circumstances where a man who goes in one direction shall be given a transfer going back towards his starting point.

Sample No. 5 shows that a passenger paid a cash fare on an east-bound Chicago Avenue car. When this was presented on a north-bound Western Avenue car the passenger, by requesting a "special" section, limited to a ride west to the next cross line only.

All transfers are to be issued at the time fare is collected.

Transfer passengers from extension lines are entitled to the same kind of a transfer as the one they present. Should the transfer be punched "for cash," issue one punched in the same way; if it shows a limitation as to direction, give a transfer with the same limitation shown.

Advertising Leaflets of the Aurora, Elgin & Chicago Railway

One of the railways in the Middle West to give considerable attention to the subject of advertising its schedules is the Aurora, Elgin & Chicago Railway.

Shortly after the opening of the line Secretary Warren Bicknell issued a map and advertising folder for this road, which was excellently adapted to the purpose for which it was designed. The road being a new one, the primary object of the first folder issued was to call the attention of people living in the vicinity of the road to the fact that it was in operation and the advantages to be derived from patronizing it rather than the former means of transportation. Thousands of these were sent to Aurora and towns along the Fox River valley, and also to points west of Aurora. The idea of sending to towns west of Aurora was that many people desiring to make the trip to Chicago might buy tickets on the steam roads to Aurora and then patronize the electric road from Aurora in to Chicago, the electric road being able to offer lower rates, equally quick time, freedom from smoke and cinders, and a new and more pleasant route than the steam roads.

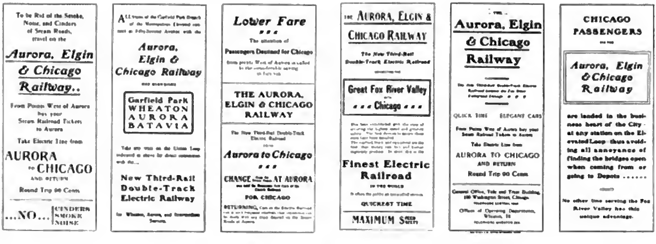
The folder when folded is the standard 4 ins. x 9 ins. timetable folder size. The full size of the sheet is 18 ins. x 24 ins. On one side is a map of the road and also in one corner a map of the down town district of Chicago, showing the Union Elevated loop and the principal buildings. These maps are in black with the exception of the route of the road and the names of the stopping platforms along the road, which are in red. This brings out the route with prominence, and is, furthermore, an easy map to prepare, as it involves but little work save the addition of the portion in red ink to a standard map. While in some cases this ease of

FOLDER FOR AN INTERURBAN ROAD

preparation is not a great consideration, frequently it is desirable to save expense and time in the preparation of a map of this kind, and this is one of the easiest ways to accomplish it. On the opposite side of the folder from the map are pages in very simple type, calling attention to the opening of the road and its advantages, some of which pages are reproduced herewith.

One of the pages not shown contains a table giving rates of fare; another one is a half-tone engraving of a three-car train on the road. As reproduced herewith three of the pages are devoted to a single advertisement stretching across the three as seen. Although this folder is free from the elaborate designs sometimes found on railroad timetables, it is none the less attractive to modern eyes on that account, as the tendency in present railroad advertising is rather toward simplicity and plainness (if the simplicity is not a crude sort), rather than toward elaborate designs, which, to a certain extent, obscure the reading matter. In the folder under discussion timetables are not given, because at the time the folder was published a new branch of the road was about to be opened and further changes in the timetable were soon to occur, so that the timetable was kept on a separate card.

The object of this folder was mainly to advertise the fact that the road was in operation and offered a desirable means of transit. Under a more settled condition, of course, it would be advisable to put a timetable on such a folder as this. However, as the cars were at the time running at half-hour intervals the necessity for timetables was not as great as it would have been had the intervals between trains been greater. The pages of the folder which are here reproduced present a much better appearance in the original because about half of the matter was in red ink, the other half being in black.



ADVERTISING LEAFLETS FOR AN INTERURBAN ROAD

Specifications for Road Bed and Overhead Construction

The requirements of all large railway systems include special features of construction in the overhead work, road bed and distribution to meet local conditions, and this general rule may be said to apply even to the smaller properties, although, of course, not as distinctively as in the more important undertakings. Many projects now under consideration and others that have been in operation several years, and are now entering the reconstruction period, will undoubtedly gain by the experience of other roads and adopt the general features incorporated in systems of about the same size, when the conditions are similar. Several requests, indeed, have been made lately for specifications by promoters and investors who have been contemplating the construction of small roads in different parts of the country, and to meet this demand and supply similar data to other managers who are in the same position the following specifications are herewith presented as examples of work covering both city and suburban service:

SPECIFICATIONS FOR OVERHEAD CONSTRUCTION AND BONDING OF THE DEADWOOD-LEAD CITY BRANCH, CHICAGO, BURLINGTON & QUINCY RY.

The intention of this specification is to cover everything necessary for the complete overhead construction and bonding of the road. If any small details have been omitted which are necessary to make the system complete, so far as the work covered by these specifications is concerned, they will be furnished by the contractor without additional cost to the railway.

The accompanying map, marked Exhibit "A," shows the location of the line, the turn-outs, cross-overs, switches, the terminals and the distance between stations. This drawing is hereby made a part of these specifications.

The line is a narrow 3-ft. gage branch, and operates from Deadwood, S. D., to Lead City. From Deadwood to Pluma the line uses one track of a standard gage branch, over which locomotives are being operated.

The length of line to be equipped at present is nearly 4 miles.

The power house is located at Deadwood, approximately as shown on the map.

RAILWAY, CONTRACTOR AND ENGINEER

Where the word "railway" is used it is understood to mean the Chicago, Burlington & Quincy Railway. Where the word "contractor" is used it is understood to mean the party who undertakes to build the work in accordance with these specifications. Where the word "engineer" is used it is understood to mean a duly authorized engineer or technical representative of the company.

CHANGES

No changes will be allowed in the construction of the electrical work, except such as are approved by the engineer of the railway, and at a price agreed upon in writing before the work is done.

DAMAGES

The contractor shall repair, at his own expense, any and all temporary damages that may accrue to public or private property during the construction of the road, and these repairs shall meet the approval of the engineer. In case suits for damages are brought against the railway, caused by the contractor's workmen during the construction, the contractor shall pay all costs, damages, fees, etc., accruing therefrom. He shall keep at all times where pole holes or other excavation work make dangerous openings, proper guards for preventing teams from driving into these openings, and keep red lights in proper position near these openings at night. It is understood that the contractor will not be held liable for damages caused to property on account of the location of the poles.

TRANSPORTATION

The railway company will furnish free transportation over its line for men, tools and material used in this work.

TIME OF COMPLETION

The road is to be ready for operation not later than ————, and the contractor shall have his entire work completed by that date.

Should the contractor be obstructed or delayed in the prosecution or completion of his work by the actual neglect or default of the railway company, or by any other contractor employed by the railway company upon the work, or by any damage which may happen by lightning, fire, earthquake or cyclone, or by the abandonment of the work by the employees through no default of the contractor, then the time herein fixed for completion of the work shall be extended for a period equivalent to the time lost by reason of any or all of the causes aforesaid, but no such allowance shall be made unless a claim therefor is presented in writing within forty-eight hours from the occurrence of such delay.

Should the contractor at any time refuse or neglect to supply a sufficiency of properly skilled workmen, materials or apparatus of the proper quality, or fail in any respect to prosecute the work with promptness and dilligence, or fail in the performance of any agreement herein contained, such refusal, neglect or failure being certified by the engineer for the railway company, the railway company shall be at liberty, after ten days written notice to the contractor, to provide any such labor, materials or apparatus, and deduct the cost thereof from any money then due, or thereafter to become due the contractor under his contract.

The contractor shall plan his work so as not seriously to interfere with the regular operation of the road. It is understood that the railway will co-operate with the contractor in the delivery of poles and material along the line; the contractor to pay for all labor required for the actual unloading of this material.

ACCEPTANCE OF WORK

When the contractor shall have finished his work in accordance with the specifications he shall notify the engineers in writing, and they will proceed as quickly as possible to examine his work, and if found in accordance with the specifications then the contractor shall be given an immediate acceptance.

If the work is not in accordance with the specifications then the engineers shall make a written list of such faults as exist, and the contractor shall immediately correct the same, and again notify the engineers in writing when he is again ready for an inspection and acceptance.

TERMS OF PAYMENT

The contractor shall be paid by the railway company the fifth of each month, on the engineer's estimates, made the first of each month. The contractor shall receive 90 per cent of the cost of all materials delivered and work performed. The railway company shall retain 10 per cent of these estimates until the contractor has completed his contract, and had same accepted by the engineers. When the engineers accept his work then the contractor shall be accorded a full and final settlement thirty days from his notification of acceptance, and the contractor shall be paid in full all money due him on the contract, less such amounts as may have been adjudged against him as liquidated damages or for claims unpaid.

OVERHEAD MATERIAL

The overhead material shall be guaranteed for two years, and shall be equal to Anderson's or Ohio Brass Company's. Whenever the number of a certain type of material is given it refers to the Ohio Brass Company's catalogue No. 5.

POLES

All poles will be Idaho or Michigan cedar, with a diameter of 7 ins. or a circumference of 22 ins. at the top end. Poles must be reasonably sound at the top end, cut from live timber and pealed. Twenty per cent butt rot will be allowed on all poles, and a crook one way not exceeding 1 in. for every 5 ft. of the full length of the pole, measured from a point 6 ft. from the butt end. The specifications of the Western Cedarman's Association shall apply to these poles.

LOCATION OF POLES

The location of each pole is shown upon the map* L-3-C. This map indicates approximately the location and length of each pole, and also shows where the side-pole cross-suspension method is to be used, and where the bracket method of suspension is to be followed.

SETTING OF POLES

The holes for at least 90 per cent of the poles from Deadwood Street to Main Street and Mill Street, Lead City, must be blasted out of rock. The remaining, or 10 per cent, of the holes will be excavated in dump or dirt. Beyond Main Street and Mill Street, in Lead City, to the terminus of the line, all the holes will be excavated in dirt. Holes for all poles shall be excavated in dirt. Holes for all poles shall be excavated to the following depths:

For	40-ft.	poles in	rock, 6	ft.	deep.
"	40-ft.	"	dirt, 7	ft.	"
"	35-ft.	"	rock, 5½	ft.	"
"	35-ft.	"	dirt, 7	ft.	"
"	30-ft.	"	rock, 5	ft.	"
"	30-ft.	"	dirt, 6	ft.	"

All poles shall be set in the center of a body of concrete, at least 24 ins. in diameter. The concrete shall consist of one part, by measure, of cement, equivalent to the best Louisville brand; three

Note.—For obvious reasons the maps and sketches referred to throughout these specifications are not reproduced here.

parts of clean, sharp sand, and five parts of stone broken to a size to pass through a 2-in. ring.

There shall be a bottom layer of concrete at least 3 ins. in depth, and concrete surrounding poles shall be thoroughly tamped to place, and capped with a neat cement-faced coned water-table with drip above ground.

All poles within the corporate limits of Deadwood and Lead City shall be shaved and painted two coats, color of final coat to be selected by engineer. All poles shall be so set on span construction as to leave 12 ins. of rake in each pole after spans are pulled up.

All poles on bracket construction shall be set with a 6-in. rake. Poles on curves, ends of turn-outs, trolley anchor poles, and trolley dead-end poles shall be anchored by a ⅝ in. x 6 ft. galvanized anchor rod passing through a 6 in. x 8 in. x 4 ft. block of wood, or "dead man." From anchor rod run a 5-16-in. galvanized iron cable secured with two turns about top of pole, inserting a wood-break insulator in each cable guy approximately 4 ft. from poles.

In the face of a cliff where a ⅝ in. x 6 ft. anchor rod cannot be set there shall be set a special ¾ in. x 3 ft. eye bolt, firmly expanded into the rock (see sketch No. 1) by driving in on the wedge at end of bolt, and finally filling the whole with neat cement. A wood break is to be inserted in all spans or guys attached to such special eye bolt.

In two or three places where poles come on bridges they shall be attached to the bent by bolting 3 in. x 10 in. planking on either side of bent about 6 ft. apart, and setting pole between such planking, and bolting same by ¾-in. bolts, using cast washers.

TROLLEY WIRES

Two No. 000 B. & S. gage, Fig. 8, copper trolley wires will be used and must be erected taut, without kinking or cutting same. Trolleys are to be spaced about 6½ ins. apart over single track, and over centers of double tracks. Trolley must be anchored on each side of the joints, using four of the riveted double-strain ears No. 2472, carrying four ¼-in. double galvanized seven-strand steel cable, diamond fashion to opposite poles on each side of track, midway between the two sets of strain ears, on span construction, and on bracket construction, erecting one extra pole opposite the pole nearest the joint, and anchoring said opposite poles, and carrying the four ¼-in. steel cables diamond fashion to said opposite poles from the strain ears. Four wood-break insulators are to be cut into the ¼-in. pull-off wires, 4 ft. from the strain ears. Ends of trolley shall be fastened together with splicing sleeves No. 2509.

Trolley shall be 23 ft. above track from Deadwood to Pluma, and 19 ft. above track from Pluma to the Lead City terminus.

SPAN WIRES

Span wires are to be 5-16-in. double galvanized seven-strand steel cable, fastened (with friction clutch tie) to ⅝ in. x 14 ins. plain eye bolts, having 6-in. thread, nut and washer on all construction Deadwood to Lead City, but within the corporate limits of Lead City the 5-16-in. span wires are to be fastened to insulated eye bolts similar to No. 2557, but ⅝ in. x 14 ins. long.

GUARD WIRE

There will be no guard wire furnished except as an extra.

POLE BRACKETS

Brackets are to be of flexible suspension type, either Richmond or Craighead, with over-support ½ in. diameter; the flexible suspension to be 5-16-in. seven-strand double galvanized steel cable; the tubing to be a tubing 1½ ins. in diameter, and length of bracket 7 ft. 6 ins. The eye bolt at end of bracket arm to have solid welded eye.

HANGERS

Straight line hangers are to be of the round top galvanized type, Nos. 3147 and 3144. Curve hangers are to be galvanized, Nos, 4014, 4013, 4012, 4011.

Straight line hangers are to be used in all spans on straight line or curves from Deadwood to Pluma, but the No. 4014 double-curve pull-over is to be used at all curve brackets from Pluma to Lead. Intermediate pull-overs, Nos. 4012 and 4011, are to be used where single trolley is over double tracks, and intermediate curve pull-over No. 4013 is to be used where double trolley is over single track, and spaced approximately 6 ins. apart.

GUYS

All bridles, head guys and pull-off wires are to be ¼-in. seven-strand double galvanized steel cable.

All slugs, anchors and heavy guys are to be 5-16-in. seven-strand double galvanized steel cable.

TROLLEY CLAMPS.

Bronze trolley clamps No. 2232 are to be used with the No. 3147 S. L. hanger. Trolley clamps No. 2225 are to be used with Nos. 4014, 4013, 4012, 4011 types of curve pull-overs.

FEEDING TROLLEY

Carry a 350-M. C. M. bare-stranded copper cable from the power house on a separate line of 30-ft. poles. These poles are to be provided with two pin cross arms, fastened to the poles with two ½ in. x 7 ins. galvanized lag screws. Each cross arm to have two ¼ in. x 1¼ ins. x 24 ins. galvanized braces fastened with galvanized lags, and each cross arm to be provided with two pins and two cable glass insulators. Poles are to be double cross-armed near power station and trolley line. The feeder is to be dead-ended over the trolleys, having its end made up into a Brooklyn insulator, fastened to the opposite pole by a piece of 5-16-in. double galvanized steel cable. This pole is to be anchored in a manner similar to curve poles. Two 000 jumpers are to be soldered on the feeder and carried into the bronze trolley feeder clamps No. 2376.

LIGHTNING ARRESTERS

Nine Garton pole lightning arresters or others of make approved by engineer are to be erected approximately every half-mile of track, and on pole near power house. Use a No. 6 bare-solid copper wire, running same from the two No. 2376 trolley feeder clamps, as per sketch 5, to the lightning arrester, and continue wire to ground by soldering same to a ⅝ in. x 7 ft. galvanized iron pipe, previously pointed and driven in the earth, and further connect to the track by soldering to the cross-bond or drilling rail and attaching wire by means of a bonding cap. On bracket construction carry the No. 6 wire from the feeder clamps alongside the bracket pipe through two feed-in insulators, No. 4462, to the lightning arrester.

NEGATIVE RETURN

Run from the power house one 350-M. C. M. bare-stranded copper negative return cable (to main line track) on the pole line previously mentioned under feeding trolley. Anchor this cable to pole on opposite side of track, inserting a Brooklyn in its 5-16-in. guy wire, then continue cable down pole on power house side to the track, running same beneath ties and between rails for six rail lengths, and connect to each rail by means of a 0000 cross-bond, as per sketch No. 3, thoroughly soldering all joints.

The contractor is to carry the positive and negative feeder leads into the power house and to the switchboard.

TREES

The contractor shall trim all branches of trees which interfere with the trolley poles. It is understood that the railway is to secure all permits for trimming trees.

BARN TRACK WIRING

The wiring to car houses and in the structure is not covered by these specifications.

ADJUSTING OVERHEAD CONSTRUCTION

If during the construction period, or within thirty days after the completion of the entire circuit, it should be pulled out of place on account of defective workmanship or material, the contractor shall renew all defective parts and furnish all labor for putting it in first-class condition. If trolley is strung during hot days a slight sag is to be allowed to provide for contraction during the cold weather.

BONDING

The double track through the Deadwood yards and the single track from the yard limits to the Lead terminus is to be bonded by means of one 0000 protected and concealed flexible bond placed beneath the angle-bars at each rail-joint.

All rail is of 30-ft. lengths with approximately 10 per cent short lengths.

The contractor is to remove and replace bolts, rail-joint plates and spikes holding same.

The ends of rail are to be drilled for the bond terminals, the holes thoroughly cleaned and the bonds applied by means of a compressor.

One 0 cross-bond is to be applied to track every 500 ft.

All special work, as frogs and "boot-jack" switches are to be bonded around by means of a 0000 stranded copper cable, carried beneath the ties to two 12-in. one terminal 0000 bonds, inserted in the rail ends adjacent on each side of switch or frog. The cable is to be spliced to the bonds, and the joints thoroughly soldered. (See sketch No. 4.)

Sketch Nos. 6 and 7 shows the section of rail and the details of joint. The contractor is to leave the track in as good condition as he finds it.

Extra precautions are to be taken with all bonds, cross-bonds and ground connections to prevent possible theft, and the bonds are to be installed to prevent exposure to view.

WORKMANSHIP AND MATERIAL

All workmanship throughout is to be strictly first class, and all work, methods of construction and material must receive the approval of the railway engineer before acceptance. The contractor shall employ workmen competent to perform the various kinds of work, and in case the technical representative of the railway is dissatisfied with the work of any workman the contractor shall at once replace workman with a more competent man.

BILL OF MATERIAL

The bill of material attached hereto has been carefully drawn off, and is supposed to be correct, but the bidder upon the overhead construction will check the same carefully, and will become responsible for the omission of any material required to make the work complete, as specified.

[Attached to the specifications is a list of material required for overhead construction and bonding of this road, but as the requirements of all roads are different it is not reproduced here.—EDITORS.]

GRADING SPECIFICATIONS FOR DEKALB & SYCAMORE ELECTRIC RAILWAY

1—IN GENERAL

The work to be done under these specifications will consist of a grade complete and ready for a single track railway between DeKalb, Ill., and Sycamore, Ill., and a small stretch lying west of DeKalb.

The contractor shall furnish all material and labor necessary to construct the grade complete. The work is to be done in accordance with these specifications and contract, and accompanying drawing, but if anything necessary to make the grade complete is omitted it is to be furnished by the contractor.

2—DESCRIPTION OF ROAD

The road will be a single track road, with three turnouts, extending from DeKalb to Sycamore. The grade of the road follows rather closely the contour of the wagon road. There will be a short stretch of private right of way just outside of DeKalb, but the remainder of the distance will be run to one side of the wagon road. In the city of DeKalb the grading will commence where the brick pavement ends, leaving the tearing up and replacing of pavement to the track contractor. The profile, line of road, and cross section of roadbed are shown in drawing 1001-3. The material to be encountered along the route will be mostly black loam and some clay, though the contractor is expected to inspect the road himself.

3—ENGINEER TO HAVE CONTROL OF WORK

The work shall be at all times subject to the approval of the engineer, by whose measurements and calculations the amount of work performed under these specifications shall be determined, and shall have full power to condemn and reject any or all work which in his opinion is unsatisfactory or does not fully conform to the spirit of this agreement.

The engineer shall decide all questions which may arise relative to the work or its execution, and his decision shall be final and binding on both parties.

Lines, grades, and specifications may be changed by the engineer at his discretion, and the engineer shall advise the contractor in writing of such changes; and for such changes the injury or advantage to the contractor shall be estimated by the engineer, but no claim for an increase in price will be allowed unless made in writing to the engineer before work is begun.

If the engineer shall be at any time of the opinion that the contractor, after having been notified of the same by the engineer, is not proceeding rapidly enough with the work, he may, at his discretion, increase the force or take such means as he sees fit to hasten the work—the expense of same to be paid by the contractor. Upon the failure or refusal of the contractor to comply with such order and direction, the engineer shall have the authority to declare the agreement forfeited. In case of forfeiture all money then due the contractor shall be retained and kept by the company.

4—SUB-CONTRACTORS

No contracts are to be sublet without the written consent of the engineer. If contracts are sublet the contractor shall in all cases be held responsible for the work, just as though no subcontracts were let.

If, in the opinion of the engineer, any workmen are incompetent, the contractor, upon written notice from the engineer, shall discharge said workman and not hire him again.

5—LITIGATION

The contractor agrees to pay and hold the company harmless from all debts or dues of, or demands or claims against the contractor or sub-contractors for debts, liabilities, or damages of any kind. If any claim devolve upon the company, the engineer may at his option settle them and deduct same from money due the contractor.

6—ROAD CROSSINGS, FENCES

All public road crossings and highways must be kept open by the contractor and replaced in good condition by the contractor at his expense.

The contractor will not be expected to furnish fence for private right of way, except as "extras."

7—SUSPENSION OF WORK

If for any reason the company shall wish to suspend work before completion, and to terminate this contract, it shall have the right to do so by giving, through the engineer, a written notice thereof. Immediately after the service of such notice the said engineer shall make an estimate of the whole work done. The contractor agrees to accept the payment of such estimate, after deducting all moneys previously paid and after deducting all claims against the contractor.

8—ENGINEER TO BE UMPIRE

The engineer is hereby constituted the sole arbiter of all matters, and to determine same in respect to work done or material furnished in the performance of this contract, and his certificate shall be final. The engineer shall have the power to appoint any assistants to represent him upon the work and to vest in them all the powers conferred upon him.

9—CONTRACTOR'S RISK

The contractor takes the work solely upon the contractor's own information as to the character of the country, and the location and amount of the various kinds of material to be encountered, and without reliance upon the profile or representations of the engineer or any agent of the company.

The contractor is to be responsible for any work done until the final acceptance.

10—CHARGE OF COMPLETED PORTIONS

The company may take charge of any completed section of the road in order to prosecute its own work, but the taking charge of same shall not signify an acceptance of same.

11—CLASSIFICATION

It is agreed that there shall be but two kinds of excavation, viz., earth and rock.

Rock shall consist of rock in place, which can only be removed by blasting, and all detached masses or bowlders containing more than one cubic yard.

Earth shall consist of all material not classed as rock.

12—SECTIONS—MEASURE OF WORK

The work shall be divided into sections of 200 ft. each, starting at the termini of the pavement in DeKalb.

The embankments of each section shall be made from the necessary excavation on that section, as staked out by the engineer, provided that excess or deficiency of excavations, if any, shall be wasted or borrowed, as the case may be, but both waste and borrow will not be paid for on the same section. No material will be paid for twice—that is to say, both in excavation and embankment, and no allowance will be made for haul on excavated material.

13—FINAL ACCEPTANCE

Whenever, in the opinion of the engineer, these specifications and contract shall have been satisfactorily completed, said engineer shall make a final estimate of the work done and material furnished by the contractor, together with a statement of the amount then due him, and the company shall within fifteen days of receipt of said statement pay the contractor in full.

14—DIMENSIONS

All dimensions of the grade, drains, slopes, and other dimensions entering in the work are to be determined by the engineer.

The roadbed is to be 12 ft. wide on top and have sides which slope 1½ ins. to 1. A 6-in. berme is to be left in the bottom of the cuts.

The grade is to be carried at elevation as shown in profile No. 1001-3.

Side ditches and ample drains are to be placed wherever necessary to drain the roadbed.

15—STAKES AND BENCH MARKS

The contractor must preserve stakes and bench marks, and in case of neglect he shall be charged with the expense of restoring them.

16—BORROW PITS—SPOIL BANKS

Earth, gravel and other materials taken from excavations (except when otherwise directed by the engineer), shall be deposited

in embankments, the cost of removing which will be included in the price paid for excavation. All material necessarily procured from without the road and deposited in the embankment will be paid for as excavation only. In procuring materials for embankment from without the line of the road, the place will be designated by the engineer in charge of the work; and in excavating and removing it, care must be taken to injure or disfigure the land as little as possible. The embankments will be formed in layers of such depth (generally one foot), and the material disposed and distributed in such manner as the engineer may direct, the required allowance for settling being added.

No borrow pits will be opened nearer than 4 ft. from base of embankment slope, and will receive same slope as corresponding embankment. All borrow pits will be excavated in a regular manner, and so as to leave no holes for standing water, generally with a descent at bottom to allow free passage of water.

Wherever the excavations furnish more material than is required for embankments, the surplus will be used to increase width of embankment, or deposited in spoil banks or waste piles, as and where the engineer may direct.

The roadbed, in cuts and on banks, to be made in a workmanlike manner; to be perfectly even and regular according to grade stakes as set from time to time by the engineer, and to be exactly of the width directed.

All slopes to be formed even and straight, according to slope stakes, and to such incline as directed in each case.

All ditches in cuts or along banks to be made of such width and grade as the engineer may direct.

If the contractor shall make excavations or embankments in excess of the directed width, then such excess shall not be paid for.

17—WORKMANSHIP, FINISH AND MATERIAL

All workmanship and finish is to be first-class. The grade is to have a smooth finished appearance and slopes are to be finished to a true plane.

TRACK SPECIFICATIONS FOR DEKALB & SYCAMORE ELECTRIC RAILWAY

1—IN GENERAL

The work to be done under these specifications will consist of the complete track equipment for an electric road between DeKalb, Ill., and Sycamore, Ill., and a short stretch lying west of DeKalb.

The contractor shall furnish all material and labor necessary to construct the track complete. The work is to be done in accordance with these specifications and contract, but if any thing necessary to make the track complete is omitted it is to be furnished by the contractor.

2—DESCRIPTION OF ROAD

The road will be a single-track road, with three turnouts, and one terminal switch, extending from DeKalb to Sycamore. In DeKalb there is a short stretch of brick pavement which is to be torn up and replaced by the track contractor. See drawing No. 1001-3.

A steel bridge with concrete floor must be crossed just west of DeKalb.

There are two single-track railroad crossings in Sycamore.

3—ENGINEER TO HAVE CONTROL OF ROAD

The work shall be at all times subject to the approval of the engineer, by whose measurements and calculations the amount of work performed under these specifications shall be determined, and who shall have full power to condemn and reject any or all work, which, in his opinion, is unsatisfactory or does not fully conform to the spirit of this agreement.

Said engineer shall decide all questions which may arise relative to said work or its execution, and his decision shall be final and binding on both parties.

Dimensions may be changed by the engineer at his discretion, and the engineer shall advise the contractor in writing of such changes; and for such changes the injury or advantage to the contractor shall be estimated by the engineer, but no claim for an increase in price will be allowed unless made in writing to the engineer before work is begun.

If the engineer shall be at any time of the opinion that the contractor, after having been notified of the same by the engineer, is not proceeding rapidly enough with the work, he may, at his discretion, increase the force or take such means as he sees fit to hasten the work, the expense of same to be stood by the contractor. Upon the failure or refusal of the contractor to comply with such order and direction, the engineer shall have the authority to declare the agreement forfeited. In case of forfeiture all money then due the contractor shall be retained and kept by the company.

4—SUB-CONTRACTORS

No contracts are to be sublet without the written consent of the engineer. If contracts are sublet the contractor shall in all cases be held responsible for the work, just as though no sub-contracts were let.

If in the opinion of the engineer any workman are incompetent, the contractor, upon written notice from the engineer, shall discharge said workman and not hire him again.

5—LITIGATION

The contractor agrees to pay and hold the company harmless from all debts or dues of, or demands or claims against the contractor or sub-contractors for debts, liabilities, or damages of any kind. If any claims devolve upon the company the engineer may, at his option, settle them and deduct same from money due the contractor.

6—ROAD CROSSINGS, FENCES

All public road crossings and highways must be kept open by the contractor and replaced in good condition by the contractor at his expense.

The contractor will not be expected to furnish fence for private right of way, except as "extras."

7—SUSPENSION OF WORK

If for any reason the company shall wish to suspend work before completion, and to terminate this contract, it shall have the right to do so by giving, through the engineer, a written notice thereof. Immediately after the service of such notice the said engineer shall make an estimate of the whole work done. The contractor agrees to accept the payment of such estimate, after deducting all moneys previously paid, and after deducting all claims against the contractor.

8—ENGINEER TO BE UMPIRE

The engineer is hereby constituted the sole arbiter of all matters, and to determine same in respect to work done or material furnished in the performance of this contract, and his certificate shall be final. The engineer shall have the power to appoint any assistants to represent him upon the work, and to vest in them all the powers conferred upon him.

9—CONTRACTOR'S RISK

The contractor takes the work solely upon the contractor's own information as to the character of the country, and the location and amount of the various kinds of material to be encountered, and without reliance upon the profile or representations of the engineer or any agent of the company.

The contractor is to be responsible for any work done until the final acceptance.

10—CHARGE OF COMPLETED PORTIONS

The company may take charge of any completed section of the road in order to prosecute its own work, but the taking charge of same shall not signify an acceptance of same.

11—FINAL ACCEPTANCE

Whenever, in the opinion of the engineer, these specifications and contract shall have been satisfactorily completed, said engineer shall make a final estimate of the work done and material furnished by the contractor, together with a statement of the amount then due him, and the company shall within fifteen days of receipt of said statement pay the contractor in full.

12—MATERIAL

The material used in constructing the railroad shall be of the following description:

The rail shall be 60-lb. 4 7-16-in. steel rail of the section designated by the American Society of Civil Engineers, or other equally satisfactory, in 30-ft. lengths, first quality.

The ties for the standard T-rail work shall be No. 1 standard railroad ties; they must be of white oak and of the dimensions as follows: Eight feet long, square ends, not less than 6 ins. or more than 7 ins. thick; to have a face not less than 6 ins. at the narrowest part between barks and to average 8-in. face, and to be spaced 2640 to the mile, but yellow pine, of size hereinafter mentioned, may be substituted in case the oak cannot be obtained.

The ties for the railway work in pavements shall be sawed oak, strictly first-class quality, and of the dimensions as follows: Six inches thick, 8 ins. wide and 7 ft. long, square ends.

Ties for curves must be of oak, either hewn or sawed, and of the dimensions as above described.

Joint fastenings shall be four-hole, 24 ins. long, and of the kind known as "continuous rail joints."

Bolts shall be ¾-in. diameter, with hexagon nuts and long enough to take a nut lock.

Nut locks shall be used, and to be the Verona, National, or other equally satisfactory.

Spikes shall be the standard railroad spikes, 5½ ins. x 9-16 in.

Copper bonds shall be the Invisible "Z" bond No. 0000, or other equally efficient and satisfactory.

Cattle guards to the number of two shall be furnished and put

in; they shall be metal surface guards, either of the National surface guard, or of other acceptable design.

Switches shall be the T-rail spring split switch, and spring rail frog; they shall be of standard design of steam railroad construction.

Track braces on curves and switches shall be the Ajax brace, or other equally satisfactory, and spaced 10 ft. apart.

Guard rails for curves may be of No. 2 rail, but must be the same section as used in other parts of the track, where necessary. Iron separators with bolts through the rail must be used; these to be of a design satisfactory to the engineer.

All material must be subject to inspection by the authorized agent of the railroad company, and any material which fails to meet all requirements of the specifications will be rejected and shall not be used in the work.

TRACK-LAYING AND SURFACING

The track is to be spiked to ties with four spikes to each tie. The outer rail of curved track shall be braced with brace blocks. Rails for curves must be bent to the proper curvature as required before laying in place, and any rails that have become kinked must be straightened out before being placed in track. Rails shall be brought to true alignment and gage, and the proper elevation of the outer rails on curves shall be given. All bolts shall be thoroughly tightened. The spikes on the inner side of the rail shall be on the same side of ties, and those on the outer side of rail shall be on the other side of ties. Ties shall be laid 2640 to the mile, or fifteen ties to a 30-ft. rail, spaced at joints as hereafter directed by the engineer; the center of the tie shall be laid on the center line of track. Ties shall be thoroughly tamped and spaced between, filled in, and surfaced to the top of same, unless otherwise ordered by the engineer. Inside guard rails shall be used, one for each track on curves where required.

BALLASTING

The contractor shall not be required to furnish or put in place any ballast, and the contractor shall not be required to move any ballast from one point to another without extra compensation therefor.

BONDING

The entire length of the track, together with the turnouts, is to be bonded by means of one 0000 protected and concealed flexible bond placed beneath the angle-bars at each rail-joint.

The contractor is to remove and replace bolts, rail-joint plates and spikes holding same, leaving the joints in the same condition as he finds them.

The ends of the rails are to be drilled for the bond terminals, the holes thoroughly cleaned, and the bonds applied by means of a compressor.

One single-0 cross bond is to be applied every 500 ft.

All special work, such as frogs and railroad crossings, are to be bonded by means of 4-0 stranded copper cable attached to two 12-in. terminal bonds inserted in the rail ends adjacent to each side of the special work.

Extra precautions are to be taken with all bonds, cross bonds and ground connections to prevent possible theft, and the bonds are to be installed to prevent exposure to view.

UNIT PRICE

The bidder is to name a unit price per joint, which unit price is to be used as a basis for additions or deductions, in case the line is extended or shortened.

OVERHEAD CONSTRUCTION OF DEKALB & SYCAMORE ELECTRIC RAILWAY

IN GENERAL

The purpose of this specification is to cover everything necessary for the complete overhead construction and bonding of the road, but if anything has been omitted which is necessary to make the system complete so far as the work covered by these specifications is concerned, it will be furnished by the contractor without additional cost to the railway.

The road consists of 8 miles of single-track road, with three turnouts and two switches, as shown upon the accompanying map and profile.

If any changes are required after the contract to be finally entered into between the successful bidder and the company they will be made at a price agreed upon in writing before the work is done.

POLES IN PLACE

There are at present —— poles in place in the city of DeKalb, but the contractor will be expected to retamp these poles, and if required, to reset a limited number.

OVERHEAD CONSTRUCTION

The overhead material shall be guaranteed for two years and shall be equal to Anderson's or the Ohio Brass Company's. Whenever the number of a certain type of material is given it refers to the Ohio Brass Company's catalogue No. 5.

POLES

All wooden poles will be round, live Idaho or Michigan cedar, with a diameter of 7 ins. or a circumference of 22 ins. at the top end. Poles must be reasonably sound at top end; cut from live timber and peeled. Twenty per cent butt rot will be allowed on all poles, and a crook one way not exceeding 1 in. for every 5 ft. of the full length of the pole, measured from a point 6 ft. from the butt end in accordance with the standard specifications of the Northwestern Cedarman's Association.

There will be required in DeKalb thirty iron poles, each to have 5-in. tops, 6-in. centers, and 7-in. bottoms, and to weigh not less than 700 lbs., and to have an ornamental iron cap. Suspension bands to be at least 3 ins. wide.

SETTING OF POLES

Inside the corporate limits of DeKalb and of Sycamore cross suspension method to be followed. Along highway and over private right of way bracket construction is to be adopted.

The normal height of trolley line above the tops of the rails will be 18 ft. 6 ins., except at railroad crossings, where it will be 22 ft.

Arrangements to be made for a cross-arm to be added in the future on all poles above bracket or suspension bolt.

All poles to be located as directed by the company's engineer in charge of the work. The poles to be an average distance of 100 ft., center to center on tangents, and as required for curves.

All poles shall be set in the earth at least one-fifth of their length, and the earth about the base of the poles is to be thoroughly tamped; tamping to be done in proportion of three tampers to one shoveler. After trolleys are in place the poles are to be retamped. The cross suspension poles shall be set with a rake outward from the center of the street about 24 ins., and are to be pulled up by span wires nearly straight. All guy poles are to be especially secured and set with an extra amount of rake. Where there is an extra strain put on any pole it shall be suitably guyed or anchored, preferably to a guy rod of the Stromberg type or equal. The location of guy stubs or rods shall be in accordance with the permits secured by the company. All poles are to be set in perfect alignment, and the tops of all poles, on either side of track, to be an equal distance above top of rails. Side suspension poles to have heel and toe keys which shall be equal to a 24-in. x 3-in. x 12 in. board at lower end of pole, and 48-in. x 3-in. x 12-in. board just below the ground.

All iron poles shall be set in the center of a body of concrete at least 24 ins. in diameter. The concrete shall be a one-three-five mixture, with cement equal to the best Louisville brand. There shall be a bottom layer of concrete at least 3 ins. thick, and the concrete surrounding the poles shall be thoroughly tamped to place and capped with a cement faced, coned, water table with drip above ground.

All poles shall be peeled and coned, and cones painted one coat of good quality paint. All wooden poles within the corporate limits of Sycamore and DeKalb shall be shaved and painted two coats of good mineral paint; one to be applied before setting, and one after poles are erected, and the line construction placed upon them. Quality and color to be approved by the engineer before being applied. Iron poles are to be painted two coats of approved paint.

Poles on curves, ends of turnouts, and trolley dead ends shall be anchored by ⅝-in. x 6-ft. galvanized anchor rod. From the anchor rod run a 5-16-in. galvanized iron cable secured with two turns about the top of pole, inserting a wood break insulator in each cable guy approximately 4 ft. from the poles.

SPAN WIRES

Span wires are to be 5-16-in. double galvanized seven-strand steel cable, fastened with friction clutch tie to ⅝-in. x 12-in. insulated eye bolts having 6-in. thread with nut and washer to protect the pole.

GUARD WIRE

There will be no guard wire furnished, except as an extra.

TROLLEY WIRE

Two No. 000 B. & S. gage, Fig. 8 copper trolley wires will be used, and must be erected taut without kinking or cutting same. Trolleys are to be spaced about 6½ ins. apart over the single track and over the center of the tracks at turnouts. Trolley must be anchored on each side of the joints, using four of the riveted double strain ears, carrying a ¼-in. double galvanized seven-strand steel cable to adjacent poles on each side of track, on span construction and on bracket construction erecting two extra poles opposite the two adjacent poles and anchoring said opposite poles. Wood break insulators to be inserted in the pull-off wires 4 ft.

from the strain ears. Ends of trolley shall be fastened together by means of splicing sleeves.

POLE BRACKETS

Brackets are to be of the flexible suspension type, equal to Richmond or Craighead, with over support ½-in. in diameter; the flexible suspension to be 5-16-in. seven-strand double galvanized steel cable, and tubing to be 1½ ins. in diameter. Length of bracket 8 ft. 6 ins.

HANGERS

Straight line hangers are to be of the round top galvanized type, with curve hangers of similar type.

Straight line hangers equal to No. 4013 are to be used where double trolley is over single track, and equal to No. 4014 double curve pull-over to be used on all curve brackets. Intermediate pull-overs, equal to 4011-12, are to be used where single trolley is carried over turnouts.

GUYS

All bridles, head guys and pull-off wires are to be ¼-in. seven-strand double galvanized steel cable.

All slugs, anchors and heavy guys are to be 5-16-in. seven-strand double galvanized cable.

TROLLEY CLAMPS

An approved form of malleable iron line clamp is to be used.

CURVES

All curves shall follow the track, but in general shall be constructed so that the greatest length of cord between hangers shall not exceed 10 ft. All pull-off wires shall be insulated, and all sharp curves are to be carried in ears of ample length, which shall be bent to conform to the curve, so as to allow no sharp turns in the wire.

ANCHORS

At the end of each curve, and as often as 2000 ft in the tangents, the trolley wire is to be anchored in both directions. The terminals of the line shall be thoroughly anchored and insulated. No anchor, guy, or other wires shall be attached to trees or property of parties other than the company, except where absolutely necessary, and then only upon permit furnished by the company.

FEEDING TROLLEY

Two 350,000 C. M. bare stranded copper cables will be installed, both at DeKalb and at Sycamore, from the power house switchboard to the trolley line. These are to be used for feeding the trolley and they will be carried upon a separate line of poles. These poles are to be provided with two pin cross-arm fastened to the poles with two ½ in. x 7 in. galvanized lag screws. Each cross-arm to have two ¼ in. x 1¼ in. x 24 in. galvanized braces fastened with galvanized lags, and each cross-arm is to be provided with two pins and two cable glass insulators. Poles are to be provided with double cross-arms near the power station, and the trolley line and at one railroad crossing. At the latter the poles must be of extra length.

Each feeder is to be dead-ended over the trolleys, and have its end made into a large Brooklyn insulator fastened to the opposite pole by a piece of 5-16-in. double galvanized steel cable. This pole is to be anchored in a manner similar to curve poles. Two No. 3-0 jumpers are to be soldered to the feeders and carried into bronze trolley feeder clamps.

The 350,000 C. M. negative return cable carried upon these pole lines is to be anchored to the pole on the power house side of the track by means of the Brooklyn strain insulator. This cable is to be attached to at least four-rail lengths, and is to be connected to each rail by means of a 0000 cross bond, thoroughly soldering all joints.

The contractor is to carry the positive and negative feeder leads into the power house and to the switchboard, suitably insulating same, and is to make the switchboard connection.

TREES

The contractor shall trim all branches of trees which interfere with the trolley poles. It is understood that the company is to secure all permits for trimming trees.

CAR-HOUSE TRACK WIRING

The wiring to the car houses and in the structure is not covered by these specifications.

ADJUSTING OVERHEAD CONSTRUCTION

If during the construction period, or within thirty days after the completion of the entire circuit, it should be pulled out of place on account of defective workmanship or material, the contractor shall renew all defective parts and furnish all labor for putting it in first-class condition. If trolley is strung during hot weather a slight sag is to be allowed to provide for contraction during the cold weather.

FEEDERS

There will be no feeders required under these specifications except the power-house connections.

WORKMANSHIP AND MATERIAL

All workmanship throughout is to be strictly first-class, and all work, methods of construction and material must receive the approval of the company's engineer before acceptance. The contractor shall employ workmen competent to perform the various kinds of work, and in case the technical representative of the company is dissatisfied with the work of any workman, the contractor shall at once replace workman with a more competent man.

UNIT PRICE

The bidder is to state a price covering the complete installation of 100 ft. of double trolley construction, which price is to be used as a basis for additions or deductions from the length of the line as shown upon the map.

The Franchise Situation in Chicago

Public opinion on the franchise question in Chicago seems to be veering in favor of the companies and against the obstruction policy adopted by the Mayor and some of his adherents. This was clearly exemplified at a meeting of the Chicago Council on Monday evening, Nov. 17. A resolution was introduced into that body favoring delay of action on the franchise question until the State Legislature passes acts enabling the city to own the street railway systems. On motion this bill was referred to the local transportation committee, which, it is well known, is hostile to the resolution and opposed to the municipal ownership ideas of the Mayor. The vote to refer the resolution to the committee was almost unanimous, showing that the sentiment of the present council favors an early settlement of the franchise question. The large vote by which the motion was passed shows that the party in favor of an early settlement of the question is strong enough to override the Mayor's veto.

Further Delay on the Pennsylvania Tunnel Franchise

The Board of Aldermen has interposed further obstacles in the way of the adoption of the Pennsylvania tunnel franchise by ordering a public hearing on Nov. 26. The conference committee presented the new franchise to the board Tuesday, and the report was referred to the railroad committee, with the understanding that the public be given an opportunity to express their views upon it. It is expected that a minority report will be presented later.

The majority report which was signed by four out of the six members of the conference committee answers the objections which have been made to the terms. It says:

The economic evil of perpetual franchises is found in those grants of public privileges where the compensation to the grantor is based on a present valuation instead of being subject to readjustment from time to time as the privilege enhances in value. This evil is obviously not present here. Another objection obtains in grants of franchises to serve the local public (such as operating a street railway in city streets) which are practically exclusive, as there the main consideration for the grant is an efficient public service which can only be assured by subjecting the grantee to a termination of its privileges at a definite time. In this case the franchise is not local in character, nor is it exclusive (the city being free to grant any number of similar franchises under its many transverse streets) and such an objection to the proposed grant under consideration is, therefore, untenable.

The report accepted the contention of the Pennsylvania officials that as the space required for the tunnel was underground and could not be used by the city for any practical purpose, and that as the city would benefit financially and commercially by the tunnel, the compensation of $2,000,000 fixed for the first twenty-five years was sufficient. Regarding the controversy concerning the insertion in the franchise of the eight-hour day and prevailing rate of wages clauses the report says:

The railroad representatives declined to accept the franchise if conditioned upon the performance of any obligation as to hours of employment or payment of particular wages, alleging that such a provision would be illegal; that it is unnecessary because the peculiar and hazardous character of the work to be done would necessitate the employment of the highest grade of labor, which inevitably demands and receives the highest wages; that in tunneling, which will be by far the greater part of the work, the hours of employment must, of necessity, owing to the character of the work, be less, rather than more, than eight hours. They further said that any concession of this character in this instance would inevitably cause dissatisfaction among their employees engaged in their numerous other enterprises now under way or contemplated, which could only result in endless embarrassment and serious disorganization of their company; that if the city authorities were unwilling to rely on the excellent record of the railroad in dealing with its employees, the railroad must decline to proceed further in the premises.

Your committee, responding to their personal inclination to secure for our laboring classes every advantage practicable and proper, endeavored to secure some modification of the certificate in this regard, but without success, realizing that under the decisions of our highest courts such a condition would be at best of doubtful validity, and that even if technically legal it would be incapable of practical enforcement, as a breach of the contract in this regard would obviously result in no damage to the city as a corporation, we cannot but believe that the city authorities will better serve the real interests of labor by granting the franchise without this condition than, by unfavorable action on the franchise, exclude from the labor market of this city an employer proposing to expend many millions in the employment of labor.

The Schenectady "Boycott"

The attempt of the Trades Assembly of Schenectady to boycott the Schenectady Railway Company has resulted in a most dismal and merited failure. On Sunday last at midnight the boycott was declared in operation, but it was not respected at any time by the union men or business interests; in fact, the high-handed policy of the Trades Assembly was openly and vigorously denounced by all classes of men.

It appears that the Schenectady Railway Company employs about 250 motormen and conductors, who do not care to join a union and are perfectly satisfied with the conditions of their employment. The effort to induce them to become members of a union having failed, an appeal was made to the company to compel them to join. This the company naturally and very properly declined to do. It was perfectly willing that the men should form or join a union if they wanted to; but if they did not want to it had no right to ask them to subject themselves to a control seeking the enforcement of rules they deemed inimical to their interests. The executive committee of the Trades Assembly then took the matter in hand and a decision was reached to punish the company by placing a boycott upon the railroad. It was decreed that every workman who rides on one of the cars would lose his union card and become a "scab;" every business man who rides once would be warned not to repeat the offense or he would be subjected to a boycott in his business; if an employee of anyone doing business in Schenectady rides after being warned his discharge would be demanded on penalty of the boycott. An effort was made to compel the Union Traction Company, over whose tracks the cars of the Schenectady Railway Company run for part of their service, to withdraw this privilege, on penalty of a general strike of its own employees. As the gas and electric lighting interests of Schenectady are closely allied with the railroad interest, members of unions and business men were forbidden to use either gas or electric lights, and the general public was requested not to do so. The Common Council was petitioned to cancel the contract for street lighting. And all of this because the motormen and conductors of the electric railway have deemed it to their interest not to affiliate with the union.

A special meeting of the Trades Assembly was held behind closed doors Tuesday evening to discuss the "differences" between the company and that body. Fully two-thirds of the delegates present were strongly in favor of lifting the boycott, but they were prevented from taking action by the filbustering tactics of the minority. The point was raised by the latter that as the boycott resolution was passed at a regular meeting it could not be rescinded at any but a regular meeting, except by unanimous consent.

The next regular meeting will be on Wednesday evening. In the meantime, many of the individual unions are expected to repudiate the boycott. Action of this kind has already been taken by the masons' union, and the local typographical, the brass workers' and polishers' unions are likely to follow suit.

But one individual union thus far has indorsed the boycott. At a meeting of Carpenters' Union, No. 146, it was decided to impose fines on all members found riding on the trolley cars. The fine was fixed at $1 for the first offense and $5 for the second offense. A third offense means expulsion from the union.

Increased Assessments of New Jersey Corporations

Mayor Fagan, of Jersey City, has signed the resolution of the Board of Tax Commissioners fixing the tax rate at $27.80 per $1,000, on an assessed valuation of $100,360,437. This action has lead to considerable complication between Jersey City and Hoboken, as well as the large corporations doing business in those cities. Among the companies whose valuation have been increased are the North Jersey Street Railway, from $503,500 to $1,043,500, and the Jersey City, Hoboken & Paterson Street Railway from $373,450 to $543,950. Various small companies found their property correspondingly increased in value. All the corporations at once decided to dispute the valuations and appeal to the State Board of Taxation, but before they had time to act they found an unexpected ally in Mayor Lankering, of Hoboken. He asserted that if the Jersey City valuations were allowed to stand, Hoboken would not receive its fair proportion of the franchise tax collected by the State from railroad, trolley and telegraph companies using public streets. The Hoboken Mayor was granted a rule to show cause why a writ of certiorari should not issue removing to the Supreme Court for review the valuations fixed by the Jersey City Tax Board. The Hoboken officials have begun presenting testimony before Theodore Rurode, a Supreme Court Commissioner, under this rule.

Increase of Wages at Philadelphia, Syracuse and Atlanta

The Philadelphia Rapid Transit Company, the Syracuse Rapid Transit Railway Company and the Georgia Railway & Electric Company have recently announced that the wages of their employees are to be increased, because in each case the employees, by the faithful performance of their duties, have aided materially in the general prosperity of the companies.

The announcement of the increase in the wages of the employees of the Philadelphia Rapid Transit Company was made Nov. 17, after a meeting of the stockholders of the company had adjourned. The increase will date from Dec. 1, and will be from 19 cents to 20 cents an hour. Twice within a year the company has made an advance of a cent an hour, which, together, make a total increase in wages of a trifle more than 11 per cent. Last Christmas announcement was made of an increase from 18 cents to 19 cents an hour. Within five years the company has advanced the wages of its conductors and motormen from 16 2-3 cents an hour to 20 cents. Three advances, aggregating 20 per cent, have been made since 1897. The first took effect in 1900, th second was the advance decreed last Christmas, and the third was that which is to be effective on Dec. 1.

The announcement of the increase for the employees of the Syracuse Company was made by E. G. Connette, general manager of the company, at a recent meeting of the Employees' Mutual Benefit Association, composed of employees of the company. Mr. Connette said that when he assumed the management of the company, about two and a half years ago, he met with the employees of the company in the association rooms and stated that he desired the co-operation of every employee of the company; that the success of the management depended upon the loyal support of every employee from the smallest to the greatest, and that the employees should share in the success of the company. In proof of this declaration the company advanced wages on Jan. 1, 1901, and on Christmas Day of the same year presented each employee a cash present of from $3 to $5. Continuing their excellent work, the employees so aided the company that its floated indebtedness has been considerably reduced, and there have remained surplus earnings which have been used for improvements. It is in recognition of this excellent work, and the desire to secure a continuance of it, that the increase just announced is made.

The new advance is a decided one, and will make the aggregate increase in operating expenses about $15,000 per annum. Men who have been in the employ of the company for a year will receive 16 cents per hour; those who have served two years will get 17 cents an hour, and those who have served three years are to receive 18 cents per hour. Men who have served over three years are to get 19 cents, while all conductors who have been in the company's employ over five years are to be given 20 cents an hour. There are eighty-three men who have been employed between three and five years, and about eighty-four who have been employed for five years. The latter will receive a maximum rate of $2 per day or 20 cents an hour. When Mr. Connette assumed the management of the company the minimum rate of wages was $1.35, and the maximum about $1.60. The new scale of wages will make the minimum rate $1.60 and the maximum $2. There are about 300 conductors and motormen in the employ of the company at present.

The increase in the wages of the employees of the Georgia Railway & Electric Company will date from Dec 1. Announcement of the increase was made to the men through a general letter from the company signed by D. A. Belden, vice-president and manager of the company. In this letter attention was called to the excellent manner in which the employees perform their duties, and to the desire of the company to have men remain with the company permanently. Attention was also called to the material increase in operating expenses that is involved in putting into effect the new wage schedule, and an appeal was made for the continuance of the excellent standard of service that has made the increase possible. First year men in the employ of the company now receive 13 cents an hour; second year men, 14 cents per hour; thereafter, 15 cents per hour. The new schedule of wages will be: First year, 14 cents; second year, 15 cents; third, fourth and fifth years, 17 cents; after five years, 18 cents.

COMMUNICATION

Car Mile or Car Hour

Nov. 15, 1902.

EDITORS STREET RAILWAY JOURNAL:

At the Kansas City convention of the Street Railway Accountants' Association, in 1900, a select committee presented a report upon the subject, "Is a Standard Unit of Comparison practicable?" The question was between the "car mile" unit and the "car hour" unit as a standard of comparison for earnings and expenses. The discussion developed quite a difference of opinion, and although the advocates of the "car hour" unit appeared to be in the majority there was quite a respectable minority that seemed to cling to the idea that the "car hour" unit was not much, if any, better than the "car mile" unit for comparing one line on one system with another. At the close of the discussion the association adopted a resolution recommending "the use of the car hour as a standard unit of comparison, with the understanding that it be put to a practical test by each company represented in the membership of the association, either in connection with the car mile or not, as they may see fit, and that the committee report back at the 1901 convention."

At the New York convention in 1901 the committee reported back that it had been shown conclusively that the "car hour" unit had demonstrated its practicability and its value, and by resolution the association recommended its adoption as a standard unit of comparison.

I had hoped that the report of the 1902 convention would show how many roads had followed the recommendation of the association, and that there might be some expression of value from them as to their experience. The road with which the writer is connected has, for satisfactory reasons, waited a year to learn from the many advocates of the "car hour" unit whether after a year's trial they have had any reason to change their views or whether they have discovered any additional evidence that the "car mile" unit is worthless, and the "car hour" unit the correct unit of comparison. I shall look to your paper with considerable interest for specific information on the subject.

It has always seemed to the writer that, whether it be one unit or another, a unit of some kind may be more or less desirable for comparing one line or system or one period with another, but its principal value to the railroad manager is not as a unit of comparison. What he wants to know primarily is what each particular line is actually doing, what net results it is accomplishing, and he wants the information in the simplest, most graphic form. The unit wanted by the manager is one that will be a correct gage of the net results, a unit that will show in concrete form the actual commercial value of the work done. The comparing of one line or system, or one period with another is a secondary but nevertheless interesting consideration. It would seem that too much stress is being put on the desirability of comparison and not enough on the getting of a correct unit of measuring the value of the results accomplished. The whole question, as between the "car mile" and the "car hour" units, would seem to be: First, which is the better gage of the results accomplished? Second, which is the better for purposes of comparison?

It has been shown that the question of speed has a marked effect on the "car mile" unit, and that a difference in speed between two lines (other conditions being similar) will render the figures per car mile valueless for purposes of comparison. In like manner is it not true that a difference in the length of run, or the length of haul per passenger, has a marked effect on the "car mile" unit, and the "car hour" unit as well? For instance, how would you compare a short line (thirty minutes each half trip) with a long line (one hour each half trip) on either the car mile or the car hour basis? Suppose the short line has an average earning of $4 per round trip, and shows 36 cents per car mile and $4 per car hour, while the long line has an average earning of $6 per round trip, and shows 20 cents per car mile and $3 per car hour—the question is, of what value are the figures for comparison? This would seem to be a fair example of attempting to compare on a standard basis two things which are unlike, and shows the difficulty, if not the utter futility, of making a standard unit of comparison. Without a thorough knowledge of the local conditions there seems to be no unit of comparison that will accurately tell the story of the relative results. Another instance might be cited of where 53 per cent of the business of a certain line is free transfer passengers, and it would be folly to attempt to compare on either suggested basis the earnings and expenses of such a line with some other line where only 10 per cent is transfers. If, as in Philadelphia, a road charges 3 cents for each transfer how could there be any basis of comparison with another road that issues free transfers? One road pays its conductors and motormen 17 cents per car hour, and another pays 23 cents or 25 cents per car hour, and there is again no equitable basis of comparison without a full knowledge of the details.

While I might be willing to concede that the "car hour" unit is a better measure than the "car mile" unit of the results on any particular line, I am still far from being convinced that either the "car hour" or the " car mile" units are of any especial value for comparing one line or system with another. The comparing of one line or system with itself for two different periods may be done more intelligently.

Railroad managers are not wedded to the car mile unit provided it can be shown that there is a better gage of work done. There is, however, more or less natural conservatism to overcome before a new basis can be universally inaugurated. It is well known that Wall Street has been accustomed for many years to look upon earnings per car mile as the concrete unit of results accomplished, and a campaign of education may be necessary to bring about a change of view. As this is written with the object of learning something of the experience, after a year's trial, of the "car hour" unit as a measure of value I trust that some of its advocates will reply.

MANAGER SEEKING INFORMATION.

An Important Decision in Pennsylvania

Additional information is at hand concerning the decision of Justice Dean, of Pennsylvania, which declares unconstitutional acts of Assembly permitting rival passenger railways to use 2500 ft. of an existing road for a connection. The decision, as was stated in the STREET RAILWAY JOURNAL for Nov. 15, was rendered in the case of the Philadelphia, Morton & Swarthmore Street Railway Company against the Chester, Darby & Philadelphia Railway Company, the Union Railway Company, of Chester, and the Chester Traction Company. The former company was organized by Philadelphians, and by demanding 800 ft. of the latter's tracks secured the right for such use in the Delaware County courts, and viewers were appointed to assess damages. The Chester Company denied the right of the court to grant the use demanded, and declared that the legislation by which it was expected to do so was unconstitutional. The Chester Company was enjoined from preventing the occupation of the track, and the appeal to the Supreme Court was taken. This was the first time the matter had ever been carried up, although lawyers all over the State had said the act would not hold water. Section 14 of the act of 1889 says in part and substance:

"Any passenger railway incorporated under this act shall have the right to use such portion of the tracks of any other company already laid down, as may be necessary to construct a circuit upon its own road at the end thereof."

The section limits the distance to 500 ft., but the act of 1895 extended the distance of 2500 ft., the first section stipulating single track and the amendment making no limit as to the number of tracks. Justice Dean says:

"We are in no doubt as to just what power the Legislature intended to confer by these acts. It was a clear grant of a right to the younger to enter upon the easement of the older company and take possession of 2500 ft of its tracks, poles and wires and thereafter to use them for its corporate purposes. It was not material that this possession was not to be exclusive. In whatever light it is viewed it was an authority to appropriate to a certain extent the franchise and property of the older company."

Justice Dean goes on to say that it is a well established principle of law that all property may be taken for public use, and that the right of the Legislature to confer on a corporation the right to take the franchise and property of an older corporation for public use cannot be questioned; but in searching the decision of other States he has been unable to find a judicial judgment upholding the right of one corporation for profit to appropriate the property of another for exactly the same uses merely for the convenience and profit of the younger corporation. He says the public receives no benefit, and the transaction is simply one for the advantage and profit of the new company.

Justice Dean holds that expectation of public patronage always tempts investment of capital, but that with property in constant peril by the demands of new corporations upon the property of the older the public would suffer by refusal of capital to invest in improvements for public use. He argues that if it is right to allow the use of 2500 ft. there is no limit to the distance or to the number of future companies which demand the right except the cupidity of the new corporation or corporations and the will of the Legislature.

The contention that if Section 14 is unconstitutional the whole act is so, and that the companies organized under it hold an illegal

existence is denied by Justice Dean, who holds that the act stands completely outside of the section killed.

The general opinion on the decision seems to be that the already impregnable position held by the Philadelphia Company in the local traction field at Pittsburgh is strengthened. Owing to the topography of Pittsburgh, Allegheny City and surrounding suburbs, it is practically impossible for a new traction line to gain an entrance to either city.

"In the opinion of a prominent Pittsburgh banker," says the Philadelphia News Bureau, "the Pennsylvania Railroad may become the greatest beneficiary of the new decision. Several county, State and national politicians are interested in various traction enterprises which parallel Pennsylvania Railroad and Pennsylvania company lines. The constituents of these enterprises are small electric railways, which it is proposed to connect, forming a comprehensive system. Where this competition threatens to become serious to the steam railroads, all the Pennsylvania Railroad would have to do would be to buy control of one of the connecting links. With this control, under Justice Dean's decision, the Pennsylvania could emasculate any network of trolley roads by preventing the use of its particular link."

The Widener-Elkins and Pomeroy-Mandelbaum Deal

The "community of interests" between the Widener-Elkins syndicate and the Pomeroy-Mandelbaum syndicate for control of lines in the vicinity of Cincinnati, mention of which has been made several times in the columns of this paper, has been consummated, and W. Kelsey Schoepf, president of the Cincinnati Traction Company, has been elected to the directorate of the Cincinnati, Dayton & Toledo Traction Company, with the new title of chairman of the board. The agreement, as previously outlined, provides for a desirable entrance into Cincinnati for the Cincinnati, Dayton & Toledo, an equal partnership in a terminal company, which will provide entrances for other interurban roads to Cincinnati, the sale to the Widener-Elkins interests of 5,000 shares of Cincinnati, Dayton & Toledo stock, and 3000 shares of Miami & Erie Canal stock, and 300,000 of canal bonds. It is stated that the Widener-Elkins syndicate now holds 10,000 shares and $1,000,000 in the stocks and bonds of the two Pomeroy-Mandelbaum projects. It is also understood that the Pomeroy-Mandelbaum syndicate has secured large holdings in the Cincinnati Traction Company. The amount of the holdings is not given, however. On account of the differences in gage of tracks, the Cincinnati Traction Company will furnish eight double-truck cars to be painted in the Cincinnati, Dayton & Toledo color, and these will meet the cars of the traction company and convey passengers direct to Fountain Square, reducing the present running time to this point by twenty minutes.

Power for Baltimore

The purchase of the $2,000,000 of common stock of the United Electric Light & Power Company from the United Railways & Electric Company, of Baltimore, Md., by a syndicate, acting through the Continental Trust Company, has been concluded. For the stock, which constitutes the entire issue, $900,000 is to be paid on or before January 15, 1903. The purchase of the control of the light and power company practically assures the launching of the great Susquehanna River electric power development project by the syndicate. There are to be three development plants that will cost between $10,000,000 and $12,000,000, and two years will be required to complete the work, the purpose being to supply motive power for the street railway system of Baltimore, to supply electricity for lighting the streets and for general power and heating purposes.

Alleged Conspiracy

The Peoria & Pekin Terminal Railway, of Peoria, Ill., which stands unique among railways, inasmuch as it combines under one management a street railway, an interurban electric railway and a steam railroad, all using the same tracks in common, and constituting a single road, has commenced suit against the Peoria & Pekin Union Company and the railroad companies which jointly own the Union Company's stock, alleging that there is a conspiracy on the part of the railroad companies to keep it from getting its share of business. The Peoria & Pekin Union operates about 20 miles of road between Peoria and Pekin, and the stock is owned in common by the various railroads entering Peoria. It is used as a belt line, and has been operated in this way for about 20 years. The Terminal Company operates what is practically a parallel line. Failing to get any considerable amount of business, it has, as stated, applied to the courts for relief on the ground that the roads delivering freight to the Union Company have made an exclusive contract which is in restraint of trade and in violation of law. The question which the court will have to determine is whether the owners of the Union shall be compelled to give up their business to a competitor.

Northwestern Elevated Report

Directors of the Northwestern Elevated Railroad, of Chicago, have made a report to the State Railroad and Warehouse Commission, showing the operations of the road for the year ended June 30, 1902. The net surplus for that period was $151,631, or about 3 per cent on the preferred stock, against a surplus of $255,428 for the preceding year, a decrease of $103,797. This decrease was due largely to the increased taxes which the company was called upon to pay, the total taxes and compensation to the city amounting to more than 3 per cent on the preferred stock. According to the statement, the Union Loop did not earn enough money during the eight months in which it has been under the control of the Northwestern to meet the interest on the bonds issued for its purchase.

During the year $365,000 was expended for permanent betterments, including $187,000 for new cars and $91,000 for power house extension. All of these betterment expenditures were met out of accumulated surplus earnings. The accumulation of earnings since the road was opened amounts to $417,113, all of which has gone back into the property.

Following are income account and balance sheet of the company as of June 30, 1902:

INCOME ACCOUNT

Year ending June 30	1902	1901	Increase
Operating earnings:			
Northwestern proper	$1,088,267	$947,465	$140,802
Loop division	376,177	......	376,177
Totals	$1,464,444	$947,465	$516,979
Rent and miscellaneous	34,570	31,301	3,269
Gross earnings	$1,499,014	$978,766	$520,248
Operating expenses:			
Maintenance way	$15,980	$6,500	$9,480
Mainenance cars	45,166	15,472	29,694
Reserve for maintenance	23,000	......	23,000
Transportation	285,196	261,148	24,048
General and legal	45,719	39,525	6,194
Total operating	$425,061	$322,645	$102,416
Net earnings	1,073,963	656,121	417,832
Charges:			
Bond interest	$742,386	$280,630	$461,756
Other interest	5,355	5,526	*180
Rental	15,241	94,657	*79,416
Taxes	159,340	19,871	139,469
Total charges	$922,322	$400,693	$521,629
Surplus	151,631	255,428	*103,797

* Decrease.

ASSETS

Cost of road and equipment	$28,208,734
Cash on hand	217,338
Accounts receivable	279,498
Materials	3,267
Lands and buildings	455,587
Sundry	181,318
	$29,345,747

LIABILITIES

Capital stock	$10,000,000
Funded debt	18,387,000
Real estate mortgages	119,000
Interest accrued	241,504
Taxes accrued	55,359
Sundry	61,695
Accounts payable	64,075
Profit and loss	417,113
	$29,345,747

Meeting of the New England Street Railway Club

The next regular meeting of the New England Street Railway Club will be held at Wesleyan Hall, 36 Bromfield Street, Boston, on Tuesday evening, Nov. 25 at 8 o'clock. William Pestell, superintendent of the motive power and machinery of the Worcester Consolidated Street Railway Company, will speak on "Labor Saving Appliance in Car House Operation," and J. P. Conway, assistant superintendent of the Old Colony Street Railway Company, branch of the Massachusetts Electric Companies, will speak on "Snow Equipment and Organization for the Proper Handling of Snow—Rotary vs. Shear Plows."

Manhattan Railway Earnings

The changes in the Manhattan system have attracted as much attention among investors as in the engineering world, and the reports of operating expenses since the electrical equipment was installed have been very closely scrutinized. An indication of the extent of the interest shown in this subject may be gained from the fact that a prominent Wall Street expert has prepared for the benefit of investors a careful analysis of the conditions affecting the values of these securities, and presented it in the form of an elaborate circular. The financial condition of the property is pronounced excellent, and it is pointed out that, owing to the policy of the company to make ample provision for all emergencies and possible claims against it, the outlook is very encouraging.

Regarding the effect of the electrical equipment upon the earning value of the property, attention is directed to the fact that, although only a part of the system has been electrically operated during the last year, the operating expenses consumed only 50.10 per cent of the gross earnings, against 55.38 per cent the previous year. For the current year it is estimated that the operating expenses will be 46 per cent of the gross earnings.

The circular continues: "The following consideration of the matter on a car mile basis will show that this estimate is conservative; the report for 1902 shows that the receipts per car mile were 23.70 cents, and the operating expenses 12.26 cents per car mile. It was estimated, at the time the decision was made to install electricity, that the saving in operating expenses therefrom would be between 2 cents and 2½ cents per car mile. In our estimate of the earnings for 1903, if the receipts per car mile are taken at 23.70 cents, the operating expenses per car mile prove to be 10.90 cents, a reduction of 1.36 cents from the cost for 1902. Inasmuch as there was an increase of 20 passengers per train in 1902 over 1901, we believe that the receipts per car mile in 1903 will be at least 24 cents, instead of 23.70 cents. In this case our estimated operating expenses would be at the rate of 11.04 cents, a decrease of only 1.21 cents. From this it will be seen that the estimated saving from electrical operation will not be fully reached during this year. How nearly these estimated results will eventually be attained it is impossible to say, but, roughly speaking, a reduction of 1 cent per car mile in operating expenses is equal to 1 per cent additional earned on the capital stock. While there is no basis on which to forecast the gross earnings for 1904, or for subsequent years, it is reasonable to expect that the operating expenses will, after the current year, be decreased substantially in accordance with the original estimates. We feel that an operating cost of 10 cents per car mile for the Manhattan is not too low to expect, when it is considered that the Metropolitan West Side Elevated Railway, of Chicago, operates for 8 cents per car mile.

"We estimate that the result of operation for the year ending June 30, 1903, will be as follows:

Gross earnings	$12,479,116
Operating expenses (46 per cent of gross)	5,740,393
Net earnings	$6,738,723
Other income	210,000
Surplus	$6,948,723
Taxes, interest and rentals	2,800,000
Applicable to dividends	$4,184,723

which is equal to 8.6 per cent on the capital stock."

New Cars for St. Louis

The St. Louis Transit Company has just added fifty new cars to the equipment of its Olive Street division. These cars were manufactured by the Laclede Car Company, of St. Louis, and will give the Olive Street line its full complement of 140. The new cars will be 4 ins. wider than the old ones, and in length measure 48 ft. over all. The body is 34 ft. long. The rear double platform, with rail partition, measures 6 ft.

The seating capacity is forty-eight persons, there being eight more seats than in the old cars. The interior of these cars is finished in solid cherry, with ceiling in birdseye maple. The rattan-covered spring seats are not reversible, but have stationary backs, which are considered more comfortable. As the cars travel head-on all the time the swinging seat is no longer necessary.

The new cars are mounted on a special type of truck, designed by Vice-President Dupont, of the company. The wheels of these trucks are all of the same size, the present pony wheel being abandoned. The rear platform is dropped 10 ins. from the floor of the car, and the first step is just 14 ins. from the ground, as against 17 ins. to 19 ins. of the present car step. The number of motors is increased from two to four. The cars will be heated with stoves of the latest pattern, which the company considers a better method for heating than the electric heaters now in use on some of the cars, and are provided with fifteen lamps, distributed at intervals of 2 ft. The cars are equipped with power brakes.

The Rolling of Solid Steel Car Wheels

A representative of the STREET RAILWAY JOURNAL recently had opportunity to visit the plant of the American Car & Foundry Company in Chicago (formerly the Wells-French plant), where a part of the establishment has been set aside for the rolling of solid steel car wheels by a new process. Wheels turned out by this process have the advantage of being as tough as steel-tired wheels and at the same time have the advantage not possessed by those wheels of being in one piece as are cast-iron wheels, so that trouble from the heating, expanding and loosening of steel tires under the brake-shoes is done away with. This new department of the American Car & Foundry Company promises to be a very important one, especially for interurban electrical lines, because the price of a solid steel-rolled wheel is far below that of any built-up wheel with the steel tire, so that interurban lines heretofore hesitating to adopt steel-tired wheels on account of the expense can equip with solid rolled-steel wheels, and secure the safety of the steel tire without its cost and other disadvantages. Although for high-speed work wheels with steel tires have always been admitted to be the safest, the high cost and the rapid wear of soft steel as compared with chilled iron has heretofore prevented their use in many places where they would be desirable.

The steel wheel department of this company is under the management of H. W. Fowler, a man well known in the car-wheel business, who began his experiments along this line and put a few thousand solid steel car wheels with rolled treads into use on some twenty different steam railroads between 1887 and 1890.

They were made from blanks of cast steel with treads and flanges compressed and hardened by rolling, under patented processes of Mr. Fowler's, by the Fowler Steel Car Wheel Company. The main reason these wheels were not a success was because of the porous character of the steel castings from which the wheels were rolled. The best steel castings obtainable at that time were used, but these frequently had serious defects. Another cause for the failure of this early attempt was that the rolls employed in forming the tread and flange of the wheel operated only against the periphery. This worked and compressed the steel in the rim upon the surface only. Notwithstanding the defects which developed in many of the wheels, there were others which gave exceptionally good results. Some of them have been in continuous service under the passenger cars of one prominent steam road for the last twelve years, and they are claimed to have already made over 800,000 miles each. This only served to indicate what might be expected if these defects could be overcome.

The present wheel is an evolution of the old Fowler wheel. The cast steel blank is still used. The advance in the art of steel casting within the last few years now makes it possible to secure a solid and reliable production. The cast steel blanks from which the car wheels are rolled are of the same shape as the finished rolled wheels as far as the hub and plate of the wheel are concerned. The rim of the cast steel blank, however, is thicker than the finished rim of the car wheel, as is also the flange. In the manufacture of these wheels from the cast steel blanks, the blanks are heated in an oil furnace to a temperature which will soften them enough for rolling. They are then put in a rolling machine, in which the rim is compressed by three rolls, two of which press under the rim and one on the top and sides. A wheel makes about eighty revolutions in the process of rolling the rim, and the metal of the rim is reduced in cross section from 15 per cent to 20 per cent, which goes to show the remarkable amount of compression of the metal produced by the rolls. The plate and hub of the wheel remains untouched and unaltered in cross section. The compression secured by the rolling invented by Mr. Fowler is even more complete than is secured in the making of open tires. It is claimed that since the tire is one piece with the rest of the wheel, that the wheels can be safely worn down much thinner than any tire mechanically held on a center. One feature of the rolling process which cannot escape an intelligent observer is the great amount of power taken in the rolling of a rim, even though the amount of reduction in cross section of the casting by one revolution be extremely small, all of which shows that a great amount of compression of the metal is taking place. But the fact that the cross section of the rim is reduced so much demonstrates this even more forcibly. The amount of rolling necessary to compress the metal of the rim is judged by the amount of rolling the

rim will stand without forming a fin between the rolls. Just before this fin begins to form the rolling is stopped, and the wheels are taken out and delivered to a closed pit, where they cool gradually and evenly for several days.

Between Boston and Lowell by Trolley

Through car service between Boston and Lowell, Mass., was inaugurated on Nov. 17, when vestibuled cars of the Lexington & Boston Street Railway Company began running from the Sullivan Square Elevated Railway Station, in Charlestown, over the surface tracks of the Boston Elevated Railway Company to Arlington Heights, and thence to Lowell via Lexington, Bedford and Billerica. The distance is about 22 miles, and is covered in approximately two and one-quarter hours, at a schedule speed of about 10 miles per hour, including stops. Cars leave Sullivan Square at 15 and 45 minutes past the hour, and the fare between Boston and Lowell is 25 cents. The fare by the Southern Division of the Boston & Maine Railroad (steam) is 60 cents; the distance 26 miles, and the average running time about one hour. On coming to Boston from Lowell, the crews are changed at Arlington Heights, where the Boston Elevated Railway Company takes the cars in charge, and gives them right of way over its own cars, running them over its own tracks into Medford, Somerville and Charlestown, and up the surface car incline at Sullivan Square into the terminal station of the elevated division, and the end of transferring surface lines to West Somerville, Malden and Everett. The extra length of the cars over those operated by the Boston Elevated necessitates special care in their operation, particularly over the incline approach interlocking switches of the Sullivan Square terminal, there being no detector bars on the surface line switches.

The new cars seat forty-two passengers each, and have cross seats. The body length is about 34 ft., and the length over all about 40 ft. Each car is equipped with four G. E. "67" motors rated at 38 hp each on the hour basis of temperature rise. The cars are painted blue and present a fine appearance, with vestibuled ends. There are two trolleys, and 33-in. wheels are used, with Taylor trucks, "Consolidated" car heaters, New Haven registers with rod attachment, and Kilbourn sanders. Two registers are used, one for cash fares, and the other for transfers. Each car has 20 16-cp lights. Free transfer to any part of Boston and its suburbs is effected by the arrangement to run the cars into the terminal at Sullivan Square, and when the Boston & Worcester Street Railway Company's cars are run into the Park Street subway station, it will be possible to travel from Lowell to Worcester via Boston, with but two changes of cars, both of these changes being made in stations entirely protected from the weather. Christensen "straight air" brakes are used.

New York's New Street Signs

It will be a matter of general interest, not only to the people of New York, but also to visitors in the Metropolis, to learn that the designs for the new street corner signs have been accepted by the Municipal Art Commission, and it is to be hoped that they will be supplied as soon as possible. Comment is commonly made that it is remarkable what a long time such a simple reform has taken under a reform administration. It is to be hoped that the proposed signs will permit patrons of street cars to read them without dislocating or straining their necks.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED NOV. 11, 1902

713,162. Fender for Vehicles; E. Sherwood, Brooklyn, N. Y. App. filed May 14, 1901. A vertically movable fender supported below the dashboard of the car and adapted to fold against the dashboard so that two cars may be coupled together without removing the fender.

713,163. Car Fender; E. Sherwood, Brooklyn, N. Y. App. filed May 8, 1902. Provides for automatically locking the fender frame against detachment in both its elevated and depressed positions.

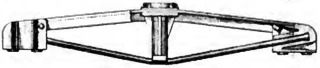
713,183. Side Bearing; J. C. Wands, St. Louis, Mo. App. filed Oct. 16, 1901. Consist of a casting forming an endless way composed of a high and low side, a continuous row of balls confined in said way, and a removable plate under the casting to support the balls on the low side of said way.

713,211. Mounting for Electric Heaters; E. E. Gold, New York, N. Y. App. filed Oct. 16, 1901. The pedestal of a movable car seat is cut out to receive the heater which is protected by guards extending out from the pedestal.

713,311. Railway Construction; L. C. Kendall, Boston, Mass. App. filed Jan. 4, 1902. Stringers support cross timbers which sustain sleepers connected to said cross timbers at their central portions, and adapted to support rails on their free ends, said free ends of the sleepers being unconnected with the ends of, and separated by a space from, the ends of the cross timbers, whereby the vibration passes through the sleepers to the construction on which the sleeper rests.

713,340. Electromagnetic Brake; W. T. Pember, Toronto, Canada. App. filed March 4, 1902. A bar extending between the wheels has shoes attached to its ends, the bar being obliquely set and so arranged that the shoe at one end is below the center of the axle of the wheel and at the other end is above the center of the axle, the bar being wound with insulated wire, the ends of which are connected to a source of current for magnetizing the bar, thus creating a magnetic and frictional brake and a magnetic pull of the wheels on the rails.

713,357. Emergency Brake; A. L. Von Stenber, Allentown, Pa. App. filed June 14, 1902. Drop-arms pivoted to a supporting frame carry at their free ends a contact plate adapted to be forced down upon the rails at right angles thereto by a hand wheel and screw shaft.



PATENT NO. 713,543

713,368. Car Truck Bolster; J. C. Wands, St. Louis, Mo. App. filed Aug. 11, 1902. Comprises a compression member, head blocks cast on the ends thereof, a tension member and a strut.

713,499. Car Brake; J. Runnoe, Crested Butte, Col. App. filed June 10, 1902. Relates to the construction of the slack adjuster.

713, 510. Truck Side Frame; C. S. Shallenberger, Milwaukee, Wis. App. filed July 12, 1902. Comprises a casting having a recess at its center, primarily open at the top, adapted to receive the springs and end of the bolster and a compression member removably inserted in said recess above the bolster.

713,543. Car Truck Bolster; J. C. Wands, St. Louis, Mo. App. filed Aug. 11, 1902. Consists of a tension member having its ends shaped for permanent attachment in a casting, head blocks cast on the ends of said tension member, a compression member and a strut.

PERSONAL MENTION

MR. GEO. F. McCULLOCH, president of the Union Traction Company, of Indiana, has returned from an extended trip through Europe. Mr. McCulloch was accompanied by Mrs. McCulloch, for the benefit of whose health the trip was made. Both have been greatly benefited by the trip.

MR. EDWARD H. RICHARDS has been appointed assistant to Mr. Arthur C. Ralph, general superintendent of the Boston & Worcester Street Railway, of Worcester, Mass., and began his new duties Nov. 10. Mr. Richards is a young man, but has had considerable street railway experience. He has lately been with the Old Colony Street Railway, at Brockton, Mass., and was before that located at Bridgewater.

MR. C. N. DUFFY, auditor and assistant to the president of the Chicago City Railway Company, suffered a sad bereavement on Nov. 8 in the death of his wife. Mrs. Duffy was a lady of exceptional social attainments and attractive personality, and was held in the highest esteem by all who knew her. She had been sick for some time and was thought to be improving, but the end came suddenly. Mr. Duffy has the sincerest sympathies of all his friends in his loss.

MR. JAMES S. HEMINGWAY has been elected president of the Fair Haven & Westville Railroad, of New Haven, Conn., to succeed Mr. Henry S. Parmelee, deceased, and Mr. John B. Carrington has been elected vice-president of the company, succeeding Mr. Samuel Hemingway, who was first chosen for the presidency, but declined because other business claims a large share of his time. Mr. James S. Hemingway is a young business man of New Haven, and for a number of years has been a leading spirit in the Second National Bank. He has also been identified with several other enterprises, including that of the Fair Haven & Westville Railroad, of which he has been a director. Several years ago Mr. Hemingway was a member of the city government.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR

LIABILITY FOR NEGLIGENCE

INDIANA.—Street Railroads—Crossing Accident—Contributory Negligence—Trial—Judgments—Judgment Notwithstanding Verdict—Special Findings—Conflict in Findings.

1. A judgment notwithstanding the general verdict should not be granted by reason of special findings, unless the findings, construed strictly against the moving party, are in such conflict with the general verdict, construed with every reasonable intendment in its favor, that the two can not exist together or be reconciled

2. A judgment can not be rendered on special findings in opposition to a general verdict, unless the findings are sufficient, when strictly construed, to warrant a judgment within the issues for the moving party.

3. The fact that special findings contradict each other only affects the findings, and does not impair the general verdict.

4. Where plaintiff was injured at a street railroad crossing, a finding that plaintiff was voluntarily driving across defendant's track when the accident occurred, can not be construed as a finding that plaintiff voluntarily encountered the danger.

5. Where plaintiff was injured at a street railway crossing, findings that plaintiff, having average capacity to see and hear, and knowing that his horse was afraid of cars, and that cars frequently ran on a certain track, attempted to drive across the track without stopping, though his view was obstructed by buildings and trees, but that he looked and listened, but did not see the car till his horse was going on the track, which was 15½ ft. from the curb, do not show contributory negligence authorizing judgment for defendant, notwithstanding a general verdict for plaintiff.

6. In an action for injuries received at street railway crossing, where the complaint avers that defendant's car was operated at a high and dangerous speed, such fact will be assumed, on motion by defendant for verdict on special finding, notwithstanding a general verdict for plaintiff, in the absence of a finding as to the speed of the car, as the court, in passing on the motion, can not consider the evidence received, but will assume that all issuable facts not included in the findings were established in plaintiff's favor.—(McCoy vs. Kokomo Ry. & Light Co., 64 N. E. Rep., 92.)

IOWA.—Evidence—Competency—Review on Appeal—Specific Objections—Limitation of Actions—Estoppel to Plead.

1. Where the pleadings in another action against the same defendant were properly admitted in evidence upon a certain issue, over the objections of defendant, the action of the court in admitting these pleadings can not be reviewed on appeal, on account of immaterial matter in one of them prejudicial to the defendant; no specific objecti n on this account having been made below.

2. Where an officer of a railway company negotiated with one who had been injured on its cars, and, acting for the company, assured her that the statutory limitation would not be interposed, intending that she should rely on such assurance, and she, doing so, postponed the bringing of her action until after the expiration of the statutory period, the company was estopped from pleading the statutory bar.—(Holman vs. Omaha & C. B. Ry. & Bridge Co., 90 N. W. Rep., 833.)

LOUISIANA.—Injury to Employee—Contributory Negligence—Assumption of Risk.

1. There was great danger of accident in carrying on the work of reconstruction of the overhead electric lines and the railway track.

2. It was not made satisfactorily to appear that plaintiff's husband, a laborer employed by defendant, was guilty of contributory negligence.

3. Whatever special patrol or warning party there may have been, it is not shown that it sought to warn defendant of the danger by which he was surrounded.

4. The risk was not one assumed by the employees.—(Thompson vs. New Orleans & C. R. Co., 32 Southern Rep., 177.)

LOUISIANA.—Municipal Improvements—Street Railroads—Paving Roadbed.

1. The difference between plaintiff and defendant grows out of the measurement of defendant's roadbed in order to fix proportion of cost of paving due by defendant to plaintiff.

2. The statute looks only to the roadbed in fixing the amount. Plaintiff's contention is that this roadbed is 7 ft. wide; the defendant's that it is less. When ties are used, the rail rests on the inside and outside of the track the length of the ties. When girders or sleepers are used, the width of the roadbed is less. The roadbed consists of the foundation on which the superstructure rests. The rails are the superstructure, and rest on the girders.

3. The proportion of the space being limited to the roadbed, the court holds that it is without authority to take the outside of the track into account, on the ground that the road is benefited by the adjacent pavement. Roadbed owes the proportion of cost of paving. This does not include part of the adjacent roadway on which rails do not rest.—(City of Shreveport vs Shreveport Belt Ry. Co. (No. 14,408), 32 Southern Rep., 189.)

MASSACHUSETTS.—Street Railway—Personal Injuries—Contributory Negligence.

In an action for personal injuries caused by being struck by a street car, plaintiff testified that he judged the car to be a safe distance away when he attempted to cross the track. The evidence as to the distance and as to the speed of the car was conflicting. Held, that the question of contributory negligence was properly left to the jury.—(Coleman vs. Lowell, etc., St. Ry. Co., 64 N. E. Rep.)

MINNESOTA.—Street Railroad—Injury to Intending Passenger.

1. Plaintiff signaled the motorman in charge of one of defendant's street cars of his wish to take passage thereon, then started on a moderate run toward the track and the point where the car would come to a stop. When within about 6 ft. of the same, he stumbled by reason of some obstacle in the street, and fell upon the track, and was struck by the car and injured. Held, that the motorman was not bound to anticipate the possibility that plaintiff might fall upon the track, and was not guilty of negligence in not having his car under such control that he could stop the same in time to avoid such an accident.

2. Evidence examined, and held insufficient to support a finding of actionable negligence on the part of defendant.—(Winchell vs. St. Paul City Ry. Co., 90 N. W. Rep., 1050.)

MISSOURI.—Street Railroads—Frightening Horse—Negligence in Ringing Gong—Contributory Negligence—Instructions—Evidence.

1. Where a runaway horse enters a street on which a street car line is operated, and the driver and horse both know of the approach of a car, it is useless and negligent for the motorman to violently ring his bell, and his act can not be justified as being to assist the driver in keeping the horse from the car.

2. The question whether a street-car motorman used ordinary care in the management of his car when a horse in front of the car became frightened at it is for the jury.

3. Negligence of a street-car motorman in violently ringing his bell as his car approached a frightened horse, thus causing the horse to run away was not justified, though the driver had knowledge, when he drove on the street, that the horse was liable to become frightened at the car and run away.

4. The contributory negligence of a person on the street, injured through negligence in the management of a street car, does not preclude a recovery unless it enters directly into and forms a part of the efficient cause of the accident.

5. In an action against a street railroad for frightening a horse, evidence that the horse was frightened a week before by a dummy engine does not authorize an instruction that plaintiff can not recover, if the real cause of the accident was the disposition of the horse to frighten at cars.—(Oates vs. Metropolitan St. Ry. Co., 68 S. W. Rep., 906.)

MISSOURI.—Street Railways—Injury to Passenger—Instructions—Damages.

1. In an action against a street railway company for injury to a passenger due to the sudden stopping of the car, an instruction that if "the said accident could have been prevented by the exercise of the utmost human skill, diligence, and foresight on the part of defendant's employees," defendant was liable, was erroneous, because imposing too high a degree of care.

2. Rev. St. 1899, section 687, provides that where an application for a continuance is defeated by the opposite party's admitting that the absent witness would testify as alleged, such party "may disprove the facts disclosed or prove contradictory statements made by such absent witness, in relation to the matter in issue."

NOTE.—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York City.

Held, that an instruction that such party "may disprove the matters disclosed in said statements, or disprove any contradictory statements made by such absent witnesses in relation to the matters in issue," was error, because, in effect, telling the jury that the absent witnesses have made contradictory statements.

3. In an action against a street railway company for damages claimed for injury to plaintiff's wife, through defendant's negligence, an instruction "that the husband is entitled to the society, health, strength, and usefulness of the wife, unimpaired by injury as the result of the negligence of another," is erroneous, when the fact of injury is disputed, and the evidence on that point is conflicting.

4. In an action against a street railway company for damages claimed for injury to plaintiff's wife, through defendant's negligence, an instruction that he could recover "for loss of his own time in nursing and care of the injured wife," without limiting such recovery to the reasonable value of his time as a nurse, was error.—(Freeman vs. Metropolitan St. Ry. Co., 68 S. W. Rep., 1057.)

MISSOURI.— Passengers — Personal Injuries—Trial—Instructions.

Instructing that if the sudden stop of defendant's street car which injured plaintiff was caused by defendant's negligence or want of skill or diligence, and that if said accident could not have been prevented by the utmost skill and foresight, plaintiff was entitled to recover, was prejudicial error.—(Freeman vs. Metropolitan St. Ry. Co., 68 S. W. Rep., 1060.)

MISSOURI.—Street Railways — Personal Injuries — Stopping Cars at Street Corner—Prospective Passenger—Duty of Carrier —Warning—Instructions—Modification.

1. Where plaintiff claimed that she was injured by the negligence of defendant street-car company in suddenly starting its car while she was boarding it at a crossing, a charge submitting to the jury whether the street corner was a regular station for receiving and discharging passengers was not erroneous, on the ground that there was no claim that the corner was a "station"; that word being used in the instruction in the sense of "place."

2. Where a street car stops at a street corner in response to the signal of a person desiring to board it, the street-car company is liable for injuries to such person caused by the sudden starting of the car while he is boarding it, though the car stopped for the purpose of discharging, and not receiving, passengers, if such person is not warned by the conductor not to board the car.

3. Where defendant denied its negligence and alleged contributory negligence, an instruction to find for defendant if the injuries were the result of an accident was improperly modified by adding the words "that was not caused by defendant's negligence," since, as modified, it impliedly authorized a verdict for plaintiff, though guilty of contributory negligence.

4. Plaintiff alleged negligence, in that the servants of defendant street railway negligently started a car as plaintiff was boarding it. Defendant claimed that the car was stopped only to discharge passengers. Held, that defendant was not liable if the car was not stopped to allow plaintiff to board it, and the conductor warned plaintiff not to do so, in a tone of voice sufficiently loud to be heard by an ordinary person, though plaintiff did not, in fact, hear.

5. Where a requested instruction is modified, it ceases to be the instruction of the party requesting it; and he may complain of any part of it, as though it had been offered by the opposite party, though it was improper as originally offered.—(Maxey vs. Metropolitan St. Ry. Co., 68 S. W. Rep., 1064.)

NEW JERSEY.—Street Railroad—Injury to Pedestrian—Negligence.

A motorman is not chargeable with negligence because he fails to apprehend that a boy who is riding on the back of a wagon will jump from the wagon and run under his car while he is engaged in looking at the wagon, in order to pass it without a collision.—(Baier vs. Camden & S. Ry. Co., 52 Atlantic Rep., 215.)

NEW JERSEY.—Verdict—Setting Aside—Incapacity of Juror.

1. That one of the jurors in the trial of a cause does not understand the English language is no legal ground for setting aside the verdict, where the right of challenge existed.

2. The only remedy is by challenge, and it is immaterial whether the incapacity of the juror was known or not.—(Dickerson vs. North Jersey St. Ry. Co., 52 Atlantic Rep., 214.)

NEW YORK.—Street Railways—Personal Injuries—Negligence—Questions for Jury—Instructions—Inapplicability to Facts —Wrongful Death—Damages—Instruction.

1. Whether or not a motorman of a street car was negligent in turning his face away from the front of the car was a question for the jury.

2. Where a boy attempted to run across a street-car track, and was struck by a car, it was error to charge that, even if contributory negligence was assumed, the question remained whether the company, by reasonable care, could have avoided the consequences of the injured party's negligence, the facts not giving opportunity for the creation of a new situation after the boy had come into the position of danger, and the request being, therefore, inapplicable.

3. In an action by an administrator of an infant for his wrongful death, it was error to charge that, "If the jury find that the plaintiff is entitled to a verdict, a verdict for more than nominal damages must be given," as the measure of damages, under Code Civ. Proc. section 1904, is the pecuniary loss, which must be shown.—(Sciurba vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 772.)

NEW YORK.—Street Railroads—Crossing Accident—Negligence—Question for Jury—Contributory Negligence—Pleading—Damages Provable—Loss of Earning Capacity—Evidence—Sufficiency—Instructions.

1. Evidence that a street car was going at a very rapid rate at a crossing when plaintiff was struck, coupled with evidence that the car was some distance away when plaintiff attempted to cross, and the testimony of the motorman that he did not see plaintiff in front of the car, was sufficient evidence of the company's negligence to go to the jury, though the motorman testified that he saw plaintiff standing on the side of the track when the car was about 15 ft. away; the motorman on approaching a crossing being bound to have his car under reasonable control.

2. When a party injured in a street car crossing accident testifies that he saw the car just as he was leaving the track, but there is evidence that the car was some distance away when he started to cross, mere proof that he was thrown on the fender is not sufficient, as a matter of law, to show that he was struck on first going on the track, or before he reached the middle of the track, and was therefore guilty of contributory negligence in going on the track at all; but the questions is for the jury.

3. A complaint which alleges that by reason of defendant's negligence plaintiff was severely and seriously injured, bruised and wounded, and suffered and still suffers great physical and mental pain, and became sick, sore and disabled, and so remains, and on information and belief is permanently injured, and has been and will be prevented from attending to business, authorizes proof that as a proximate result of such injury he has suffered fracture of the skull, destruction of the ear, paralysis of one side, deafness, loss of eyesight, loss of memory, a mild form of insanity, loss of sexual powers, and that his injuries are of a progressive character, and will result in his death, and that his earning capacity is injured as a result thereof.

4. Evidence, in an action for personal injuries, by physicians and others, showing that plaintiff suffered fracture of the skull, destruction of an ear, paralysis on one side, deafness, loss of eyesight, loss of memory, a mild form of insanity, and loss of sexual power, and that his injuries are progressive, and that he is unable to do his work with the same help as formerly, was sufficient to authorize the submission to the jury of the issue of damages for loss of earning capacity, though he was receiving the same wages from the same employer at the time of the trial as at the time of the injury, and his employer testified that plaintiff was doing the same kind of work satisfactorily.

5. An instruction in a personal injury case that reasonable compensation may be awarded if the injury is permanent, taking into consideration the probable loss of earnings which will be sustained, but that the conclusion must be based on the evidence, and that the jury must follow the evidence and reasonable inferences drawn therefrom, is a sufficient statement of the rule that, in order to authorize a recovery for future consequences of such an injury, it must appear reasonably certain from the evidence that they will occur.—(Hoyt vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 832.)

NEW YORK—Street Railways—Car Jumping Track—Negligence—Question for Jury—Burden of Proof.

1. In an action for personal injuries sustained by plaintiff by being thrown from a street car on its jumping the track, where there was evidence that the car at the time was going at a "pretty good rate," and that the accident happened at a point where there were side tracks leading into the car stables, the question of defendant's negligence was for the jury.

2. In an action for personal injuries sustained by plaintiff by his being thrown from a street car on its jumping the track, though plaintiff made a prima facie case by proof that the car was going at a "pretty good rate," and that the accident happened at a point where there were sidetracks leading into the car stable, the burden nevertheless remained on him, when the proof was all in, to show negligence on the part of the defendant.—(Hollahan vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 751.)

NEW YORK.—Injunction Pendente Lite—Discretion of Court—Review on Appeal.

The appellate division cannot interfere with the discretion of the special term in refusing to continue an injunction pendente lite, restraining corporations from delivering or carrying into effect an agreement of lease executed between them where it appears to have been approved by the unanimous vote of the stock holders of one of the corporations and by over 80 per cent of the stockholders of the other, and it is shown that the lease has, in fact, been delivered and possession taken thereunder.—(Content et al vs. Metropolitan St. Ry. Co. et al, 76 N. Y. Supp., 749.)

NEW YORK.—Action for Personal Injuries—Successive Verdicts—Power of Court to Set Aside.

Where four successive juries in an action for personal injuries have brought in verdicts for the plaintiff the last verdict should not be set aside as against the weight of evidence, unless the circumstances are extraordinary and the verdict clearly outrageous.—(McCann vs. New York & Q. C. Ry. Co., 76 N. Y. Supp., 684.)

NEW YORK.—Coupon Bonds—Payment—Delivery of Coupon—Purchase Before Maturity—Negotiable Instrument.

Where coupons from bonds promise the payment of a certain sum on a certain date, and the mortgage securing the bonds provides that coupons shall always be transferred by delivery, the purchaser of a coupon before maturity is entitled to payment as provided in the coupon, notwithstanding any limitation or condition of the bond and mortgage, the provision as to delivery of the coupons making them in law negotiable instruments.—(Haskins vs. Albany & H. Ry. & Power Co., 76 N. Y. Supp., 667.)

NEW YORK.—Appeal — Evidence — Streets — Negligence — Questions for Jury.

1. On appeal from a judgment dismissing an action for negligence in placing an obstruction in a street on the ground that there was not sufficient evidence to connect defendant with the act complained of, plaintiff is entitled to the most favorable inferences that may be drawn from the evidence.

2. In an action for an injury resulting from defendant's negligence in placing an obstruction in a street it is for the jury to determine whether the act of placing an iron bar in the street in such a position that plaintiff came in contact therewith was negligence.—(Parkes vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 983.)

NEW YORK.—Appeal—Conflicting Evidence.

A judgment for plaintiff in an action for personal injuries will not be disturbed on appeal where the evidence was conflicting and no objections made to the charge.—(Lauck vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 977.)

NEW YORK.—Street Railways—Personal Injuries—Collision with Pedestrian—Contributory Negligence.

Plaintiff was pushing a hand cart between defendant street railway company's track and the sidewalk. On seeing a car approaching he called to the driver to stop, but made no effort to do so himself, continuing to push his cart toward the car, until he collided with it and was injured. Just previously plaintiff had been pushing his cart on the sidewalk, and could have returned thereto. There was no showing as to the width of the cart or the distance between the sidewalk and the track. Held, contributory negligence as a matter of law.—(Thal vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 918.)

NEW YORK.—Appeal—Evidence—Admissibility—Failure to Make Objection.

Where defendant in a personal injury case brought by an infant failed to raise the objection to evidence of plaintiff's emancipation and loss of earnings that plaintiff's emancipation had not been pleaded, the objection cannot be raised on appeal.—Kenny vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 904.

NEW YORK.—Preference on Calendar—Waiver.

Where a sole plaintiff, suing as administratrix, in an action triable in the County of New York, serves a notice of trial and a notice of a motion for preference, under Code Civil Procedure, section 791, for the April term, 1902, and they are not withdrawn or acted upon, the failure to make that motion in the April term operates as a waiver of the right to a preference and she cannot obtain it by serving similar papers for the May term.—(Emerick vs. Metropolitan St. Ry. Co., 76 N. Y. Supp., 901.)

NEW YORK.—Carriers—Injuries to Passenger—Evidence.

Plaintiff, a passenger, while leaving defendant's car, stepped on a nail, which penetrated his shoe and entered one of his toes, remaining there. No direct proof was given that the nail came out of the floor of the car. Defendant proved that the car had been inspected an hour before the accident and that a matting covered the floor. Held, that, since the evidence was as equally consistent with the absence as with the existence of negligence, plaintiff could not recover.—(Cahn vs. Manhattan Ry. Co., 76 N. Y. Supp., 893.)

CHARTERS, FRANCHISES AND ORDINANCES

MAINE.—Street Railroads—Route—Refusal to Approve—Appeal—Constitutional Law—Streets—Public Use — Control by Towns.

1. In an appeal, based upon the alleged neglect or refusal of municipal officers to approve the proposed route of an electric railroad company, under the provisions of chapter 268, section 6, Public Laws 1893, as amended by chapter 119, section 2, Public Laws 1899, relating to the organization of street railroad companies, it is necessary that enough should be alleged to show that the court has jurisdiction and that the appellant had the right to apply to the municipal officers for an approval of its route. But it is not necessary to allege all the steps by which the appellant obtained that right. The statute gives that right to every "corporation organized" thereunder. Under the statute as it existed when the appellant company was organized, as preliminary to the organization, it was necessary that the railroad commissioners should determine that public convenience required the construction of the railroad. But it is unnecessary to allege specifically, in an appeal like this one, that the railroad commissioners had so determined, for it is necessarily implied in the expression "corporation organized," or in any expression meaning substantially the same, as in the one used in this appeal.

2. It being argued that section 1, chapter 119, Laws 1899, is unconstitutional, the court, without considering that question, holds that whatever might be the construction of that section, with respect to the mooted question of constitutionality, section 2 of the same chapter, upon which the application and appeal in this case are based, stands in full force.

3. The court holds that chapter 119, section 2, of the Public Laws of 1899, relating to the route and location of street railroads in the ways and streets of a town, to the approval thereof by the municipal officers and to appeals from their action or refusal to act, is not unconstitutional, as being beyond legislative authority or as being arbitrary and unjust, or as permitting the property of towns to be taken for street railroad purposes without just compensation. The public has a mere easement in land taken and condemned for a highway or townway. It has the right to use it in certain ways. Within the scope of the easement the public, which acts through the Legislature, may regulate and control, may extend or diminish the public uses as it sees fit.

4. The Legislature has authority even to regulate and control towns themselves. For towns are but subdivisions of political government created by the Legislature. The operation of a street railroad is an appropriate public use of a street.

5. While a town is charged with the performance of many duties with respect to roads, and possesses a qualified control over them, it does not own them. When the Legislature authorizes a new method of use of the public easement in a way a town has no such property interest in the way as will entitle it to pecuniary compensation, nor has an injury been done to it of which it can properly complain. (Appeal of Milbridge & C. Electric R. Co., 51 Atlantic Rep., 818.)

MASSACHUSETTS.—Street Railroads—Location—Permit—Conditions—Validity—Excuse for Non-Performance—Deposit—Forfeiture.

1. A town granted a permit to construct a street railroad to a company whose road, as located in its articles of association, extended from another town to and through the town granting the permit, on condition that it would forfeit a certain deposit if it did not construct 10 miles of the road within one year. Held, that, it appearing that the 10 miles of road could be built, the refusal of the other town to grant the company a permit was not such an excuse for non-compliance with the condition to build such 10 miles as would avoid a forfeiture of the deposit.

2. A street railroad company which, as a condition to the granting to it of a permit to construct its road through a certain town, made a deposit with the selectmen of such town, to be paid over to the town treasurer if the company did not have 10 miles of its road in operation within one year, could not, after having failed to construct such 10 miles within the year, recover the deposit, whether the condition was a proper one or not.—(West Springfield & A. St. Ry. Co. vs. Bodurtha et al., 64 N. E. Rep., 414.)

NEW JERSEY.—Municipal Corporations—Grant of Franchise—Revocations—Passage of Ordinance.

1. In a proceeding to take away rights granted by an ordinance or otherwise possessed by an individual or corporation a municipality can only act after notice and opportunity to be heard has been given to the person or corporation whose property rights are to be affected.

2. When an ordinance is stayed in its progress to a final passage through a failure of proper continuances by the Council or

other municipal body it dies with the end of the last vitalizing action. There must be a continuity in such municipal action.—(State (Jersey City, H. & P. St. Ry. Co., Prosecutor) vs. City of Passaic, 52 Atlantic Rep., 242.)

NEW JERSEY.—Municipal Improvements—Paving Street—Assessment on Street Railroad.

1. Where a city street has been paved and improved under chapter 217, Laws 1895 (P. L. 1895, p. 407; 1 Gen. St., p. 487), authorizing the board or body having control of the streets and highways of any city of the first-class of this State to pave or otherwise improve any street, avenue or public highway in such city, and to cause so much thereof as shall equal the amount of benefits to be assessed by its proper officers upon the property specially benefited thereby, it was held, on review, that an assessment of such benefits made upon a street railway constructed and operated along the street in question under the authority of a municipal ordinance was unauthorized and should be set aside.

2. The decision is based upon the ground that the right of the railway company to locate its tracks in the street and operate its railway therein was not a lot or parcel of land, within the meaning of the statute, which, inter alia, directs the commissioners, in making their assessment, to make therewith a report and map showing the benefit to each lot or parcel of land specially benefited by the improvement.

3. An ordinance of the city requiring the railway company to pave the space within its tracks and two feet outside the same gives no authority in support of such an assessment made against the company under the statute named.—(North Jersey St. Ry. Co. vs. Mayor, etc., of Jersey City, 52 Atlantic Rep., 300.)

NEW YORK—Street Railroads—Acquisition of Street Rights—Damages Recovered by Abutting Owner—Trust in Favor of Former Owner—Reservations in Deed—Procedure to Enforce Trust—Deed by Owner to Railroad.

1. A deed reserved to the grantor all claim or right of action against an elevated railroad company for damages to the property conveyed by reason of the construction, etc., of its road. The grantee obtained a judgment for such damages, and the grantor thereafter sued the grantee, and obtained a decision that such recovery was impressed with a trust for his benefit, but not determining his and the grantee's respective interests therein. Held that the grantee having an interest in the recovery to the extent of the costs of obtaining it, and possibly being entitled to it all, and being well worth any judgment which might be rendered against him in the grantor's action, the grantor was not entitled to an order restraining the railroad company from paying the grantee his recovery, and requiring such recovery to be paid into court to abide the decision in the grantor's action, but on giving a bond conditioned to indemnify the grantee for loss of the use of his recovery, etc., the grantor might apply for an injunction to restrain the payment of the money to the grantee.

2. Where a deed reserved to the grantor all claim or right of action against an elevated railroad company for damages to the property conveyed by reason of the construction, etc., of its road, and the grantee thereafter obtained a judgment for such damages, and a controversy resulted as to who was entitled to the recovery, the grantee, having the legal title to the property, could make the usual conveyances, releases, etc., to the railroad company as fully and completely as though there were no controversy about the recovery.—(Shepard vs. Manhattan Ry. Co. et al., 76 N. Y. Supp., 269.)

OHIO.—Eminent Domain—Interurban Railroad—Use of Highway—Injunction.

1. The construction and operation of an interurban railroad laid with T-rails entirely on the side of a public highway next to the abutting improved farms owned and occupied by the plaintiffs, and entirely between their lands and the traveled part of the highway—the company having authority to run an unlimited number of cars and trains for the carrying of passengers and the transportation of freight, express matter and government mail—is an additional burden on the public highway and obstruction to and interference with the plaintiffs' easements and rights therein, not substantially different from those that are imposed by the construction and operation of steam railroads under like conditions.

2. The construction and operation of an electric plant in connection with such railway, and on the same side of the traveled public roadway, for supplying heat, power and light to consumers for profit, constitutes another additional burden, which is an invasion of the plaintiffs' property rights.

3. The plaintiffs are entitled to injunction in such case to prevent the construction and operation of such railroad and of such electric plant, or either, until compensation and damages shall be assessed them in a proper appropriation proceeding and paid or secured to be paid.—(Schaaf et al. vs. Cleveland M. & S. Ry. Co. et al., 64 N. E. Rep., 145.)

PENNSYLVANIA.—Street Railways—Duty to Pave—Recovery by City.

1. A street railway company which has been allowed by a city to occupy a macadamized street, by ordinance requiring it to pave its right of way with cobblestones, and keep said paving in good repair, thereby acquires no contract rights which will relieve it from complying with demand of the city that it replace the pavement on its right of way, which is in fact out of repair, with pavement corresponding with an improved pavement adopted for the rest of the street.

2. Under a provision in a street railway company's charter that the City Council may establish such regulations in regard to the railway as may be required for the purpose of grading streets and to prevent obstructions, the company may be required, at its own expense, to lower its tracks to conform to a change in grade of street.

3. Where a city has done paving on a street railway's right of way which the company was bound, but neglected, to do, the sum expended thereon is prima facie the amount the city is entitled to recover of the company.—(City of Reading vs. United Traction Co., 52 Atlantic Rep., 106.)

GEORGIA.—Negligence—Electric Wires—Corporations—Notice to Servant—Imputed Negligence.

1. When a street railway company with reasonable promptness discovers the sagging of one of its trolley wires, which had been unexpectedly caused by the falling of a wire belonging to another, and immediately takes proper steps to prevent its wire from causing injury to travelers in the street over which the same is suspended, the company meets the legal requirements as to diligence under such circumstances.

2. Notice to the servant of a corporation with respect to a matter over which he has no authority, and as to which be has no duty to perform, is not notice to the corporation.

3. Every person must exercise ordinary diligence in protecting himself from danger, and, failing to do so, must take the consequences.

4. The negligence of a servant in failing, while driving his master in a vehicle, to avoid danger, is imputable to the latter.—(Read vs. City & Suburban Ry. Co., 41 S. E. Rep., 629.)

VIRGINIA.—Street Railroads—Right to Occupy the Public Highways—Power of Road Trustees.

1. Acts 1889-90, page 26, authorizing a street railway company to maintain and operate a railroad in the city of Norfolk and to "such other points in the counties of Norfolk and Princess Anne not exceeding 20 miles in length from the limits of the city," as the company's directors may determine, but providing that no work shall be commenced within the city without first obtaining the council's consent, and Acts 1893-94, page 17, providing that the company may acquire by condemnation proceedings the right of way of any extensions and branches of the railroad, do not confer upon the company power to operate upon the public highways outside of the city of Norfolk a street railroad for the transportation of passengers without first acquiring the right by purchase or condemnation proceedings.

2. Under Acts 1893-94, page 127, as amended by Acts 1895-96, page 846, providing that the board of road trustees of Norfolk County shall have authority to work and keep the roads of the county in repair, the board cannot confer upon a street railway company the right to operate upon the highways a street railway. (Norfolk Railway & Light Co. vs. Consolidated Turnpike Co., 40 S. E. Rep., 897.)

WISCONSIN.—Street Railways—Eminent Domain—Streets—Actions—Joinder—Equitable Remedy—Damages.

1. Under Rev. St. 1898, Sec. 1863a, as amended May 2, 1899, authorizing the exercise of the right of eminent domain by street railway companies, but providing that such right should not extend to any public thoroughfare in a town or village, a street railway company is without authority to condemn a right of way through a street, so that, where a street railway was constructed through a street, the owners of the servient estate are not restricted to condemnation proceedings under Sec. 1852, providing that the landowner may institute such proceedings if the railroad fails to, but are entitled to damages and abatement.

2. Adjoining owners of the servient estate in a street in which a street railway has been unlawfully constructed have a right to sue jointly for abatement.

3. The owners of lots of various widths and locations abutting on a street in which a street railway has been unlawfully constructed cannot sue jointly for damages in a gross sum.—(Younkin et al. vs. Milwaukee Light, Heat & Traction Co., 87 Nor. Rep., 861.)

FINANCIAL INTELLIGENCE

THE MARKETS

WALL STREET, Nov. 19, 1902.

The Money Market

The money market is feeling the good effects of the recent tremendous liquidation of speculative holdings in securities. Just how far this liquidation has reduced outstanding bank credits will not be immediately known. The record of national bank operations outside New York City is only published once a quarter, the trust company statistics only once a half year. Inasmuch as by far the greater part of last summer's speculative purchases were financed by these outside institutions, the recent return of speculative credits has affected their position much more than the position of the central national banks of New York City. Consequently no idea can be had through the regular Clearing House statement of how much the stock market decline has improved the money conditions of the country. Last Saturday's report showed a decrease in loans of only $5,000,000. But even this sum would have been considerably greater had proper account been taken, under the average system, of the very heavy selling of Friday and Saturday on the Stock Exchange. This coming week's figures will doubtless make a fairer representation by showing another good-sized decrease in the loan column. Yet, while last Saturday's credit contraction was far less than seemed reasonable under the circumstances, it was enough to offset the loss in cash at the Sub-Treasury and allow a small increase in the surplus reserve. The Treasury problem, now that the Secretary has withdrawn his temporary remedies, is once again quite serious. The market apparently must reconcile itself to this disturbing factor, and look forward to the time, near at hand, when it will be counterbalanced by the inflow of currency from the interior. In fact, there were some indications even last week that the return movement of money had begun. Gold exports, with demand sterling very firm around 4.87, and with Paris exchange at the lowest of the season, must still be reckoned one of the probabilities. But each week that they are postponed during the trying period between now and Christmas, means a great gain for the local money position. Were money rates to ease off at all the only barrier to gold shipments would be removed. This is the best reason for believing that there will be no concession yet awhile from the prevailing interest rates.

The Stock Market

The precipitate decline in the stock market reached what, to all appearances, was its climax on Friday afternoon. Since that time sharp recoveries have occurred among the active shares, and confidence has in some measure been restored. The decline was checked not so much because the unsound banking conditions which caused it have been surely relieved, as because prices reached a level where they became attractive to investors. Investment purchases on a very extensive scale were what rallied the market from its extreme demoralization, which on several occasions came perilously near the stage of panic. The speculative community has safely passed through the violent shock, but it will be a long time before the wounds are healed, and convalescence is complete. The experienced observer cannot well expect, therefore, anything more than a moderate recovery, such as regularly occurs when the first urgent liquidation is over. An advance of any magnitude is quite out of the question. The most that can be hoped for is that the market will quiet down, the fever of the last few weeks subsiding, and that normal fluctuations, within a comparatively small range, will be resumed. Had not the financial and commercial situation been sound at bottom the market would certainly have had a far more serious time of it. As it was the collapse in speculative circles went far enough to do considerable damage, and this will take a long time to repair.

The feature of the entire market has been the movement in Manhattan Elevated, which, after yielding less than the other stocks in the general break, was bid up with great rapidity on Monday and Tuesday almost to the high level of a year ago. The usual rumors of a lease to the New York Central have been revived, but the reason which appeals most forcibly to well-informed persons is that the rapidly increasing earnings of the property have attracted investment buying in such quantity as to reduce the amount of the stock in the open market to a comparatively small total. Under these circumstances it has not been a difficult matter for a strong pool to lay hold of the floating supply and to force up the price sharply, the movement being favored, whether openly or not, by the capitalists identified with the management. The old prediction that Manhattan would cross Metropolitan in price has been verified in an interesting manner. Brooklyn Rapid Transit was offered down by a "bear clique" to the lowest figure it has touched in a year and a half. But on the decline supporting orders from inside sources were met in quantity, and the stock, during the last few days, has been decidedly firm.

Philadelphia

There is not much to be said of the movement of the traction securities in Philadelphia during the week. Business in them has been curtailed by the general market depression, but prices have scarcely suffered. The indications are, as often observed before, that the floating supply of the principal shares that might be dislodged by such a break is very small. Besides this the securities are low-priced, which renders them less susceptible to a money market disturbance. Philadelphia Rapid Transit dipped to 15½ last Thursday, but quickly rebounded to 16½, and Union Traction has shown similar steadiness at a range between 46 and 47. American Railways has not gone below 53 nor above 54, but the market for the stock continues to reflect a steady absorption. Small lots of Philadelphia Traction have brought 98, and small sales of Railways General are reported at 4¼, and of Consolidated Traction of New Jersey at 69¼.

Chicago

Chicago stocks have been dull and depressed during the week, especially in the case of the elevated securities. Northwestern common, under pressure, sold down to 31½, regaining subsequently only a fraction of the loss. The preferred sold at 81. It is a fact, now conceded, that the universal transfer decision is taking a good deal of traffic away from the Northwestern, in favor of the Union Traction surface lines. This has stimulated the negotiations with the St. Paul Railroad for an interchange of the Evanston business. The transfer decision does not seem to have had any similar adverse effect upon Metropolitan's traffic, for the earnings of the company are said to be maintaining an average gain of 20 per cent over last year. Nevertheless, Metropolitan shares have been pressed for sale along with the rest, the common sinking as low as 37½, and the preferred 85. Lake Street has also been weak, at a decline to 9. City Railway dropped 2 points to 210, but Union Traction, with scarcely anything doing, held steady around 15½. According to present plans the question of extending the franchises of the surface roads will be settled during the next sixty days.

Other Traction Securities

Boston traction stocks have been very irregular, but with a rather firmer undertone than in the case of last week. After selling at 154½ Boston Elevated dropped again to 153. Massachusetts Electric was strong, at one time the common getting up to 36⅝. Later, however, the price fell back to 35. The preferred, on scattering transactions, held well around 96¼. West End sold at 94⅜, and later at 93⅞. In Baltimore the United Railway securities have held their own, the stock at 13⅞, the incomes around 68, and the generals around 95. Nashville securities are unchanged, at 4 for the shares and 77¾ for the 5 per cent certificates. Other sales in the Baltimore market include Lexington Railway 5s at 104¾, Charleston Street Railway 5s at 106⅛, Atlantic Street Railway 5s at 106¼, Anacostia & Potomac 5s at 98½, and Second Avenue, of Pittsburgh, 5s at 118¼. On the New York curb the week's sales of traction Traction common at 35⅞ to 37, the preferred at 90 to 93. Camden & Trenton at 4⅛ and 4, New Orleans Street Railway common at 15½ to 14½, the preferred at 49. St. Louis Transit (400 shares) at 28, United Railways, of St. Louis, 4s at 85, and 84¾, and New Orleans 4½s from 80 to 79½. There has been another very quiet week on the Cleveland Exchange. Sales numbered only 728 shares. Aurora, Elgin & Chicago receipts ranged from 35 to 35¼, sales 280 shares; Miami & Erie Canal sold at 33 and 33½ for 370 shares, and Syracuse Rapid Transit sold at 32 for a small lot. Monday a small lot of Western Ohio receipts sold at 26½, a drop of 3 points from last sale. There are plenty of bargain hunters on the Cleveland Exchange, but the traction stocks appear to be in strong hands, and there is very little forced liquidation.

Iron and Steel

In the main, the iron situation continues favorable. Reduction in prices in certain finished products is more than offset by the abundant evidence in other parts of the industry that consumption is still running well ahead of output. The entire steel rail-making capacity of the country is contracted for for practically

the whole of next year. Pig-iron production, on account of the difficulty in getting fuel, has fallen off from 345,000 tons weekly on Oct. 1 to 337,500 tons on Nov. 1. Consumption has not, meanwhile, diminished in any line. Quotations are $21.75 to $22.50 for Bessemer pig iron; $30 to $31.50 for steel billets, and $28 for steel rails.

Metals

Quotations for the leading metals are as follows: Copper, 11½ cents; lead, 4⅛ cents; tin, 25.90 cents, and spelter, 5.35 cents.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Nov. 11	Nov. 18
American Railways Company	53½	53
Aurora, Elgin & Chicago	a37	a37
Boston Elevated	152½	155
Brooklyn R. T.	59	58¾
Chicago City	210	210
Chicago Union Tr. (common)	15	15
Chicago Union Tr. (preferred)	a49	45
Cleveland Electric	85	84
Columbus (common)	57	58½
Columbus (preferred)	106	106
Consolidated Traction of N. J.	68½	69
Consolidated Traction of N. J. 5s	110¼	110¼
Detroit United	86½	86
Electric People's Traction (Philadelphia) 4s	98¼	98¼
Elgin, Aurora & Southern	a60	a51
Indianapolis Street Railway 4s	86¾	86½
Lake Shore Electric	12½	12
Lake Street Elevated	9¼	9
Manhattan Railway	133	142
Massachusetts Elec. Cos. (common)	36¼	35¾
Massachusetts Elec. Cos. (preferred)	96	96
Metropolitan Elevated, Chicago (common)	38	36
Metropolitan Elevated, Chicago (preferred)	85½	85
Metropolitan Street	136	137
New Orleans Railways (common)	15¾	13¾
New Orleans Railways (preferred)	50	48
North American	120	119
Northern Ohio Traction (common)	—	a67
Northern Ohio Traction (preferred)	93½	92½
North Jersey	32¾	32¾
Northwestern Elevated, Chicago (common)	34	31½
Philadelphia Rapid Transit	17¼	16¾
Philadelphia Traction	98	98
St. Louis Transit (common)	28	28
South Side Elevated (Chicago)	106	105
Syracuse Rapid Transit	31½	31
Syracuse Rapid Transit (preferred)	76	76
Third Avenue	125	123
Toledo Railway & Light	a38	30
Twin City, Minneapolis (common)	113	111
United Railways, St. Louis (preferred)	—	—
United Railways, St. Louis, 4s	84¾	84¾
Union Traction (Philadelphia)	46½	46½
Western Ohio Railway	28¼	26

a Asked.

BALTIMORE, MD.—The Continental Trust Company has closed the deal with the United Railways & Electric Company for the purchase of the $2,000,000 of common stock of the United Electric Light & Power Company, and the stocks and bonds of the Mount Washington Electric Company. The trust company, acting as a syndicate, is to pay $900,000 for the entire issue of the common stock of the Electric Light & Power Company, and $150,000 for the stocks and bonds of the Mount Washington Electric Company, on or before Jan. 15 next. The purchase is a step in the scheme for development of electric power from Susquehanna River.

BALTIMORE, MD.—The recent purchase by the Railways & Light Company of America of street railway and lighting properties at Macon and Augusta, Ga., calls attention to the operations of this company in purchasing and consolidating street railway and lighting properties in the South. The company, as a result of its purchases, now controls the Lexington Railway Company, Lexington Gas Company, of Lexington, Ky., the Knoxville Traction Company; Knoxville Electric Light & Power Company, of Knoxville, Tenn.; Macon Railway & Light Company, of Macon, Ga.; Augusta Railway & Electric Company; Augusta & Aiken Railway Company, of Augusta, Ga.; Portsmouth, Berkely & Suffolk Water Company, of Portsmouth, Va. The executive office of the company is at Baltimore, and the office of the general manager of the company is at Richmond, Va. The officers of the company are: J. Wm. Middendorf, president; R. Lancaster Williams, vice-president; H. P. Page, secretary; A. H. Rutherford, treasurer; E. L. Bemiss, general manager.

BOSTON, MASS.—The Boston *Financial News* says: "It is understood that gross earnings of the Boston Elevated Railway Company for the fiscal year ended Sept. 30 amounted to about $11,200,000, showing an increase over the previous year of about $400,000. The ratio of increase is stated to be about $1,000 a day per year. The Boston Elevated Company did not suffer a very serious decrease in earnings on account of the cold summer, as, while the surface travel fell off, the increase on the elevated section was very nearly large enough to offset it."

WORCESTER, MASS.—The Worcester & Southbridge Street Railway Company has filed its report for the year ending Oct. 1 with the Massachusetts Railroad Commissioners. The report covers only two months and eleven days, operation of the road having been begun July 21. During that period 675,237 passengers were carried, which is 32,213 passengers for each mile of road operated. The gross earnings were $32,165. The operating expenses, taxes, etc., were $13,595, making the net earings $18,570. The number of car-miles run was 103,833.

WORCESTER, MASS.—Confirmation of the statement that the Worcester & Connecticut Eastern Railway Company is closely allied with the New York, New Haven & Hartford Railroad is found in a prospectus of the former company, which says: "The railway company has no competition from other electric roads in its territory, and will be operated in harmony with the New York, New Haven & Hartford Railroad, whose control and ownership of the majority of the stock assures full co-operation in developing the resources of the country." An estimate of the probable earnings of the company for the coming year shows: Gross earnings, $310,000; operating expenses and taxes, $175,000; net earnings, $135,000. The company is to issue $2,060,000 of first mortgage 4 per cent and 4½ per cent gold bonds. This issue of bonds will care for these items: Thirty thousand of Webster & Dudley first mortgage bonds; $150,000 of the first mortgage bonds of the Worcester & Webster, or so much of that amount as can be secured; 400 shares of the People's Tramway Company's; 500 shares of the Danielsonville & Norwich Street Railway, and the floating indebtedness, amounting to not less than $250,000 of the Worcester & Webster. All these securities will be deposited as collateral to secure the mortgage. Also 1408 shares of the total issue of Worcester & Webster stock and 500 shares of the total issue of the Webster & Dudley Street Railway.

DETROIT, MICH.—The Jackson & Battle Creek Traction Company has been formed, with a capital stock of $1,500,000, by the merger of the Jackson-Albion-Calhoun County Railway and the Marshall & Battle Creek Railway. The officers of the new company are: C. M. Spitzer, of Toledo, president; A. L. Spitzer, of Toledo, vice-president; W. A. Fotte, secretary; S. N. Potter, treasurer. The above, with S. C. Rorick, W. A. Bolland, Wm. Robertson, W. H. Thompson and J. R. Nutt, are the directors. The Savings & Trust Company, of Cleveland, has been made trustee for $1,200,000 of bonds issued by the company. The line is 45 miles in length.

MUSKEGON, MICH.—The report of the Muskegon Traction & Lighting Company for the seven months from March 1 to Oct. 1, shows: Gross receipts, $101,869 for 1902, against $83,658 for 1901; operating expenses, $62,400 for 1902, against $55,847; net earnings, $39,469 for 1902, against $27,811 for 1901.

NEW YORK, N. Y.—The Manhattan Elevated Railroad Company reports earnings as follows:

Quarter ended Sept. 30	1902	1901
Gross receipts	$2,495,112	$2,093,277
Operating expenses	1,338,941	1,312,130
Earnings from operation	$1,156,171	$781,147
Receipts from other sources	81,288	191,287
Gross income	$1,237,459	$972,434
Fixed charges	644,769	632,350
Net earnings	$592,690	$340,084
Cash	270,743	......
Profit and loss surplus	6,372,118	......

DUNKIRK, N. Y.—The Dunkirk & Fredonia Street Railroad Company has given a mortgage for $100,000 to the Fidelity Trust Company, of New York, to take up all outstanding obligations. The mortgage covers the plant of the Fredonia Gas Company, now merged with the Dunkirk & Fredonia Street Railroad Company.

GLENS FALLS, N. Y.—The report of the Hudson Valley Railway Company for the year which ended June 30, 1902, shows: Gross earnings from operation, $321,068; operating expenses, $226,790; net earnings, $94,277; other income, $36,108; gross income, $130,386; fixed charges, $126,923; net income and total surplus, $3,463. The number of passengers carried during the year, including transfers, was 4,408,761. The total car mileage was 1,655,461.

CLEVELAND, OHIO.—The Cleveland bankers and capitalists who financed the Northern Texas Traction Company are preparing to issue the securities of the road. The property will be bonded for $2,500,000, with stock of like amount. The Prudential Trust Company, of Cleveland, will be the trustee for the bonds.

CONNEAUT, OHIO.—The Conneaut & Erie Traction Company, now building a road, has increased its capital stock from $10,000 to $50,000.

WARREN, OHIO.—The Western Reserve Traction Company has been incorporated, with $10,000 capital stock, by T. A. Willard, M. A. Lander, E. Jay Pinney, C. W. Noble and E. H. Gebert. The company proposes to build an electric railway from Warren through Trumbull County.

PHILADELPHIA, PA.—The earnings of the American Railways Company for October were $86,874, an increase of $13,684 over the same month last year. From July 1 to Oct. 1 the earnings were $353,193, an increase of $90,252 over the same period last year.

RICHMOND, VA.—It is again reported that the deal for the purchase of the Richmond & Petersburg Electric Railway by the Virginia Passenger & Power Company has been arranged. The Richmond & Petersburg Electric Railway operates between Petersburg and Manchester and was built by the Cleveland Construction Company, in which Messrs. Mandelbaum, Christy and other Ohio capitalists are interested.

STAUNTON, VA.—Control of the Staunton Street Railway, Electric Light & Gas Company has passed into the hands of local capitalists.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition. *b* All capital stock owned by Detroit United Ry.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., Oct. '02	55,687	30,881	25,201	12,011	10,892
	1 " " '01	51,479	28,709	22,710	11,448	10,272
	6 " June '02	318,367	185,392	133,57[illegible]	77,550	56,018
	6 " " '01	256,967	151,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	*370,845	290,166	191,162	100,001
	12 " " '00	518,742	*317,475	196,216	141,131	55,117
ALBANY, N. Y. United Traction Co.	1 m., Sept. '02	132,006	81,370	50,636	24,000	26,730
	3 " " '02	110,645	251,730	102,907	71,508	31,399
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., Sept. '02	18,432	10,160	7,972	......	......
	1 " " '01	18,476	9,366	8,470	......	......
	3 " " '02	65,255	33,968	31,250	16,024	15,246
	3 " " '01	61,100	31,021	42,196	14,988	15,148
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '02	10,959,400	7,396,997	3,562,904	2,906,359	646,549
	12 " " '01	10,536,994	6,858,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos.	12 m., Sept. '02	5,779,145	4,917,496	1,962,648	937,236	925,412
	12 " " '01	5,548,857	3,692,216	1,850,501	934,294	905,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., Sept. '02	1,184,384	667,361	516,992	......	......
	1 " " '01	1,090,156	661,011	429,548	......	......
	3 " " '02	3,387,780	1,681,[illegible]4	1,705,965	......	......
	3 " " '01	3,411,101	2,032,215	1,378,886	......	......
	12 " June '02	12,780,705	*8,933,214	3,847,401	......	......
	12 " " '01	12,101,198	*7,879,845	1,281,663	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., Sept. '02	321,855	161,525	160,831	77,702	83,129
	1 " " '01	253,322	106,834	146,388	81,961	64,437
	3 " " '02	1,019,518	506,664	512,854	235,741	277,113
	3 " " '01	791,450	311,745	446,725	245,783	250,342
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., Oct. '02	40,759	27,246	13,454	13,409	25
	1 " " '01	39,628	24,502	14,470	13,842	634
	8 " " '02	432,05[illegible]	250,962	182,045	109,062	72,984
	8 " " '01	334,126	211,870	122,250	110,049	2,201
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Oct. '02	15,331	6,548	9,783	......	......
	1 " " '01	15,254	6,812	8,241	......	......
	10 " " '02	163,130	66,195	96,743	......	......
	10 " " '01	147,412	62,410	81,002	......	......
CLEVELAND, O. Eastern Ohio Traction Co.	1 m., Oct. '02	17,396	10,142	7,234	6,039	1,180
	10 " " '02	[illegible]	80,065	71,405	54,574	16,894
Cleveland, Elyria & Western	1 m., Oct. '02	28,219	16,090	12,132	......	......
	1 " " '01	22,792	12,011	10,124	......	......
	10 " " '02	248,511	135,001	113,136	......	......
	10 " " '01	205,729	113,108	85,394	......	......
	12 " Dec. '01	242,206	130,865	112,341	57,095	55,247
	12 " " '00	179,094	102,303	77,301	34,565	42,742
Cleveland, Painesville & Eastern	1 m., Oct. '02	16,213	9,655	6,558	......	......
	1 " " '01	15,159	8,238	7,181	......	......
	10 " " '02	160,6[illegible]	88,621	71,057	......	......
	10 " " '01	134,834	71,001	68,022	......	......
	12 " Dec. '01	161,9[illegible]1	*86,102	77,809	72,500	5,309
	12 " " '00	141,112	*69,592	71,520	72,500	†980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.				12,823	22,230	30,585
	1 m., Aug. '02	56,118	*33,295	28,794	15,807	12,977
	1 " " '01	73,525	*43,741	232,119	131,250	131,869
	8 " " '02	526,176	*311,026	208,149	125,328	82,841
	8 " " '01	385,744	*127,615			
DETROIT, MICH. Detroit United Ry.	1 m., Oct. '02	302,348	173,325	129,063	......	......
	1 " " '01	252,081	138,504	113,577	......	......
	10 " " '02	2,886,[illegible]81	1,628,424	1,257,254	......	......
	10 " " '01	2,512,523	1,382,956	1,130,557	......	......
	12 " Dec. '01	2,919,177	*1,506,765	1,422,106	652,277	670,129
	12 " " '00	2,575,277	*1,439,868	1,136,[illegible]	616,408	519,731
Detroit and Fort Huron Shore Lines *b*	1 m., Sept. '02	39,771	23,492	16,281	......	......
	1 " " '01	33,281	21,176	14,111	......	......
	9 " " '02	321,160	188,969	134,421	......	......
	9 " " '01	246,917	162,856	126,061	......	......
DULUTH, MINN. Duluth-Superior Tr.	1 m., Sept. '02	46,763	23,091	23,672	9,619	14,053
	1 " " '01	39,165	19,941	19,241	9,190	10,051
	9 " " '02	396,274	206,904	189,384	86,919	102,465
	9 " " '01	335,906	181,561	153,716	82,379	71,359
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., Oct. '02	33,648	21,041	12,607	8,318	4,674
	1 " " '01	29,578	18,064	11,614	8,359	3,290
	10 " " '02	341,900	200,165	141,735	83,333	58,404
	10 " " '01	304,144	170,290	133,856	82,334	50,582
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction *a*	1 m., Aug. '02	24,940	12,083	12,857	......	......
	1 " " '01	16,849	9,065	7,884	......	......
	8 " June '02	111,972	60,838	51,134	......	......
	8 " " '01	80,340	51,464	28,876	......	......
HAMILTON, O. The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Oct. '02	41,747	22,648	19,099	10,512	8,587
	5 " " '02	225,849	113,854	112,395	81,783	30,612
LONDON, ONT. London St. Ry. Co.	1 m., Oct. '02	11,645	7,408	4,237	1,911	2,326
	1 " " '01	10,105	6,856	3,749	1,367	1,792
	10 " " '02	127,317	78,200	49,096	22,195	26,891
	10 " " '01	116,814	72,274	41,530	19,800	21,730
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Oct. '02	239,953	114,992	121,961	67,814	57,137
	1 " " '01	206,812	99,249	107,558	63,409	44,151
	10 " " '02	2,254,794	1,061,410	1,193,384	664,625	528,759
	10 " " '01	1,992,050	977,549	1,014,474	621,810	390,663
	12 " Dec. '01	2,442,31[illegible]	1,185,551	1,256,9[illegible]	755,489	501,609
	12 " " '00	2,200,098	1,189,787	1,000,911	694,065	306,847
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Sept. '02	330,630	130,611	200,019	60,290	148,525
	1 " " '01	306,384	123,131	185,253	57,675	127,390
	9 " " '02	2,667,095	1,191,320	1,475,775	530,789	943,142
	9 " " '01	2,340,165	1,058,846	1,274,318	505,273	768,044
MONTREAL, CAN. Montreal St. Ry. Co.	12 m., Sept. '02	2,046,299	1,135,176	911,082	......	......
	12 " " '01	1,900,680	1,105,267	795,413	......	......
NEW YORK CITY. Manhattan Ry. Co.	12 m., Sept. '02	11,583,546	3,545,395	6,038,151	2,712,069	3,326,082
	12 " " '01	10,433,872	5,306,649	5,127,223	2,683,132	2,444,091
Metropolitan St. Ry.	6 m., Dec. '01	3,887,986	1,738,972	2,148,964	1,151,140	992,824
	6 " " '00	3,786,050	1,659,649	2,066,861	1,129,467	937,911
	12 " June '02	15,806,641	7,393,868	8,460,739	4,815,421	3,665,337
	12 " " '01	14,720,767	6,755,181	7,965,636	4,584,069	3,481,567
OLEAN, N. Y. Olean St. Ry. Co.	3 m., Sept. '02	18,401	8,135	10,506	4,082	6,208
	3 " " '01	16,872	6,867	9,485	4,200	5,283
	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co.	3 m., Sept. '02	9,480	5,217	4,263	2,093	2,186
	3 " " '02	28,674	15,881	12,793	6,250	6,543
	12 " June '02	66,795	*36,392	30,403	23,185	7,277
PHILADELPHIA, PA. Union Traction Co.	12 m., June '02	14,418,180	6,402,838	7,715,85[illegible]	*6,637,781	1,078,078
	12 " " '01	13,431,081	5,630,186	7,505,494	*6,741,828	861,966
American Railways	1 m., Oct. '02	95,875	......	......	......	......
	1 " " '01	82,190	......	......	......	......
	4 " " '02	449,398	......	......	......	......
	4 " " '01	345,132	......	......	......	......
	12 " June '02	1,002,520	......	......	......	......
	12 " " '01	841,498	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., Sept. '02	93,782	46,083	47,699	24,889	22,806
	1 " " '01	82,428	45,851	36,578	24,963	11,632
	9 " " '02	831,862	483,601	348,161	229,301	164,860
	9 " " '01	758,417	449,855	308,558	222,018	86,540
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., Sept. '02	61,164	33,545	27,619	19,025	8,594
	1 " " '01	58,962	32,658	24,301	19,025	5,278
	3 " " '02	184,314	101,224	83,090	57,075	26,015
	3 " " '01	163,308	91,560	70,842	57,081	19,841
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., Oct. '02	124,498	60,454	64,004	38,833	25,171
	1 " " '01	114,866	54,647	61,060	37,815	22,267
	10 " " '02	1,196,546	607,072	590,474	291,541	304,933
	10 " " '01	1,073,706	515,302	556,204	339,543	218,721
	12 " Dec. '01	1,311,084	*696,407	674,677	418,169	256,309
	12 " " '00	1,182,517	*616,945	566,572	409,051	156,317
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,637	17,810	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,370	133,288	53,987	......	......
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	3 m., June '02	56,635	35,622	21,013	25,000	†3,986
	3 " " '01	56,986	35,600	21,386	25,000	†3,663
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co.	1 m., Sept. '02	39,618	*22,401	17,217	......	......
	3 " " '02	111,522	*63,040	51,482	......	......
	6 " June '02	196,050	*110,891	87,659	......	......

STREET RAILWAY JOURNAL

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Race War in New Orleans Averted

The action of the Criminal Court in New Orleans last week in dismissing the complaint against the management of the local street railway for violation of the "Jim Crow" law in that city is not at all surprising, but it seems not to have been anticipated by the patrons of the company or the prosecuting attorney. The court accepted the view of the company's legal representative that the law was unconstitutional because it delegated to street car conductors judicial powers which can only be exercised legally by the regularly constituted tribunals of the State. It was held that the question of determining the race of a passenger was not within the province of the conductor. Moreover, the law was defective in not fixing the maximum and minimum penalties to be inflicted for its violation. It is expected, however, that the case will be carried to the Supreme Court of the State for a ruling.

The Louisiana statute was particularly offensive to a large class of intelligent and respectable citizens who resented the imputation that they were negroes, but could not sustain the claim that they belonged to the "pure white" race, and it was likewise opposed by the negroes when any attempt was made to restrict them in their movements. Likewise, white men who were huddled together in a contracted space while there was plenty of room in the part of the car assigned the negroes, resented the inconvenience which they were forced to suffer. Consequently there was much clashing, and feeling ran so high that bloodshed was feared at times, and a race war was threatened. Happily the danger is now averted. The removal of the law from the statute books will relieve the situation, and will be welcomed by the street railway companies throughout the State, as well as by passengers, white and black, who have been inconvenienced through its operation.

Sand and Sand Cars

A clean rail is important to efficiency, economy and safety in operation, and railway companies spend considerable sums of money every year for cleaning and sanding of track. Operation on slippery rail is not only uncomfortable to the passengers, but it is conducive to increased wear and tear of machinery, increased power of consumption, and is a breeder of accidents of the worst kind. The season of bad slippery rail, on every road with heavy traffic, is reflected in the statement of accidents and the resultant damage claims. Strenuous efforts are usually made at such times to keep the rail in good condition, but it is surprising how poorly equipped many roads are for doing this necessary work promptly, economically and effectually.

A slippery rail seldom gives any warning to the motorman. After a few moments of heavy fog or light, drizzling rain a good, dry rail may become as slippery as ice over an entire railway system. That necessary evil, the sprinkling cart, or a deposit of dew or frost, or a few golden autumn leaves, rightly placed, will bring about the same condition. Grasshoppers, potato bugs and other insects, having arrived at the season when life has no further charms for them, make a most excellent lubrication for the rail where none is needed. For such conditions sand is the almost universal antidote. When of the right quality, properly dried and screened, and when deposited on the rail in the proper quantity it does its work well.

The first problem is to obtain sand of the proper quality, to screen and dry it, and to handle it between the source of supply and the final placing on the rail as economically as possible. The next problem is to get it on the rail as quickly as possible when needed, and to deposit only the requisite amount, and to place it on the top and not in the flangeway of the rail or on the paving stones or the asphalt. Too much sand is almost as objectionable as no sand at all.

The methods of handling the sand on many roads between the source of supply and the final disposition are surprisingly crude and wasteful. It may be that this is one of the proverbial small items which, in the press of seemingly more important matters, is escaping the attention of railway managers. A certain large

urban and suburban system with which the writer is familiar works its own sand pit, and secures sand therefrom of a fair quality to supply its whole system. A foreman with a gang of six or eight men is almost constantly occupied at the pit in uncovering, screening and handling the sand and loading it on flat cars for delivery at the different depots and terminals. A regularly organized gang of flat-car men is kept busy delivering the sand. On arrival at the depot or terminal it is handled with shovels and thrown into the receiving bin. It is then shoveled into the drier, and when dry is again put through a finer screen to remove the small gravel, and is then shoveled into the dry or storage bin. From there it is shoveled by hand into the sand cars, or placed in the sand boxes on the regular cars. The cars, as a rule, have no oscillating hopper, and it is necessary to send along one or two men with shovels to feed the sand to the spouts on either side. It will be seen that between the source of supply and the final disposition this sand is handled by hand six or seven times. A considerable portion of the labor is done by conductors and motormen, who are paid at the rate of 20 cents to 23 cents per hour, which is rather high pay for common unskilled labor.

An examination of the sand cars in operation on this company's lines showed that the spouts or chutes were delivering as much or more sand on the pavement and in the flangeway than on the rail itself. The plan of shoveling the sand into the chutes resulted in a very uneven distribution, some places being left practically bare while in spots the sand was dropped by the handful. The conclusion was unavoidable that not more than 25 per cent of the sand which came from the pit and was handled at so much expense was being used effectively on the rail.

Sand, like coal and other similar materials, may be handled with some regard to economy with hopper or drop-bottom gondola cars, bucket and chain conveyors, elevated bins and chutes to deposit it in the sand car, and thereby minimize the cost of labor. With properly designed sand driers and storage bins the loading of the sand car is done quickly, and much valuable time is saved in getting the sand on the rail when needed. The design and construction of the sand car is of quite as much importance as the other details of handling the sand, and the fact that some few roads in recent years have been experimenting to improve their sand cars indicates that interest in the matter is awakening.

Overdoing a Good Thing

Man is an imitative creature, and nowhere does this atavistic character show itself more strongly than in copying a frequently successful policy irrespective of the fitness of things. In modern engineering no line of advance has been marked by more conspicuous successes than the electrical transmission of power. It is already no mean factor in the distribution of industry and we may safely say that its past achievements will be altogether overshadowed by its importance in the future. Yet the very brilliancy of the results attained has served to dazzle the perception of a good many intelligent people who ought to know better. And while electrical power transmissions have in the vast majority of cases led to sound economic results, we are bound to say that numerous cases have come to our notice in which it has been unwisely used and leads to a steady financial loss. Moreover, we are sorry to say that electric railroads have been numbered among the unwise enthusiasts whose judgments have been warped by the influence of current fashion. In short, we are strongly of the opinion that electric roads have, in not a few instances, overdone the power transmission business and involved themselves in a situation which means permanent increase in motive power expenses. As a mere matter of engineering it would be entirely possible to operate, let us say, all the street railways in Iowa from a single central power station, with sub-stations scattered over the State, but the economic side of the proposition is a totally different matter. Unless transmitted power is cheaper than power locally generated there is seldom good reason for the transmission.

Now, in railway working there is a peculiar temptation to over-indulgence in power transmission. It may be quite demonstrable that the cost of fuel is so nearly uniform over the region covered by the system as to preclude a direct saving by transmission, but there still remains the uncertain and almost indeterminable saving due to improvement in the load factors. In point of fact the practical data on this saving are very meagre, but the saving undoubtedly exists, and is sometimes of considerable importance. Yet upon this dubious factor really hinges the saving in power transmission in, perhaps, the majority of cases. If we consider the conditions in a large electric railway network, putting aside the utilization of hydraulic power, it is well within the truth to say that in the majority of cases the cost of fuel is nearly enough uniform over the district to make any direct saving by electrical transmission wholly illusory. There are, however, two indirect sources of economy, considerable enough to be important. First, the substitution of a single generating station for scattered stations enables power to be more cheaply generated, irrespective of the conditions of load. Second, the conditions of load may greatly improve at the same time. Of the two, the first is the easier to evaluate, since the question resolves itself into the efficiency of the apparatus effect of increased attendance which can be readily computed. The effect of increased atendance which can be readily computed. The change in load factor, however, is very difficult to predict in advance, and it is, besides, a quantity which remains far from constant as time goes on, so that it is extremely hard to estimate the advantage to be gained from it.

In examining a network of electric roads with respect to the economical distribution of power, the fundamental fact to remember is that all power transmitted and delivered to the lines via sub-stations, with rotaries, is subject not only to losses in transmission but to additional charges due to the fixed charges, upkeep and attendance on the transmission system and sub-stations. In other words each kilowatt-hour delivered to the working conductors via a transmission system costs considerably more than it did at the central generating station. The exact increase in price depends on many factors, but it is always considerable, probably 30 per cent to 50 per cent, even under rather favorable circumstances, 75 per cent to 100 per cent in less fortunate situations. And the cost of power at the central station cannot be computed in the ordinary way in making such a comparison—it must include full allowance for fixed charges, depreciation and replacements. These usually amount to 35 per cent or 40 per cent of the total cost of power, so that if one hears that a certain road put energy on the bus-bars at three-quarters of a cent per kilowatt-hour, it is perfectly safe to say that the items usually omitted would bring the real figure to one cent or one cent and a quarter. And save in the largest stations figures like these are very seldom reached. The upshot of the matter is that in power transmission for railroads it is hard to show a saving unless there happens to be a very favorable situation for a central power station, conjoined with the certainty of a reasonably good load factor. We could mention several conspicuous instances in which there is the best of reasons to believe that the adoption of power transmission involves a positive and permanent loss in the motive power department.

And in case of demonstrable equality of cost between transmitted power and that obtained from distributed generating stations, the advantage lies wholly with the latter on the score of reliability. A well-planned modern transmission system is wonderfully reliable, but in transmission for railway purposes the consequences of a breakdown, even of an hour or two, are so serious in loss of revenue and demoralization of service that it is hard to go too far in recommending caution. In case of a transmission from water-power, where the saving in cost is large, the proper upkeep and guarding of the lines can be most liberally provided for, and in very large urban distributions to sub-stations the maintenance of the lines sinks to relatively small importance. But on large and scattered systems fed from a single steam-driven station, the care of the lines not in the way of ordinary maintenance, but for proper insurance against interruptions of service, is a rather serious matter and one to which altogether inadequate attention has generally been given. We do not desire to croak or to contravene the march

of progress, but we feel strongly that electric railway men are generally too incautious in taking up the transmission of power over large areas. That it has been accomplished with excellent results in many cases is undeniable, but this is very far from asserting its universal applicability. The argument from analogy is peculiarly unsafe in the premises, since the questions involved are delicate questions of degree and not merely of kind. No such enterprise should be undertaken without careful investigation and the best of advice. In the recent growth of electric railroads we are constantly facing new problems in power distribution, and to solve them in the best way requires the greatest astuteness and finesse. Generalizations in such matters are peculiarly unsafe.

The Construction of Electric Interurban Cars

A few years ago there was probably much more diversity of opinion as to the general features which should be incorporated in a car for interurban service than there is at the present time. It is not long since single-truck cars were being built for interurban service. Many such are still in operation. It soon became evident, however, that if high speed was to be maintained, the single-truck car must be abandoned for interurban service. Giving a fast electric interurban service with a single-truck car is about the equivalent of attempting to haul fast limited passenger trains on a steam road with switch engines. Even with track conditions very perfect, danger of derailment at high speeds is considerable, and as the track is often far from perfect on interurban lines, the case is made still worse against the single truck car. The maximum traction type of truck has likewise been abandoned for fast interurban service, because of the small amount of weight on the pony wheels of the truck, and the liability to derailment. As far as trucks are concerned the consensus of opinion among master mechanics who have had experience in the operation of interurban lines is, undoubtedly, favorable to a truck either along master car builders' lines, as adopted by steam roads, or a truck on the same general principles, modified or simplified. By the same general principles is meant the use of a swing bolster and two sets of springs, one between the bolster and truck frame, and another set between the wheels and truck frame.

In the matter of wheel treads, much discussion has taken place in these columns in the past two years. Unfortunately the wheel tread from which it would be desirable to adopt is very often prohibited by the shallow flangeways in the city track over which interurban cars must pass. Probably the average of the present practice as to the interurban wheel treads is the standard M. C. B. form, modified by having the width of tread and depth of flange reduced.

What promises to be the standard interurban car body of the future, is one having a motorman's cab at one end of the car only, and not open to passengers; the baggage compartment immediately behind the motorman's cab provided with seats for smokers; behind which is the main part of the car, with leather, plush or rattan cross seats, seating from 40 to 50 passengers. Where baggage and express is not carried the front compartment is made simply a smoking compartment instead of combination baggage and smoking. One plan which seems to accommodate itself very well to the needs of the combination baggage and smoking compartment is to place stools around the sides of the car, which can be pulled down for use, and which are counterbalanced so as to fold up automatically to the side of the car as soon as a person leaves a stool. Some roads provide smoking compartments separate from a baggage room, but on the whole the two seem to work in very well together, and give a greater flexibility than if there is a partition between. There are still, of course, many roads which run their interurban cars either way, and have controllers at both ends of the car. The tendency is, undoubtedly, toward having all the controlling and heating apparatus in the compartment with the motorman, where it cannot be disturbed by the traveling public.

In this connection it should be noted that the motorman's cab of an interurban car is the most difficult place to keep warm that there is on the car, and next in difficulty of heating comes the baggage and smoking compartment immediately behind the motorman's cab. These compartments being at the front end of the car get the full benefit of whatever high wind might be blowing, and unless more than usual precautions are taken to heat the front of the car, it will be too cold for the motorman and very uncomfortable for smokers. Hot-water heating has been generally adopted in some of the Western States as the proper thing for long interurban cars, and where heaters of this kind are used, the most natural thing to do, in view of these conditions just spoken of, and the one which is being done by those experienced in these matters, is to locate the hot-water heater in the motorman's cab. It takes up less valuable room there than anywhere else in the car, can be attended to by the motorman, does away with the dust and dirt incident to a fire in the passenger compartment of a car, and puts the greatest heat at the point where it is most needed, viz.: at the front end of the car. With this arrangement the water circulating in the hot-water pipes is the coldest at the rear of the car, and the result is that the heat distribution throughout the car is fairly uniform, since there is a tendency for the air which inevitably enters the car at the front end when running at a high speed to leave around the doors and windows at the rear end.

As to the size and weight of interurban cars, practice is still far from settled. The constant tendency is towards an increase of weight as the maximum to be made is increased from year to year. Car bodies and trucks have to be made stronger for the higher speed, and high speeds also call for heavier motor equipment. Weights of double-truck interurban cars at present run all the way from 30,000 to 64,000 lbs. Some of the slower speed interurbans have probably purchased equipment which is much heavier than is necessary, while for those making the higher speeds the heavier equipments are none too strong. The gap between city and interurban cars is a wide one. An interurban car for high speed, like a steam railroad car, is made not only to withstand the wear and tear of high-speed service, but with a view of the consequences of derailment. The street car is made to carry its ordinary load with the minimum weight possible. An interurban car is made to survive wrecks, and were it not for this fact could be made much lighter.

Labor Clause and Pennsylvania Tunnel Franchise

The action of the Pennsylvania Railroad Company in voluntarily raising the wages of its employees east of Pittsburgh should disarm opposition to the proposed tunnel franchise, because of the refusal of the company to bind itself to certain conditions proposed by labor organizations, which it is conceded by those urging their adoption cannot be enforced under the law. The announcement of the action taken by the Pennsylvania Company came in the nature of a surprise, but it was in accordance with the policy of the management, and it swept away every argument against the tunnel project, based on the assumed hostility of the company to the interests of its employees and to the rights of labor to organize. Instead of antagonizing labor and exacting the maximum of service for the minimum of wages the company has recognized the fact that the cost of living had advanced, and has voluntarily increased the wages of its employees sufficiently to meet the new conditions. This increase will be uniformly 10 per cent, and will apply to all employees receiving less than $200 per month. It will affect 106,000 men, or about 89 per cent of the company's force, and will add upwards of $5,000,000 to the annual pay roll. This of itself should be sufficient guarantee that the interests of labor would be recognized and respected by the company, and that the distrust which the politicians and their willing tools in the labor organizations assume to feel is wholly unwarranted. It would seem to an unprejudiced observer that the action of the Pennsylvania Company places the opponents of the tunnel franchise in a most ridiculous position, and shows how reckless they are of the true interests of the city. Their rule or ruin policy has greatly delayed the work on the tunnel, and has really jeopardized the entire project, without securing any material benefit for the city or labor.

An Important Freight Handling Road

One of the most important subjects under the consideration of the management of interurban roads is that of adopting steam methods in handling freight. Many of the electric roads throughout the country have entered into the business of carrying package freight, but only one or two of them have gone so far as to purchase their own standard freight equipment and place a freight solicitor in the field, yet this feature of electric railroading is one which promises within the next few years to develop as rapidly as has the interurban passenger business during the last decade. In spite of the fact that it is questionable whether all electric railroads will be permitted to use standard freight equipment through the towns on their lines, this question will have to be solved by each individual line for itself, but it appears from the experiences of the few lines which have attempted this practice, that the smaller towns will make few objections to the operation of freight cars through the streets providing this service is confined to hours when the streets are not crowded.

The Toledo & Western Railway, operating 68 miles of road, running into Toledo, is unquestionably one of the foremost roads in the country in respect to freight handling. In the October souvenir issue of the STREET RAILWAY JOURNAL this year, brief reference was made to this road, and its terminal freight station at West Toledo by Albion E. Lang, and some of its freight trains were illustrated. Additional data on the extent of this work and the methods employed follows:

At Sylvania, 8 miles from Toledo, the road branches into two divisions, one running northwest to Adrian, Mich., and the other almost due west closely following the Michigan State line to Fayette. Plans are being made to extend the northern division to Jackson and the western division to the Indiana State line, and possibly beyond, to connect with other roads building or in operation in Northern Indiana. When completed these lines will form a through route to Chicago.

The two divisions of the Toledo & Western differ considerably in the character of the trade upon which they depend. The northern division to Adrian closely parallels the "old road" of the Lake Shore & Michigan Southern Railway, touching several towns whose transportation facilities have long been developed, thereby bringing the electric line into direct competition with one of the strongest steam lines in the country.

On the other hand, the western division traverses a territory which, heretofore, has been absolutely isolated from transportation facilities, and which for many years has been actually begging for the facilities now afforded. This district has a peculiar history, offering few parallels in the well populated Middle West. Years ago the district comprised the Black and Cottonwood swamps, a country almost impassable and practically useless. When the Lake Shore, the pioneer of the Western roads, pushed out towards Chicago, it avoided this district by taking a northern route through lower Michigan. Later, when the "Air Line" was built, it was inclined southward through Delta, Bryan and other towns. In the meantime drainage transformed these swamps into one of the most productive sections in the Middle West. Numerous towns sprang up, and for a time thrived, but the poor transportation facilities eventually brought matters to a standstill. During the last few years, it is claimed, the population of the district has actually fallen off, the farmers moving away disgusted with the handicap of being forced to team from 12 miles to 15 miles, north or south, to a railroad. Naturally the electric line promoters met with a good reception when they promised a road which would offer every convenience of a steam road and lower rates.

With a view to serving this section to the full extent the Toledo & Western has been equipped to take care of every class of trade that a steam road could handle. The rolling stock includes standard steam freight cars, stock cars, flat cars, gondola coal cars in addition to the ordinary package express cars used by other electric roads. During the last season they have utilized two combination coaches, three express cars, twelve box cars, eight hopper-bottom gondolas, and twenty flat cars, of 60,000 lbs. each, and three 50,000-lb. stock cars, which are constantly in freight service. Additional equipment is now being procured for this department.

TYPICAL FREIGHT, EXPRESS AND PASSENGER STATION ON TOLEDO & WESTERN RAILWAY

Grain elevators are being built in several towns, and at each station there is a stock pen for cattle and horses. At all towns there are well-equipped stations with ample sidings, where freight cars may be loaded. Freight of all kinds is handled on the same basis as on steam roads, and there are regular scheduled freight trains operating over both divisions of the road. Of course these trains are not permitted to enter Toledo, but at West Toledo, about 4 miles from the center of the city, there is maintained a terminal freight station, consisting of a warehouse and tracks, capable of holding about fifty standard steam cars.

There are six sub-stations, located at Morenci, Lyons, Metamora, Adrian, Blissfield and West Toledo, which are utilized in promoting and handling the freight and express business. These buildings are all of similar design, and the accompanying cut, showing the station at Blissford, may be accepted as a typical view of the class of structures which have been erected for this purpose. They are located in the villages, making them convenient for passenger and freight requirements, and are of unusually attractive design. They are two stories high, and are built

of paving brick with stone trimmings, and cost about $3,500 each. The ground floor is occupied by the ticket office, waiting-room and baggage room, with the electrical equipment in the rear, and the upper floor is fitted up for living apartments for the attendant and his family. As rent and light are furnished free to the attendant, a very superior class of help is thus secured at reasonable wages. The attendant has entire charge of the station, taking care of the electric equipment as well as handling baggage and freight, selling tickets and performing the other general duties of station agent in small towns. He is also supposed to keep the passenger and freight solicitor informed as to opportunities for being offered to manufacturers at attractive figures to induce them to locate along the line. During the summer the car-load business has averaged over twenty cars per day, and this promises to increase each summer as the farmers learn to appreciate this method of shipping their produce.

The class of business just mentioned is entirely distinct from the package freight business, which is handled as on numerous other roads, the package freight cars operating to the center of Toledo and delivering their goods at the union freight station, which was fully described in the October convention issue of this paper. The package freight cars make two trips a day over each line, and

BETWEEN / AND	Toledo Ohio	West Toledo Ohio	Melwood Ohio	Wernerts Ohio	Trilby Ohio	Crescent Ohio	Whiteford Road Ohio	Sylvania Ohio	Centennial School O.	Smith's Siding Ohio	Allen Junction Ohio	Bowen's Corners Ohio	Berkey Ohio	County Line Ohio	Metamora Ohio	Champions Ohio	Whiteville Ohio	Town Line Ohio	Seward Ohio	Lyons Ohio	Barbers Ohio	Denson Ohio	Rangers Ohio	Morenci Mich	Wolcott Mich	Powers Ohio	Handy's Corners O.	Fayette Ohio	Southlands Mich	Kellogg Mich	Holtz Mich	Tagwold Mich	Riga Mich	Blissfield Mich	Harrison Mich	Palmyra Mich	Clark Mich	Nash Mich	Wabash Crossing	Adrian Mich
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*Barbers, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]																				
*Denson, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]																			
*Ranger's, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]																		
Morenci, Mich.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]																	
*Wolcott, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]																
*Powers, Ohio.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]															
*Handy's Corners, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]														
Fayette, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]													
*Southlands, Mich.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]												
*Kellogg, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]											
*Holtz, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]										
*Tagwold, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]									
Riga, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]								
Blissfield, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]							
*Harrison, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
Palmyra, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
*Clark, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
*Nash, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
Wabash Crossing, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Adrian, "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

Rates in Cents Per 100 Lbs.

Rate Basis	1st Class	2d Class	3d Class	4th Class	5th Class	6th Class
1	7½	7½	7	6	4½	3
2	7½	7½	7½	7	5	3½
3	7½	7½	7½	7	5	4
4	10	9	8	6	4	3
5	10	9	8	7	4½	3
6	10	9	8	7½	[illegible]	4½
7	11	10	8	[illegible]	5	3½
8	12	10	8	[illegible]	5½	[illegible]
9	11½	10½	8½	7	5	4
10	12	11	8½	7½	5½	4½
11	12½	11½	9	8	6	[illegible]
12	13	12	10	8½	6½	5
13	13	12	10	8½	6½	5½
14	13½	12	10	8½	6½	5½
15	14	12	10	8½	6½	5½

*PREPAID STATION

EXPLANATION.

To arrive at rates between any two stations on The Toledo & Western Railway take the rate basis number, shown in table, opposite the Station to and from which rates are desired and use the class rates shown opposite corresponding rate basis number in rate sheet.

EXAMPLE.—To arrive at rates between Toledo, Ohio and Adrian, Mich., in Table taking rate basis, number 13 is shown as applying between these two Stations Opposite Rate Basis No. 13 in Rate Sheet appears the following class rates, 13, 12, 10, 8½, 6½, 5½.

LOCAL FREIGHT TARIFF BETWEEN ALL STATIONS ON THE TOLEDO & WESTERN RAILWAY

securing business. At these stations patrons are allowed to use the telephone in ordering goods to be shipped over the electric road. At Blissfield there is a freight station in addition to the usual rotary station, and at several of the smaller places there are neat frame buildings provided for this service.

This fall the Toledo & Western handled a large portion of the grain and produce raised by the farmers along its northern division and practically all the crops of those on the western division. Since the advent of the line the country has taken on new life, and several churches and stores and numerous new dwellings have been erected, the electric line handling all the lumber, brick, stone and other materials required for the work. Manufacturing establishments are springing up, and the company has purchased lands desirable for building sites, which is they are handling on an average of from 35 tons to 40 tons per day. The rates for both these classes of business are practically the same, and are determined by the standard freight classification, the tariff chart for which is shown herewith. After looking up the class the agent can instantly determine the rate from any point to another. The blanks used in handling both classes of freight are practically the same as those used on steam roads, and several varieties are shown herewith. A way bill accompanies each shipment. When freight is received from the consignor a receipt is made in duplicate, one copy going to the consignor and another kept on file for reference and tracing. When goods are delivered to the consignee a receipt is received in duplicate, a copy going to the consignor. A book of cash receipts and cash disbursements is kept, also a record book of freight bills received.

AGENTS REBILLING CARLOAD SHIPMENTS MUST FILL OUT THIS TABLE

ORIGINAL POINT OF SHIPMENT

ORIGINAL CAR

INIT .... NO. ....

LOCAL FREIGHT WAY-BILL.

W. B. No. ....

The Toledo & Western Railway Company .... 190 ....

CAR INITIALS ....

FROM .... TO .... CAR NO. ....

FROM WHOM RECEIVED	CONSIGNEE AND DESTINATION	NO PKGS	ARTICLES	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID

TRANSFERRED

INTO CAR ....

AT ....

DATE ....

The Toledo & Western Railway Co.

ABSTRACT OF LOCAL WAY-BILLS FORWARDED.

From .... *Station, for the Month of* .... *190* ....

See Note on Back.

Date W. B.	No. of W. B.	WEIGHT	FREIGHT	Advance Charges	Prepaid	Date W. B.	No. of W. B.	WEIGHT	FREIGHT	Advance Charges	Prepaid

THE TOLEDO & WESTERN RAILWAY CO.

ABSTRACT OF WAY-BILLS FORWARDED.

At .... *Station for the Month ending* .... *190* ....

Date	W. B. No.	STATION	Weight	Collect	Prepaid	Date	W. B. No.	STATION	Weight	Collect	Prepaid

FORM 74.--7-1-2M

The Toledo & Western Railway Company,

G. M. No. ....

.... Station .... 190 ......

Agent's No. ....

REPORT OF FREIGHT OVER, SHORT, DAMAGED OR WRONGLY CONSIGNED.

From .... Way-Bill No. .... Date .... Car No. ....

Received from Train No. .... Date .... 190 .... Conductor

Consignee, Marks and Destination.	ARTICLES BILLED	State whether Over, Short or Damaged. Give Full Particulars.

.... Agent

FORWARDING AGENT ANSWER FOLLOWING QUESTIONS.

By whom and in what condition loaded? ....

By what train? .... Car No. .... Conductor .... Forwarded?

For what other Station car loaded? ....

For what other Station did you load similar freight? ....

If OVER freight is from you, furnish billing and advise? ....

Are you short, and on what billing? ....

Have you any record of freight over? ....

Was freight properly and securely stowed? ....

.... Agent.

NOTE—Agents must make a separate report of each consignment and send one each to Billing Station and General Manager by first train.
Report for General Manager to be filled out with copying ink.

FORMS ADOPTED IN FREIGHT DEPARTMENT OF THE TOLEDO & WESTERN RAILWAY

An abstract of freight way bills, received and forwarded, is sent to the auditor once a month, as well as a monthly balance sheet. There are also blanks for freight over and freight short, goods damaged and for the correction of errors in way bills.

Distinct from both the car-load freight and the package freight business is the milk business, which is quite an item. Milk is handled at a straight rate of 15 cents for 10-gallon cans for any distance. Tickets are sold at this rate by the agents, and one is attached to each can on shipment. A milk car makes a trip over both divisions every day, and the cars all run to the union station in the center of the city. A considerable revenue is also derived from United States mail, which is handled on the combination cars.

The antagonism of steam lines toward electric lines has made it impossible thus far to interchange car-load freight business with the steam roads, but occasionally individual shippers have had cars transferred over the electric road, and it is believed to be only a matter of a short time before satisfactory arrangements can be made with the steam roads whereby car-load business can be interchanged. There seems no good reason why such arrangements should not be made, since the Toledo & Western does not attempt to cut rates where it comes into competition with the other roads for car-load business.

C. F. Franklin, general manager of the Toledo & Western, is a steam road man of long experience. Prior to accepting this position he was general superintendent of the Toledo, St. Louis & Western Railway, and before that he held a similar position with the Ohio Southern Railway. He has introduced steam methods into every department where practical, and in the auditing, freight and passenger departments has surrounded himself with men of experience in handling similar work on steam roads. For trainmen and station agents he has selected, as far as possible, experienced steam road men. "Trains," instead of single cars, are operated, and while the despatching is at present handled by telephone, it is the intention later to install a telegraph system and handle train instructions from the several stations, using the telephone system as an auxiliary for calling up between stations or for use when the telegraph is out of order.

Under the present despatching system there are telephones at all stations and at switches. The despatcher's office is located at

The Toledo & Western Railway Co.

TRAIN ORDER BLANK.

Date 190

Order No. .... *Time* .... *M.*

To M. & C. of Train No. ....

Car No. .... *At* ....

Run ....

From ....

To ....

Motorman ....

O. K. by .... *Dispatcher.*

EXTRA TRAIN ORDER; CLEAR ALL REGULAR TRAINS FIVE MINUTES

The Toledo & Western Railway Co.

TRAIN ORDER BLANK.

Date 190

Order No. .... *Time* .... *M.*

To M. & C. of Train No. ....

Car No. .... *At* ....

Work Extra between ....

And ....

Motorman ....

O. K. by .... *Dispatcher.*

WORKING ORDER; WORK BETWEEN TWO POINTS AND CLEAR ALL REGULAR TRAINS

The Toledo & Western Railway Co.

TRAIN ORDER BLANK.

Date 190

Order No. .... *Time* .... *M.*

To M. & C. of Train No. ....

Car No. .... *At* ....

Meet Train No. .... *Car No.* ....

At ....

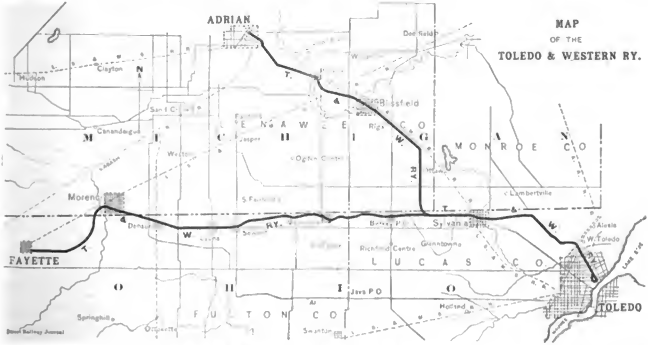
And ....

Run to .... *And Call.*

Motorman ....

O. K. by .... *Dispatcher.*

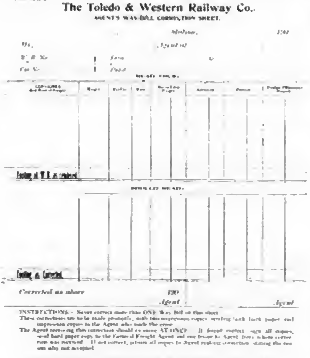
MEETING ORDER



SECTION SERVED BY THE TOLEDO & WESTERN RAILWAY

the headquarters at Sylvania. There are three varieties of orders, with blanks for each. They are: The regular meeting order; the working order, which permits trains to work between two points, clearing all regular trains, and order for extra trains, which must clear regular trains by five minutes. The blanks are in duplicate, the motorman taking down the order and handing a copy to the conductor. There are three classes of trains: First class, or passenger trains; second class, or package freight trains, and third class, or freight trains.

The first section of the road, from Toledo to Sylvania, 9 miles, was placed in operation in April, 1901. Those from Sylvania to Adrian, Mich., 25 miles, and from Sylvania to Morenci, 28 miles, were completed early this year, while the western extension to Fayette has just been completed. The tributary population, including Toledo, which has 132,000, is about 200,000. The leading towns on the two divisions, with the population, the distance


The Toledo & Western Railway Co.
AGENT'S WAY-BILL CORRECTION SHEET.
Footing of W. B. as rendered
Footing as Corrected
Corrected as above 190
Agent
Agent

FORM FOR CORRECTIONS IN AGENT'S WAY BILL

from the union passenger station at Toledo, together with the rate of fare for single trip, round trip and special Sunday round trip (good returning Monday), are shown in the accompanying table:

MAIN LINE

Population	Miles	Name of Station	Fare	Round Trip	Sunday
900	48	Fayette	$0.90	$....	$....
1,500	40	Morenci	.75	1.35	.80
400	32	Lyons	.60	1.10	.75
150	29	Seward	.55	1.00	.70
....	26	Whiteville	.49	.88	.65
300	24	Metamora	.43	.72	.56
200	20	Berkey	.35	.65	.45

ADRIAN DIVISION

Population	Miles	Name of Station	Fare	Round Trip	Sunday
10,000	37½	Adrian	$0.60	$1.10	$0.75
200	31½	Palmyra	.55	1.00	.70
1,300	27	Blissfield	.45	.85	.60
200	24½	Riga	.40	.75	.55
700	12½	Sylvania	.20	.35	.25

Rates are made to commuters, and the company sells a mileage book at $8, which entitles the holder to $10 worth of travel within a year. There are coupons, each representing 1 cent, and the conductor pulls the regular fare in coupons.

Under an arrangement with the White Star and Detroit & Cleveland lines of steamers, the company sells combination round trip tickets from any of its stations to Detroit or Cleveland.

The New York office of the Sao Paulo Tramway, Light & Power Company, the Mexican Light & Power Company, and the Trinidad Electric Company has been removed from 621 Broadway to Room 220, 29 Broadway. The business offices of F. S. Pearson, L. J. Hirt, W. P. Plummer, H. L. Cooper and R. D. Mershon have also been moved to the same place.

Trackless Trolley Car for Freight

In the issue for March 1, 1902, of the STREET RAILWAY JOURNAL a short description was published of the trackless trolley passenger cars installed by Max Schiemann, of Dresden, in the Biela Valley, near Dresden. The system has been operated very successfully, and considerable freight is now being hauled over the road. Fig. 1 shows a view of a motor car and a trail car taken on the occasion of a visit to the line by the Dresden Elektrotech-

FIG. 1.—TRACKLESS TROLLEY CARS FOR HANDLING FREIGHT

nische Verein last summer. The motor car shown in the photograph is usually used for the transportation of light express matter, and the trail car for coal and other heavy goods. The train in actual operation is shown in Fig. 2, which is a view taken after a light fall of snow to show the condition of the roads during

FIG. 2.—OPERATING TRACKLESS TROLLEY FREIGHT CARS AFTER SNOW STORM

late fall. The train is steered by means of the front wheels of the first car, and it has been found that the wheels of the second car, being of the same gage, will track absolutely after those of the first car.

The trolleys, as previously stated, are provided with a sliding contact. The motor car has a weight of 4 tons, and is capable of carrying a weight in packages of 1 ton. The trail car weighs 1.5 tons empty and 5 tons loaded, making a total weight of the loaded train of 10 tons. On a level the cars run at a speed of 15½ miles an hour.

Wendell & MacDuffie, of New York, have just opened a factory at 51 Dey Street for the manufacture of armature and field coils and the rewinding of armatures. The company's offices will be continued as heretofore for the sale of electric railway material of all kinds, and the new plant will make possible the supplementing of the large supply business with an excellent repair department. The concern is to be congratulated on the enterprise and prosperity which this new move indicates.

Pay Department of the Metropolitan Company's Construction Department

Paying the men off once a week on the Metropolitan Street Railway Company's construction work entails a great deal of careful preparation and exact calculation, and a regular routine is observed each week.

The timekeepers on the several jobs first enter the names of the men, who are already on the work, in the timebooks. As each name is added to this list the man is given a ticket (see Exhibit I), upon which is written his pay number and name. The color of the pay ticket is changed each week, for the benefit of the pay department. The tickets are also numbered consecutively.

YOU CAN'T GET YOUR WAGES WITHOUT IT.

.... Divis on Const.

.... SECTION.

KEEP THIS TICKET.

No. ....

NAME.

....

NOT TRANSFERABLE.

EMPLOYED AS...........

DO NOT GIVE IT TO ANY ONE ELSE.

Pay Ending

EXHIBIT I—WORKMAN'S TICKET

Form 3 C.

Metropolitan Street Railway Company

CONSTRUCTION DEPARTMENT,

621 BROADWAY.

WORKMAN'S PAY TICKET.

This ticket is good only when presented by the man to whom it is issued. Men will at all times carry this ticket on their persons, and show it to Time Clerk when he asks to see it. No time will be allowed to any man who fails to show his ticket, and no wages will be paid unless this ticket is presented.

EXHIBIT IV.—BACK OF WORKMAN'S TICKET

In the case of the Italian laborers who are employed each is given a brass check, with a number upon it. This takes the place of a name upon the pay roll and timebooks, for it would be beyond the average American to wrestle with some of these foreign names. Then, too, comparatively few of them speak English at all. The brass checks answer every purpose and save much time.

It should be mentioned that the advantages of having different colored tickets would be obvious to any one who would endeavor to pay off a gang of men from the pay wagon. For instance, yellow is the color of tickets to be redeemed on a certain pay day, and a man hands a blue one, the paymaster at once knows that it is an old ticket, and that the man, for some reason, did not receive his pay. As the old pay envelopes are not carried out in the pay wagon, but are kept in the safe at the office, the man with the blue ticket is instructed to present it at the office, where back pay can be obtained. As the tickets each week are numbered consecutively, it is easy to tell if a man has been paid, or if his pay is on hand, as the envelopes are likewise arranged consecutively. The different classes of labor are, of course, kept by themselves in the timebook, making it simpler to transfer to their respective sheets, such as laborers, rockmen, etc. These books are sent to the pay department the latter part of each week. Each clerk takes a book and copies the names it contains on large sheets, with headings and columns similar to that shown in Exhibit II. Each sheet enumerates the classes of labor to be found on it, and the rate of pay for each man as well as the man's pay number is inserted with his name. The names which are in the timebooks are all transferred by Friday or Saturday morning to their respective sheets. Each set of sheets belonging to one job is, of course, kept together.

Saturday the pay envelopes (Exhibit III) are made out for such names as are already entered. The man's number and rate are put in, and the class of labor is printed on the pay envelope opposite the blank space intended for the man's name. In the upper left-hand corner is the space for the pay number. It will be noticed that there is also a space for deductions from the wages of the man. He may lose one of his tools, or, in the case of the clerks, there may be a deduction on account of fines, which are imposed because of errors. This regulation has been found necessary to make employees exercise greater care in their work.

Everything is now ready for Monday morning. The timebooks are again turned in early on that day with the records complete for the previous week. Any new names which have been added are placed on the bottom of their respective labor classification, on the particular job sheets, with their pay numbers and rate.

It will be seen by again referring to Exhibit II, that the sheets are divided into couplets of columns, marked "N" and "D," representing day time and night time of each day worked. Laborers and ironmen work ten hours a day, while bricklayers and pavers work eight. In both cases, however, they get paid time and a half for working overtime. If a man works two hours overtime, his regular time as in the case of a laborer would go in the "D" column, and his overtime, three hours, in the "N" column. The two columns, taken together, thus represent a day. The date of such day is placed over the couplet. The aggregate amount of time is then extended, and the amount to be paid beyond this. The "remarks" are synonymous for deductions. The total of each job is taken and signed by the clerk who figured it. Pay envelopes are then made out for the new names which have been added and placed at the bottom of the pile of envelopes of each job, which are kept separate. Each lot is then taken and the time and pay for the week are inserted. This is copied from the pay-roll sheets. The envelopes are then carefully compared with the sheets.

Form 11 C. 50M 5-1902.

Interurban Street Railway Co.

No.

Lessee

Metropolitan Street Railway Co.

CONSTRUCTION DEPARTMENT.

Pay Ending, ______________ *190*

.... **Laborer.**

		$	Cts.
No. of Days	*Rate $1.50.*		
Less			
Balance due			

NOTICE.—If there is any ERROR in this payment, SAVE THIS ENVELOPE and speak to TIMEKEEPER.

ERRORS will not be corrected WHILE PAYING OFF.

EXHIBIT III.—PAY ENVELOPE

Monday night, or early Tuesday morning, the sheets are sent to the superintendent of construction, who signs them. They then go to the auditor's office, where the check for the amount is drawn on some bank. The amount is generally between $40,000 and $50,000 each week. The pay wagon then proceeds, with a couple of clerks, to the bank, and the money is taken direct to the pay office. It is then placed on a high counter in the center of the room. It makes a large pile, being mostly in the smaller denominations. The money is first counted in bulk, and then each package is counted, to see that the amount received is exactly what the check called for.

The money is arranged in piles at one end of the counter in front of the paymaster, who takes the first pay envelope, No. 1, counts out the amount indicated on the envelope and passes it forward, with the envelope, to one of the clerks stationed on each

IRONMEN Form 70 E.

Metropolitan Street Railway Co.,

CONSTRUCTION DEPT.

______________ DIVISION.

______________ SECTION.

Pay for ___ Weeks Ending ______

______________________ **Contractor.**

Name	No.	Occupation	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	[illegible]	Rate per Day	Amount Paid	Remarks	Paid

EXHIBIT II.—FORM OF PAY SHEETS

side of the counter. Each man's pay thus has a check on it. The clerk counts the money and puts it in the envelope, then shoves it to the end of the counter, where it is sealed and placed in a metal box in its proper numerical order. It is very important that everything be finished so as to enable the paymaster and his assistants to go on the works early in the morning.

In case of not striking a balance the envelopes have to be all gone over until the error is found.

A reliable and experienced driver who understands the work is kept especially for the pay wagon. He must know the best routes about the city, must be an expert in handling horses, and must be constantly on the alert for a signal, either from the detective or the paymaster, to drive on. Great care must be exercised, as a crowd gathers very quickly, and sometimes becomes rather troublesome, as was the case some years ago at the corner of Fourth Avenue and Twenty-Third Street, when the crowd became so great that the wagon and horses were actually forced up over the curb against the building. The wagon is not very apt to attract attention, there being no marks to show what its mission is. It is built very strong though.

In paying the men every precaution is taken to guard against fraud and to see that the money reaches the proper hands. The men hand in their pay tickets at the pay wagon window. The envelopes having been arranged consecutively, it is a simple matter to get the man's pay from the pay number on his pay ticket. The paymaster asks the man how much is due him for the last week. If his demand agrees with the record in the envelope it is given him, but in case he asks for more or less he is asked for the number of hours he worked. If it still looks like a mistake, and the man claims more than the pay roll calls for, he is paid what the pay-roll calls for; if less, he is paid what he asks for. A notice on the envelope (Exhibit III) governs the correction of errors. Exhibit IV is the reverse side of Exhibit I.

All pay which is not called for is held in the pay department for some time, when it is turned over to the auditor's office. This uncalled for pay is made up mostly of small amounts credited to men who have worked an hour or two, and for some reason regarded their pay for this time too small to call for. It amounts up in the course of a year, though.

When the pay is given the man in exchange for his pay ticket the pay ticket is punched and kept on file in the office.

Multiple Unit, Voltage Speed Control for Trunk Line Service*

BY. H. WARD LEONARD

In February, 1894, I read a paper before this Institute describing a system which I considered applicable to the operation of a trunk line electric railway. The essential features of this system were:

First. The generation and transmission of a high-tension single-phase alternating current, the power houses being placed as far apart as the insulation of an alternating-current transmission would permit.

Second. The entire elimination of sub-stations.

Third. A transformation of the energy upon the locomotive so as to secure a voltage speed control for the electric motors, thereby obtaining smooth acceleration and efficient control of the locomotive at any desired speed and in either direction.

At that time there were no engineers, so far as I know, who agreed with me that these features were essential for the operation of a trunk line railway by electric motors.

In the recent past, however, many prominent engineers, both abroad and in this country, have declared themselves in favor of these essential features, and I, therefore, feel warranted in describing an improvement upon the system I originally proposed, by which I can secure the important and now well understood advantages of a multiple control of any desired number of locomotive units.

The accompanying cut illustrates diagramatically one form of my multiple unit voltage speed control as applied to two locomotive units for trunk line service.

The current is generated in the form of a single-phase alternating current at as high an e. m. f. as is practicable to-day, say 20,000 volts. A moving contact leads the single-phase alternating current upon the locomotive. If desired, static transformers can be placed at suitable points along the line of the railway which will reduce the initial e. m. f. to any desired lower e. m. f. upon the contact conductor.

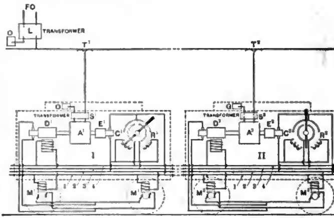
In many instances it may be desirable to place upon the locomotive a transformer S' for reducing the tension of the alternating current led to the synchronous motor A^1.

A single-phase synchronous motor on the locomotive receives this alternating current and is driven by it continuously at a practically constant speed; the current after passing through the motor, being led to ground through a moving contact. This single-phase motor A^1 drives continually a small exciter E^1 and also a large continuous current dynamo D^1, whose field is separately excited by the exciter E^1 and has in its field circuit a reversing field rheostat R^1. The armatures of the propelling motors are connected in multiple directly across the terminals of the armature of the dynamo D^1. The field magnets of the propelling motors M^1 are separately and constantly excited by the exciter E^1.

By manipulating the reversing field rheostat R^1, the current through the armatures of the motors M^1 necessary to obtain the required tractive effort, can be obtained at any desired voltage from the lowest voltage to the full speed voltage, and in either direction.

A perfectly smooth and rapid acceleration can thus be obtained with minimum energy from the source of supply.

The simultaneous multiple control of the several locomotive units is obtained by means of the four small wires 1, 2, 3, 4, which are lead along the train.



TWO LOCOMOTIVE UNITS WITH MULTIPLE UNIT VOLTAGE SPEED CONTROL

In this cut the operator is supposed to be upon the locomotive I. The exciter E^1, which is producing a constant e. m. f., has its terminals connected to the wires 1 and 2. Across these wires 1 and 2 are connected the field windings of all the propelling motors on the two locomotives, so that they are all constantly and fully excited.

The wires 3 and 4 are also supplied by a current from the exciter E^1, but the reversing field rheostat R^1 is in the path of this current. The fields of the two dynamos D^1 and D^2 are connected in multiple across these wires 3 and 4 which extend along the train.

It will be evident that by manipulating the reversing field rheostat R the operator can vary simultaneously and similarly the field exciting currents supplied to D^1 and D^2 and that therefore he can cause the voltage of these two dynamos to vary in exact unison from zero to the maximum voltage in either sense. Thus, the operator can cause the two locomotives to start, accelerate, run at full speed, retard, and reverse in perfect unison, always dividing the load perfectly under these various conditions.

By placing the controller R^1 in its open position and going to the other locomotives, the operator can similarly control the two locomotives simultaneously by means of the controller R^2.

By the use of this system I expect to be able to secure the following advantageous features:

First. The haulage over existing roadbeds, grades, bridges, etc., of very much heavier trains than can be hauled by any steam locomotive.

Second. A material reduction in the cost of maintenance of the locomotives as compared with steam locomotives.

Third. A material saving in the maintenance of the roadbed because of the absence of hammer blow, shouldering, rocking and skidding.

Fourth. A material increase in the weight of the train which

*Read at the meeting of the American Institute of Electrical Engineers, New York, Nov 21, 1902.

could be hauled around a certain curve by a locomotive having a certain weight on drivers.

Fifth. A material increase in the load which could be started upon a certain grade by a locomotive having a certain weight on drivers.

Sixth. A material reduction in the dead load necessarily hauled by a steam locomotive, represented by the part of the steam locomotive and tender not on drivers.

Seventh. A very large increase in the number of trains of given weight and speed which could be operated from a given power house compared with the series parallel or cascade systems. Or, to state this another way: a very much higher rate of acceleration with the same maximum output from the power house, the same conductors, the same weight per train and the same watt hours per ton mile, than is possible with the series parallel or cascade systems.

Eighth. As each locomotive unit can be equipped with any desired nnmber of driving axles and any desired number of locomotives can be operated under mutiple control, the amount of power which can be applied to a single train and controlled by a single operator is practically unlimited.

Ninth. Fifty per cent of the energy now wasted on friction brakes can be saved in the form of useful electrical energy restored to the system.

Tenth. The first cost of equipment will be very much less than that of any system, for equivalent service, which involves the use of sub-stations.

Eleventh. The cost of haulage per ton mile will be greatly reduced as compared with steam locomotives, especially because of the large increase in the weight of the train which can be hauled.

Twelfth. Difficulties due to electrolysis would be reduced to a minimum.

DISCUSSION

S. F. Dodd.—There is one question I would ask Mr. Leonard, and that is what facts he can give us in regard to the weight and efficiency of such a locomotive as he describes. It will be impossible to apply such a system in single or small units, and the only field for such a locomotive will be for trunk-line service. Now, let us consider a large locomotive like the Baltimore & Ohio tunnel locomotive, whose weight is 96 tons. I do not know exactly how much waste room or waste weight there is. I do not think there is much of either. These locomotives are operated by a motor generator set, which weighs 36 tons. It raises the voltage from 500 volts to 700 volts. Suppose it generated 700 volts. To develop that amount of current it would require about a 750-kw motor generator, weighing somewhere between 50 tons and 60 tons, and making the total weight 150 tons. Thus, it will be seen, for large locomotives they would get a weight somewhere in the neighborhood of 150 tons, which will cut the weight efficiency down less than we could expect to have it in electric motors of this style.

N. W. Storer.—Mr. Dodd struck the nail on the head. Such a system, I believe, will increase the weight of the locomotive far beyond what is ordinarily required for the power of the locomotive. I believe if youtakea large locomotive scarcely any excessive weight will be necessary, particularly if you take into account the motors and other necessary parts, and, I believe, if you add to that a motor generator outfit you will have a locomotive which is 50 per cent heavier than it should be.

H. Ward Leonard.—I will not spend any time on the Baltimore & Ohio locomotives, which, although historic, we all know are absolutely uncommercial for freight haulage on trunk-line service. I think it is likely there is not much room on that particular locomotive for a motor generator. I know the company which built it considered whether it should put a motor generator on it, and apparently it did not find room for it. As to the particular question of the effect of the motor generator in locomotive practice, I beg to point out that the best constructed locomotives which have been made in recent years are the Decapod locomotives, and these have about 50 per cent of the entire weight on drivers, which is put there to secure better power results and to secure larger tractive effects. The next difficulty that was met with was that they would skid the wheels if the weight on the drivers was not sufficient to take care of the power produced, and various complicated devices have been invented in recent years to shift a part of the weight of the locomotives, and endeavor to secure more weight on the drivers. It is, therefore, not only important, but really essential that you get more weight upon the drivers of any locomotive, such as I am considering. Furthermore, admit for the sake of argument that the point is well taken that the weight hauled is increased by the motor generator, I still wish to point ont that a motor generator would not be designed whose weight would compare with the weights of the motor, or with the weight of the motor generator, which is put in a sub-station. A motor generator employed on a locomotive would resemble closely a generator driven by a steam turbine, as to size and weight. Members who are particularly interested in following the matter further will find quite detailed figures as to the weight of a motor-generator relative to the total weight of the locomotive in a paper by Mr. Huber, last March, describing locomotives for the Zurich Company, which were built on my system, and which will go into commercial use in the next few months. The present steam locomotive, in having 50 per cent of its weight on drivers, could double its present horse-power, and such a locomotive would doubtless show great economies in the haulage of freight. There is scarcely a railroad in the United States to-day that is not struggling with the problem of hauling its freight, and what is wanted is a locomotive which will haul twice as many tons as is now hauled. The fact that a few more tons, 50 or 60 at most, are placed on the locomotive, is entirely insignificant when compared with the entire weight of a 3000-ton train.

Efficient Discipline *

BY W. W. WHEATLY

"Order is Heaven's first law." Permanence and stability depend upon law and order. The proper management of large enterprises, such as armies and railway systems, requires the united action of a large number of individuals. It is essential that the individual units work with one common purpose, and that individual energies be concentrated. This is usually done by focusing power and authority in one individual, be his title president, general manager or superintendent. He secures united action by asking obedience to certain regulations or laws which are intended to restrain action within certain bounds and direct its course. As the cars are guided by the rails upon the permanent way, so do rules and regulations guide the action and energy of railway employees within certain limits. The ability of the manager is reflected in the skill with which he makes laws and enforces them, and in the facility with which he brings into harmonious relations the component parts of his organization so that, while each will perform its proper function independently of the other, there will be a time and place where the energy and action of all will unite and work together for a common purpose.

The existence of rules and regulations presupposes the authority and power to enforce them. Unless the power goes with the authority the very best rules are imperfect and impotent. In the army and navy the power to enforce the rules and regulations is embedded in the law of the land, but in the railway service it must depend upon the voluntary consent of the parties concerned. For the purposes of this paper efficient railway discipline will be considered, first, as synonymous with instruction and training in accordance with established rules, and second, as synonymous with punishment inflicted by way of correction and training.

I.—INSTRUCTION AND TRAINING

The generally accepted idea of discipline, that it is entirely punitive, is wrong. The railway officer who proceeds upon the theory that punishing the offender is the beginning and the end of discipline, is making a serious mistake. Discipline is or should be primarily educational and the railway officer must be the teacher—upon him must rest the responsibility of educating and training his men. The instruction and training of railway employees, especially those engaged in the train, station or car service, has not been given the attention its importance demands. After a long and varied experience in steam and electric railway operation the writer has become greatly impressed with the lack of systematic methods of instruction and training. New and untried men come into the service as apprentices and graduate into responsible positions under the guidance of some older man. The instructor may not himself have been properly instructed or trained, or if properly trained he may not have the faculty of teaching others. Later, these new men undertake to instruct others. The new man without any special attention upon the part of anyone becomes part of the great machine. Proper training depends not alone upon a thorough acquaintance with the rules and regulations and the general or specific requirements of the service, although this is a primary requisite; it depends largely upon a methodical and systematic course of inspection to determine whether there is proper observance of the rules and an honest pride in the service. To know the rules is one thing, to observe them habitually is another. Furthermore, the strict observance of rules is not the end of training—no code of rules can cover all the varied requirement of a perfect railway service; good judgment and discretion must begin where the rules end, and these things can only be instilled into the apprentice by continual inspection of his work and the correction of his faults.

* Read before the New York Railroad Club, Nov. 21, 1902.

The admirable discipline in the army and navy comes from constant and persistent training and inspection. The instruction is given by men selected and educated for the purpose and frequent inspection is made by the higher officers. This training kept up through a long period enables the apprentice to secure an assignment to active service. Then when the supreme emergency arrives for which he and his companions have long been preparing they go into action as one man, guided by one mind, and become a mighty force. In railway service the instruction and training of the apprentice is more often a matter of chance than of system; left to pick up what he can he does not always get what he should have. To know just enough of the rules and of the business in general to pass an imperfect examination and get to work as quickly as possible is the controlling idea in his mind. Too often he expects only to use his position as a stepping-stone to something that temporarily pays better, and he is filled with a restless craving for change. He does not expect to become a careful, earnest worker in this field; nobody makes him do it, and therefore he does not do good work. This lack of inspection and instruction permits many poorly trained men of this stamp to pass into and out of the railway service, and their presence is inimical to good discipline.

Some of the electric railroads have established schools of instruction and nearly all of them have more or less effective methods of inspection. The schools of instruction are equipped with skeleton cars exposing to view the operations of motors, controllers, trucks, brakes and showing clearly the wiring and all the mechanical and electrical details of the cars. Competent instructors are present and here the older men, as well as the apprentices, are given instruction concerning their routine duties. Lectures on technical subjects by experts are given periodically, and there are occasional talks before large numbers of the men by one or more officers of the company. The steam railroads have maintained for many years air brake instruction schools, but their efforts, as a rule, have gone no further.

If it is expected that those who are in the service to-day and those who enter it hereafter are to make it their life work the question of proper methods of instruction and training is an important one to the men as well as to the company. It is due to the men that they should be fitted for advancement; that their work should be watched, and that they be advised and encouraged whenever they fall short.

2.—PUNISHMENT INFLICTED BY WAY OF CORRECTION AND TRAINING

To enforce laws, rules or regulations there must be a recognized authority with power to fix penalties for infringement. The responsible officer of a railroad must become the judge and jury, take the evidence in every case, establish the facts and render judgment. It is better to prevent disobedience by careful training and systmatic inspection than it is to punish the offender. But there will always be those who will shirk their duty or who will take chances, as well as those who may unwittingly err. It should become generally known that each and every infringement will be taken up and punished without fear or favor.

That is generally the best government which is supported and upheld by the governed, and which accomplishes the end of its organization with the least friction and the least display of arbitrary authority. While it requires great executive ability to carry large enterprises forward to successful issues, it also requires the rarest kind of executive ability to administer punishment for wrongdoing in a manner that will be considered by all men as fair, just, righteous and honorable. In determining what the system or method of punishment shall be we must consider what purposes are sought in inflicting the penalty. They are two-fold, viz.: (1) to vindicate the law and secure obedience to it, and (2) to set an example to others, to benefit them as well as the subject. The most merciful and righteous penalty which will secure these ends would appear to be the best. The old method of punishment by means of suspensions and fines appears to be giving way to a more enlightened and merciful method which not only answers the same purpose, but has a greater educational value. Every occurrence for which punishment may be administered ought to be turned to the benefit of the transgressor and be so handled that he may look upon it as an object lesson and a stimulus to better things. The system or method of punishment, whatever it may be, should encourage rather than discourage the subject. Its effect should be instructive. It should have a tendency to increase the efficiency and loyalty of the subject rather than the reverse.

Many of the large roads of the country have within recent years adopted one or another modification of the system known as the "Brown or Fall Brook System" of discipline without suspension, and have reported its good results. Volumes have been written in its advocacy, and we shall probably hear much of its workings from those who take part in this discussion. Without going into its details, it is evident that the best-managed railroads of the country are committed to the principle involved and it may be concluded, therefore, that the argumentative stage has been passed. The writer believes thoroughly in the underlying principle and thinks that all roads should adopt some modification of the essential idea. Its adoption will not, however, alone bring successful results; something more is required than to inaugurate the principle. To secure the best results the men must become willing and earnest workers and be induced to take pride in their vocation. They must become attached to it. Show me a road or a business where the tenure of position is secure, where the wages are satisfactory, where promotion for merit is certain and where there is ample provision for sickness, disability, old age and death, and I will show you a service where the administration of discipline is easy and the results satisfactory. In such a service men gladly become earnest and loyal workers and take an honest pride in the successful conduct of the business.

CONCLUSION

Returning now to the idea of the concentration of individual energies as expressed in the beginning of this paper, you are requested to look around and say whether it is not apparent in every department of business and of labor. Is it not true that the one thing which forces itself strongly upon our notice is the superseding of individuality by concentration? Have not the great aggregations of capital and the aggregations of labor grown greater and stronger? Is not authority and power to act concentrated in fewer hands? Have they not for many years been strengthening themselves, extending their organizations, perfecting their discipline, and trying by every means within their power to attach men to them and to increase the earnestness and loyalty of every unit of the great combinations? We are just beginning to comprehend that irresistible economic forces are at work, and that the universal desire for a more compact and better disciplined organization is in response to the instinct of self-aggrandizement or self-preservation. Recent troubles in the industrial world have shown that mixed with our boasted national supremacy and material prosperity there are throbs of discontent and the conflict of opposing elements. Organized boards of conciliation and arbitration may for a time plaster over the breach, but the crack in the wall remains an element of weakness and of danger. If such is the condition now, when times are prosperous, what may happen when the times are bad, competition keen and profits disappearing?

The opposing elements are not irreconcilable, but the danger is greater than ever before, because of the combined power and strength of the contestants. There will be no halt in the march of intelligence and progress, but there may be a realignment of the opposing forces. It is a time when employers and employed should understand one another better and cultivate a spirit of frankness and conciliation. The master and man idea should be dispelled; in its stead there should come a higher idea of the relation of the employer and employee and its foundation stone should be co-operation. The manager of every large institution should not meet his men only when trouble arises; he should meet them, as does President Vreeland, at regular intervals, touch elbows with them, talk with them about their routine work and show them by his actions that he has an interest in them and a genuine regard for their welfare. By such means, doubt and distrust are overcome and a more perfect confidence is encouraged. These are the fundamental priciples of efficient discipline.

Establishing and Enforcing Discipline *

BY C. H. KETCHAM

When speaking of discipline, it is generally thought by the men as meaning suspension from service; but the Century Dictionary says it means teaching, instruction, cultivation of the mind, government and special training to act in accordance with rules. We understand the meaning of discipline to be the means of securing the best results we are now desirous of accomplishing. First, a staff of officers is necessary, men who are thoroughly conversant with their duties, who have complete control of themselves—having been well disciplined. A man who cannot control himself in the handling of men should not have control of others, because he will do himself injustice and certainly do injustice to the men under his charge.

The work of the train rules committee of the American Railway Association has made the establishment of rules governing employees in train service easier than formerly, and as most roads have adopted standard rules, it has improved the work and education of trainmen. The local conditions, however, of each road must be carefully considered, taking into consideration the facilities; special rules can take care of such matters.

The best discipline would discover irregularities and correct vio-

* Abstract of paper read before the New York Railroad Club, Nov. 21, 1902.

lations of rules or lack of good judgment before loss of life or destruction of property occurs, making it necessary to inflict punishment. Close watch should be kept, and when it is found that the conductor, engineman or other trainmen are violating rules that may lead to trouble, get as many together as possible, tell them what these violations are and what they will lead to, and inform them that you are doing this because you want to keep them out of trouble, and obtain good service. A case in question on a certain railroad occurs to me. Speed was restricted on dead freights down a certain grade, but the slow speed order had been long neglected; a train of twenty-five cars became derailed because they were not able to stop where a rail was up, although flagged a mile distant, and four new engines were wrecked at the foot of the grade. The superintendent changed shortly after; the incoming superintendent heard of the wrecks; had his master mechanic get together as many enginemen as possible at one time, told them all about it, informed them that the speed limit was going to be enforced on second-class trains, and that it was necessary for all to run their trains to make the same time. This case was used as a text for special instruction. Ten years have now elapsed and there has not been a wreck there since.

When promoting a trainman to conductor, or fireman to engineman, after they have been examined by master mechanic and train master on machinery and train rules, good results, I think, are obtained by the superintendent taking them in hand and bringing to their attention their increased responsibilities, what is expected of them, and cautioning them not to take any chances, but if in doubt to put their train on a siding, stay there, and ask the despatcher for advice, that it will not be considered a reflection but a desire to be right; tell them of irregularities that have occurred, how they occurred and how they could have been prevented. Impress upon them the responsibility of themselves and the company to the public, and let them know that if they obey rules and show good judgment the superintendent will not be compelled to administer discipline—that they make the cases and, like a judge in court, he has to do his duty as an officer of the company.

The officer who has to inflict or decide punishment for violations of rules should be fair, honest and conscientious, appreciating that he represents the company, the public and the men. If he knows of an employee whose record is such that the man should not be kept in the service, but does not dispense with his services, he has indirectly and to a certain extent assumed responsibility for the man's acts. The court would not excuse, neither would the public, who look to the officers to protect them from disaster. That punishment is necessary for violation of rules, cannot be denied. If we violate the laws of the State, we have to stand the punishment inflicted; if we violate the laws of health, our body suffers—in both cases to the extent of our violations. All men are not of the same temperament, therefore they cannot all be handled alike. Some men feel keenly a reprimand or a record placed against them, and with them such punishment has good results; whereas other men must feel the rod, and suspension of certain duration seems to be the only punishment that will get the best results out of them. Employees should know that they are going to get the benefit of their record, and, if suspended for two weeks for a certain offense, know that another man getting into the same trouble, but without their good record would be suspended thirty days; they should realize the reason why this is so. Where several wrecks of the same nature have occurred the temptation to discharge the third man regardless of record, because the officer thinks it must be stopped, does not look like justice. The third man involved should be handled for his act on its merits. Thorough investigation should be conducted and all possible efforts made to obtain the facts; if in doubt, take the necessary time to make sure that you are satisfied who is at fault. Try and make plain to the person responsible where he violated the rule or lacked in good judgment; but after you have concluded that the employee should not be kept in the service, he should never be re-employed. To discharge a man is a very serious matter; therefore the conclusions should be drawn only after very careful consideration. If a man is good enough to re-employ he should not have been discharged. The custom of discharging a man while expecting to re-employ him destroys effective discipline; the superintendent's approval should be required before discharging an employee. The enforcement of rules should be very exacting, especially where the train movement is affected.

As to what punishment is the most effective, a record or a reprimand in some cases is sufficient; at other times a moderate or long suspension is necessary. Each case must be considered on its merits; no set plan can be laid down that can be followed with invariably good results. The "Brown" system has been juggled to such an extent, to meet the wishes of an officer who has a desire to be slack on discipline or who lacks the courage to enforce it, that it has lost its effectiveness; whereas, had that officer tried to build up the man he would not have an unpleasant duty to perform. Our judges would not be long tolerated if they failed to do their duty, so an officer should do his duty without fear or favor, but tempered with mercy and justice. From information received in conversation with the rank and file on some of the roads, I am led to believe that many superintendents courted the Brown system because formerly their ranking officers frequently reversed their decisions and destroyed their usefulness as disciplinarians. Now the Brown system saves them from embarrassment. The superintendent should be the officer to whom the men look to settle their cases; if he knows them as he should, and is the right man in the right place, the company, as well as the men, will be fully protected.

Organization and Discipline*

BY G. W. SLINGERLAND

It was recently stated by a great public educator that "The world has been made over during the last fifty years." With this process, you gentlemen of the railway and steamship service have had much to do; within a very few of those years we have seen the making over of your forces in the conversion of the inefficient and careless sectionman into the faithful, vigilant, storm-defying track and road watcher; we have appreciated the transformation of the uncouth, muffle-voiced brakeman, who kicked so hard against the "badge of servitude" when first he put the uniform on, into the natty trainman of to-day, who, after assisting "passengers off first, please," and helping others on, steps inside the car as the train starts, and, in a distinct voice, announces, "Jonesville next stop—next stop is Jonesville," repeating it before the station is reached; we have noted the alert and silent motorman on the end of the car erstwhile occupied by the jolly, gossipy driver, as well as many other familiar incidents of this great evolution, which is still going on.

Leaving the discursive line of thought engendered by the breadth and age of our theme I will, if you please, devote the remainder of my time to some types of discipline in other than railway organizations; and in order that this paper may not greatly exceed the minimum of time to be consumed in its reading, I will confine it to references to three widely differing kinds, all of interest to railroad men, all with the "full and free consent of the governed," one of which is supported by voluntary contributions or assessments of its members, the second partly by its own revenue and partly by public taxation, and the third a revenue-earning transportation company. Before doing so, however, permit me to say that in my opinion the "efficiency" of any discipline is so largely judged from the viewpoint of the observer, and those view-points so frequently change—as has been the case with some of us concerning that of the slipper the shingle, the birch and the ruler—each must decide for himself as to the "effectiveness" of any method, or leave it to old Father Time and results.

The first of these types is the American Federation of Labor, which, regardless of our views as to its principles, purposes or tendencies, we must admit presents a discipline which trains its members to absolute obedience and subjection to the control and direction of its officers, the sinking of individuality and abnegation of self, and maintains zeal, spirit and confidence in the face of all discouragement, even when striking against the rock on which is implanted the banner of forces that believe in the inherent right of every man to sell his own labor, skill or ability to his best advantage—a rock around which its many very able and energetic chieftains have not yet found a safe course to steer.

The second selected type is one of our dear old Uncle Samuel's departments. I refer to that department of our government which more than all others appeals most strongly to our civic pride—that one which is almost invariably used as an argument in favor of government ownership or control of public utilities by a very few generally well-informed and well-meaning citizens, a very large number of others who think they think, and politicians of both parties who wish to stir the public pulse for party advantage or personal gain, viz.: The Post Office Department of our general government. To the popular belief that its discipline is the embodiment of all that is perfect and an important factor in producing its efficient service, we may humbly bow; but it is my individual opinion that many other much more important factors have aided in the development and perfecting of our magnificent postal service than has its autocratic discipline by the Revised Statutes. Prominent among these factors we may mention the extraordinary facilities provided by railroad and steamship companies, frequently at nominal cost—our sublime and childlike faith that government can do no wrong, which causes us to pay both for transportation of our mail matter and taxes for transportation of other people's freight by mail—and the much decried "spoils system" which,

* Abstract of paper read before the New York Railroad Club, Nov. 21, 1902.

making political bosses of its fourth-class postmasters and officials of higher grade, for a long period gave to the government, without adequate pecuniary compensation, invaluable services sometimes of the very highest administrative ability, which, if paid for in cash, would either have swelled the appropriations to an unwarrantable and unobtainable extent or reduced the value of the service by its withdrawal from crossroad hamlets. May we not also, but with equal humility, question whether this severe discipline aids as rapidly as might a more liberal one in the development of the great and unquestioned proficiency of its intelligent, uniformed force, and particularly its mail clerks in the Railway Postal Service.

For my third (and last) type I wish to call your attention to the discipline of a great transportation company which applies to all its force, a small army of men working in and traversing thirty States and territories and all the Canadian provinces, of agents and shipping correspondents in every commercial port and city of the Old World subject only to the governmental regulations or commercial customs of different nations in which their work is done, and fits nearly every phase of the lexicographers' definitions, including also "prevention" and the "open door"—a definition which I think was coined by the president of this club. Its education and training of its employees is broad and comprehensive, tending always to the rapid and careful performance of many diversified duties.

The first of its general instructions is: "A printed circular is issued from the president's office monthly for the information and instruction of employees only, etc." The heading of this monthly circular reads, "Suggestions tending to simplify details, further economy or increase the efficiency of our system for doing business are cordially invited from all connected with the company, and will be duly considered." These circulars are always educational and are eagerly looked for and carefully studied by employees who are trying to fit themselves for promotion, and that covers the majority of them. Another of the general instructions says, "The most polite and gentlemanly treatment of all customers—whether men, women or children, rich or poor, white or black, or however insignificant their business—is insisted upon. It must not be forgotten that the company is dependent on these same people for its business"—and violations of this rule are never excused or condoned. You will note that as a preventive it is very politely intimated to the employee that if the company does not get patronage on account of his incivility it will have no use for him, and there is no question that it is so read and applied.

No civil service examination to ascertain their knowledge of astronomy or geology and like subjects is required of applicants for positions, nor are they asked their religious or political creeds or affiliations—the requirements are good character, fair physical condition, good eyesight and hearing, intelligent appearance, and, of course, ability to read and write. The lowest grades of service are label-boys, porters and wagon helpers. Promotion for efficiency is the invariable rule of the American Express Company (which is the one referred to herein) and as its officials of every grade have been promoted from its ranks the ambitious young men in all grades are always trying to fit themselves for promotion; there is usually more than enough to fill the better positions, and it is very rarely that a new man can find an opening which will give him a big salary on the start.

It is the only commercial or industrial concern of which I know, 80 per cent of whose employees, scattered over the world as these are, make written contracts, which, while binding on the company (frequently in large amounts), are operative when signed by the employee and without being vised by the home office, and on which the company is only released from obligation when, after passing through many hands and quite possibly crossing continents and oceans, they are completed by some other employee distant from the point of agreement; so effective is its discipline that although many tens of thousands of such contracts are made by its employees daily, the instances in which they are not executed both in letter and spirit are infinitesimally small when compared with the entire number.

It is this educational discipline which qualifies its men rapidly and carefully to perform many widely differing daily duties, the list of some of which makes that famous one of the "country station agent" pale into insignificance. While some of its employees could not pass a government civil service examination the practice which makes perfect, their ambition and the methods of the company make them proficient much more rapidly than does other discipline. As an illustration of this (and it is also brought up because of the discussion at our last meeting on the subject of loading cars) it might not be out of place to say that on one of the leading trunk lines from this city the United States Railway Mail Service sends about eighteen exclusive mail cars during twenty-four hours; in addition to our business for points within 150 miles of the city and long-distance shipments sent out earlier in the day, we load at our principal depot in this city between seven and nine o'clock every week-night, eighteen exclusive express cars carrying matter for Northern New England, Canada, around the Great Lakes, the Missouri River and the Gulf of Mexico, and over the Rocky Mountains to the Pacific Coast and the far Orient. These cars are loaded for various principal points and branch routes and the business is always loaded in station order, and the packages in them are placed in sealed trunks or cases which are also destined to cities and smaller routes. Its men from the lower grades of service become so extremely proficient in the geography of the country that there is always a considerable portion of its depot force competent not only to sort, way-bill and load this matter quickly, but to name the proper route, trunk or identical place in the car where each shipment should be placed to insure its reaching its destination by the shortest and quickest route, even if such destination should be, as is frequently the case, a small hamlet off of railway lines.

Another phase of its discipline, which has a very important bearing on its efficiency, is both preventive and corrective, namely, that covered by the general rule that "who breaks, or loses, pays." This rule is rigidly applied in every case where it is shown that the loss or breakage occurred through the carelessness or negligence of the employee or was preventable by him; but it is not enforced when it is shown that the result was owing to causes beyond the employee's control—the utmost care always being used not to do the man injustice. There are several other prominent features of its discipline to which we might further allude, but I fear it would trespass too greatly on your time, and, therefore, will not detain you further in regard to this illustration of what we think is very "efficient discipline." I will close with the following quotation from an anonymous author: "Discipline, like the bridle in the hand of a good rider, should be ever active, both as support and as a restraint, yet seem to lie easily in hand. It must always be ready to check or to pull up, as occasion may require, and only when a runaway should the action of the curb be perceptible."

Northwest Railway Club

At a recent meeting of the Northwest Railway Club there was a brief discussion on the merit system, prompted by a paper read at a former meeting on "The Best Form of Discipline for Engine and Train Men." The Brown system of debit and credit was explained, and George Dickson, of the Great Northern Railway, discussed the advancement in the character and intelligence of the men of late years. The engineer of seventy years ago was a mechanical genius, he said, and was selected because of his familiarity with his locomotive, whereas the successful engineer of to-day is careful, conservative and obedient. Discipline is of higher importance to-day than formerly. Mr. Dickson, in closing his remarks, made a suggestion regarding the disposition of cases of discipline brought under the rules:

"I believe that where so many men of one class are engaged in the one kind of work, as in the case of road men, there should be one man whose business it should be to sit in judgment on all men who are unfortunate enough to come under the rules of discipline. He should be a man capable of rendering an honest and just decision, treating all men alike, whether the system be one of merit marks or suspension. There would be a sameness in the judgments meted out and the superintendent would be relieved of an unwelcome duty.

"I believe that merit marks should be given when a certain number of miles has been made without accident, and the man who is successful in rolling up a big mileage, especially during the busy season, should receive his just reward."

H. T. Gould, of the Minneapolis, St. Paul & Sault Ste. Marie Railway, said: "It is a very difficult matter for anyone to get at this subject in a satisfactory way. You can always see the bad points in a man, because they are always reported to you, but when you come to his good points it is a different proposition. In handling a personal record under the Brown system, I think it is the duty of every man in the employ of the train service to look at the merit side as well as the debit side. I think that the trainmen and the enginemen are a little jealous of one another, and for that reason you do not see the good qualities, where you always get the bad. I am speaking now from the standpoint of the operating department. I am not as well versed in the mechanical side of it. But I always find that we have debits to place against a man's record, when undoubtedly some credits are overlooked through not being reported. And therefore I think, in order to make that system a success, the trainmen and the enginemen should report to their respective heads of the departments the good qualities of the men and not always the bad."

Vice-President Falther closed the discussion with the following observations: "There seems to be a very general consensus of

opinion that if a man is to be debited for an error committed, or for some slight mistake or fault, he should certainly be credited by an equal amount, if he shows good qualities, in order to wipe out the debit against him. Otherwise it would seem that it must be a question of time only when these debits accumulate to such an extent that he cannot at all eliminate them, and he must quit the road and find employment elsewhere, thus bringing about the very reverse of what was intended; that is the improvement of the service. The question of improvement of the service should be borne in mind, I think, throughout, and if we have, as the last speaker has stated, debits against a man, we should certainly also have credits for him."

The next feature of the programme was a paper by M. H. A. Ferguson, of the Chicago Great Western Railway, on "Draw-bar Pull Rating of Engines," and the discussion it provoked. The paper was accompanied by two curves made from records obtained by dynamometer car tests covering a period of over six months, and including 10,000 cars. The curve showing the pounds per ton draw-bar pull was very regular. It was also shown how much less the pounds per ton is for heavy cars than for light ones; but when the pounds per ton is multiplied by its proper weight of car, the character of the curve is entirely changed, showing the importance of taking care of the resistance of each car separately, instead of the "adjusted" method of adding a fixed average factor to each car regardless of weight. The curves given are for a straight and level track. In order to find the draw-bar pull for any weight of car for any given grade and curve, direction is given to add the draw-bar pull due to grade alone to the draw-bar pull for level tangent, and, if there be any curve, also add the product of the degree of curve times 1.35. This result, multiplied by the weight of car in tons, gives the total draw-bar pull for that car on the given grade. Mr. Ferguson said that he had found, during the course of some road tests, that the following was a simple and quite accurate way of obtaining the draw-bar pull of various weights of cars over any grade or curve, it only being necessary to know the figures for a level tangent: "Let us suppose that an engine, exerting a draw-bar pull of 20,000 lbs., hauls a train of thirty cars, weighing 1500 tons, over a certain grade and curve at the required speed. If we divide 20,000 by thirty, the number of cars, we find that the average draw-bar pull per car is 669 lbs; also, by dividing 1500 tons by thirty we find that 50 tons is the average weight per car; then by dividing 667 by fifty we get 13.34 lbs., as the average draw-bar pull per ton for a 50-ton car. The draw-bar pull for a 50-ton car on a level tangent is 2.6 lbs. Therefore 13.34 minus 2.6, or 10.74, is the pounds per ton draw-bar pull for that grade or curve, and is constant for any weight of car. For other weights than fifty, add to 10.74, their level tangent resistance in pounds per ton, multiply by the weight of car, and we have the figure for our loading table."

British Electric Railway Practice

At the meeting of the British Institution of Civil Engineers on Tuesday, Nov. 11, a paper was read on "Electric Tramways," by C. Hopkinson, M. Inst. C. E., B. Hopkinson, and E. Talbot, M. Inst. C. E.

The authors stated that when, about the year 1897, electric tramways had begun to be constructed in Great Britain on a large scale, there had already been many thousand miles in operation in America, and a vast amount of American experience had been available in connection with this branch of engineering. Consequently, British tramways had been constructed largely according to American methods, and showed a good deal of the uniformity characteristic of American practice. The authors' experience had been gained principally in the construction of the tramway systems of Leeds and Newcastle-on-Tyne, and the paper discussed a number of important points in tramway practice, which were illustrated by reference to these two systems of tramways. The paper was divided into four sections, viz.: (1) Generation of power. (2) Transmission of power to the cars. (3) Rolling stock. (4) Earth returns.

The nature of the load on a tramway generating station was discussed, and it was shown from actual records to what extent increasing the number of cars resulted in making the load more uniform. With seventy cars or more, the load was so nearly constant that the steam consumption per unit was substantially the same as though it were constant and equal to the mean. Hence in a station of this size, equalization of the load by means of a storage battery was of no use as regarded economy, though in a small station it might be of great value. A storage battery equal to replacing one-third of the generating plant for one-half hour, should, however, be installed in a continuous-current power station for the purpose of replacing a generating unit in case of breakdown, and for running cars at night. The effect of short circuits on the generator was considered; in the worst case there might be a force equal to three or more times the normal force applied at the periphery of the armature for a period of one-tenth of a second, that being the time which a circuit-breaker took to open. This necessitated a very strong connection between armature and fly-wheel. Another effect of the opening of the circuit-breaker was the sudden diminution of the load on the engine to nothing, which necessitated special arrangements for preventing the engine from running away. This required either very quick governing or a heavy fly-wheel. Except for short circuits, an ordinary governor and an ordinary fly-wheel were sufficient. Tachograph records showing the rise of speed on one of the Newcastle engines when the load was thrown off were discussed. The question of over-compounding dynamos was considered, and dynamos wound for constant potential were recommended.

The simplest method of transmitting the power to the cars was to make the trolley wire into an electrically continuous network and to feed the current into it at several points. In practice, however, it was found necessary to divide the trolley line into sections insulated from each other, each section being fed at one point. The points of division in the center of a city were determined by considerations of safety; in the outer districts, questions of economy and the necessity of keeping the variations of line potential within limits might come in. The principles were illustrated by reference to Newcastle-on-Tyne. There was no objection to the line potential occasionally dropping 100 volts below normal; and this led to the result that a two and one-half minute service of cars could be worked up to a distance of 2 miles from a feeding point. The most economical size of cable was next considered; the mean current density should rarely exceed 300 amps. to the square inch. This entailed a mean drop of potential of about 13 volts per mile of feeder, and feeds could be carried to a distance of 1 mile or 1½ miles without boosting. The loss in the trolley wire in supplying ten cars on 1 mile of double track from one end was between 2 per cent and 4 per cent of the power given to the cars. The conclusion was that on the outer sections the line might be divided into sections 2 miles long. In many cases excessive traffic on a particular route had to be dealt with on a few days of the year, the traffic being small on other days. This was illustrated by reference to a case in Leeds where fifty cars had to be supplied with current on twenty days in the year at an average distance of 3½ miles from the generating station. The method by which this was done with continuous current and boosters was discussed, and was compared with and found preferable to three-phase high-tension transmission and conversion. The Leeds tramway system was as extensive a system as could be economically served by a single continuous-current generating station, placed in the center of the system.

The most important requirements in a motor car for use in city systems were that it should be capable of rapid and well-sustained acceleration, and that it should be able to go quickly up hill. These requirements could be fulfilled only by motors capable of traveling on the level of speeds far above what was allowable in practice. Curves were given showing the acceleration of the car from rest with various motors and under various conditions. A mean acceleration of 3 ft. per second per second up to a speed of 10 ft. per second could be obtained with motors of a type found to be satisfactory in Leeds and Newcastle. The effect of bad driving on starting was considered.

There was much difference of opinion on the subject of earth returns. In Great Britain the Board of Trade restriction of the rail drop to 7 volts had made cases of electrolysis by return currents very rare, but it could not yet be said that absolute safety was secured for metallic pipes in the neighborhood of tramway tracks. The resistance of the rails and bonds used in tramway practice as determined in experiments by the authors was given. In a new fished and bonded joint a good deal of current went through the fish-plates and sole-plates. The Falk cast-welded joint was described and also the Thermit-welded joint. It was considered unadvisable by the authors to use such joints on sharp curves or on crossing a bridge with steep approaches on account of the effect of expansion and contraction. On straight track, however, the lateral support to the rails prevented variations of temperature from doing damage. Experiments were described from which it appeared that from one-sixth to one-fourth of the current in the rails was diverted into the earth. A service of about ten cars per double mile could be worked over a distance of 2 miles, the feeding point being at one end, without the 7-volt limit being exceeded. The system of return feeders in Newcastle and Leeds was described. Where the Board of Trade limit was exceeded, if all the current were taken out of the rails close to the power station, the extension of the return feeder to points about ½ mile distant from the power station would produce a very marked reduction in

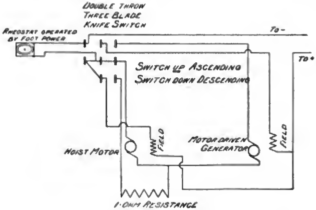
the rail drop, owing to the fact that the great concentration of current which took place in the center of the city with converging routes was thereby avoided. This was the system now adopted in Newcastle-on-Tyne, but provision had been made on the switchboard whereby the cars could be divided into two groups, each group being run by its own generator. The first comprised all the cars outside a radius of 3 miles, and a second all within that radius. In Leeds the greater part of the current would be taken out of the rails close to the power station, but a portion sufficient to bring the drop of potential in the rails within the legal limit would be drawn back through a number of return feeders about 1 mile long. Exceptional traffics at particular points were dealt with by special boosters and return feeders. The authors' experiments showed that a current of 300 amps. in the rails between two points, 2 miles apart, implied a potential of about 5 volts between those two points. The potential was proportional to the current within 1 per cent, which showed that the conduction of the leakage current through the earth was metallic in its nature and not electrolytic to any considerable extent. Examination of the current in the rails, and of the potential at various points of the tramway system, with a constant current of 300 amps. passing had shown that only a very small portion of that current got into the gaspipes. This result was discussed and was shown to be not surprising. The possibility of electrolysis with such currents as did get into the pipes was considered. Unless there were strata of such small extent and high conductivity compared with the average, and so placed as to cause a concentration of the current into the pipe to a density of a thousand times the mean current density or more, no corrosion of the pipe would take place, and the 7-volt limit might be exceeded many times without damage to the pipe. On the other hand, if such strata were present, electrolysis (with damage to the pipe) was quite possible, even though the 7-volt limit was not exceeded.

Electrically Operated Coal Hoist Having Variable Speed Control *

BY P. O. KEILHOLTZ

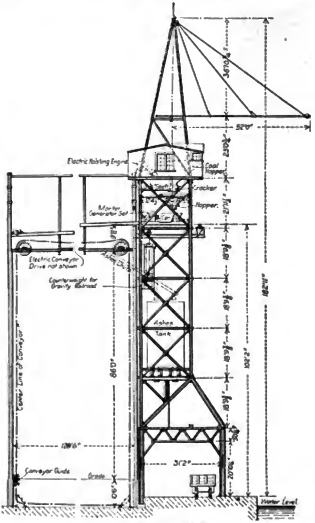
The use of electric machinery for coal hoisting has many advantages over steam machinery when the hoist is considerable. It has also the advantage of less cost of operation and maintenance. Its initial cost, however, is greater.

There are two distinct operations in coal hoisting: Raising the loaded shovel and lowering it empty. All that is required for raising is a smooth acceleration for closing and raising the shovel, and full power application as long as possible in order to decrease the time of hoisting. Full power application can be continued longer with an electric hoist than with steam, owing to the less inertia of the former. A smooth acceleration is required because the cables are without stretch and for very high hoists would introduce objectionable strains in the structure or damage to the gearing. It is in lowering the empty shovel that the electric hoist has marked advantages. With steam hoist the lowering is accomplished by braking, and with high hoists,



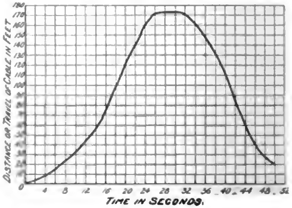
WIRING DIAGRAM

large shovels and rapid lowering the large amount of heat generated by the brakes is difficult to get rid of. As brakes depend upon friction, which is a function of two things—the surface conditions and the pressure between the rubbing suraces—the amount of friction is uncertain, and braking, therefore, is objectionable because violent surgings are introduced in the boom structure and tower. With the electric hoist, owing to the perfect reversibility



COAL HOISTING TOWER

of the electric motor, the motor is used as a generator having a separately excited field and driven by the weight of the descending bucket. In its armature circuit is a rheostat to dissipate the heat generated. It is at once apparent that this heat dissipation can



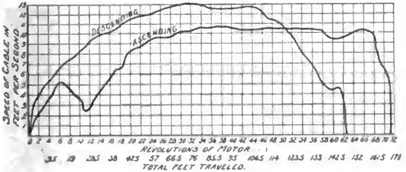
DISTANCE TIME CURVE

be better accomplished with a rheostat than with a brake band.

The Ward-Leonard system of control is used and the apparatus consists of a motor generator set and a hoist motor which receives its power from the motor generator set, the motor of which is supplied with 550-volt direct current. The field of the generator is separately excited and its strength is controlled by the operator by means of a foot operated rheostat. The field of the hoist

*Read at the meeting of the American Institute of Electrical Engineers, New York, Nov. 21, 1902.

motor is excited by the 550-volt direct current. By means of a double throw, three-blade switch, the foot rheostat is cut out of the generator field circuit and cut into the field circuit of the hoist motor; and the armature leads of the hoist motor cut from the armature circuit of the generator to the rheostat.



VELOCITY CURVE

Appended will be found sketches of coal-hoisting tower, wiring diagram, distance-time curve and a velocity curve, together with data of test and other particulars.

Weight of coal hoisted, average of seven shovelfuls.	2,337 lbs.
Weight of shovel empty	2,900 "
Total weight lifted, exclusive of weight of ropes	5,237 "
Average lift	126 ft.

Readings of main motor.

Volts	540
Average current in amperes to close shovel	57
Maximum current in amperes to close shovel	73
Average current in amperes to raise loaded shovel	189
Maximum current in amperes to raise loaded shovel	243

Field current, not included in above, 2.8 amps.

From the velocity curve (ascending) it will be seen that it took 11 seconds to close the shovel, and from the distance-time curve 26 seconds to close the shovel and raise it to the dumping hopper. Therefore, 15 seconds is the time taken to raise the loaded shovel; and as the lift is 126 ft., the average velocity is 8.4 ft. per second.

$$\text{The efficiency is, } \frac{\dfrac{8.4 \times 5237}{550}}{\dfrac{189 \times 540}{746}} = 58\tfrac{1}{2}\%$$

Performance test: Coal lifted, tons, 101.86; time, minutes, 87.33; rate, 70 tons per hour.

PARTICULARS OF ELECTRICAL APPARATUS

Main motor: M. P., 6/150, hp. 450; volts, 550.
Generator: M. P., 6/85, kw. 450; volts, 250.
Hoist motor: M. P., 6/100, hp. 200; volts, 250.

Steam Pipe Covering and Its Relation to Station Economy *

Before awarding a contract for covering the steam pipes in the Manhattan Railway Company's power house, a careful investigation and test of different types and thicknesses of covering was made under the author's direction. In order to get the necessary data it was decided to carry out a complete test of the various types of covering on the market, and also to investigate the effect of varying the thickness of the insulating wall.

The method adopted is illustrated in Fig. 1, and consisted in coupling up about 200 ft. of 2-in. iron pipe and mounting the same on wooden horses about 3½ ft. from the floor, the three lines of pipe being approximately 4 ft. apart and 4 ft. from the nearest wall, in order to avoid any errors due to heat connection and radiation. Sections 15 ft. in length were marked off on straight portions of the pipe, and so arranged as not to include any pipe couplings or bends; 2 ft. from each end of each section heavy potential wires were soldered onto the pipe, and at the extreme ends of the pipe 1,500,000 circ. mil copper-insulated cables were soldered on, the openings in the pipe having been previously closed by means of a standard coupling and plug. One of these cables ran direct to one terminal of a 250-kw, 250-volt, steam-driven, direct-coupled exciter, which was solely devoted to furnishing current for the test, and which could have its voltage varied within wide limits so as to furnish any current up to 1500 amps. The cable connected to the other end of the pipe was then connected to three ammeter shunts in series, in order to enable the readings to be easily checked, after which it was carried through a circuit breaker and switch to the other exciter terminal. The pipe covering test was carried on in a vault in which there was no source of heat and no possibility of draughts of air, and arranged so that the section in which the test was being carried on could be locked up in order to prevent interference with the test.

Invitations for bids were sent to all the principal pipe covering manufacturers and jobbers, specifying that each one would be expected to cover one or more sections of the 2-in. pipe for a competitive test, and that samples from the successful bidders' covering would be analyzed in the company's chemical laboratory, and no covering accepted which departed more than 3 per cent from this analysis.

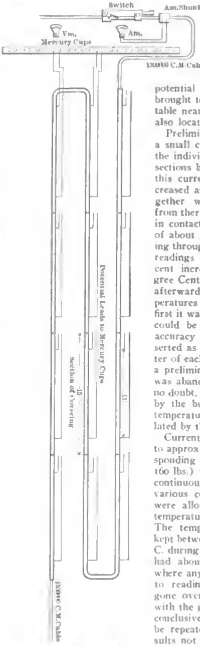


FIG. 1.—CONNECTIONS FOR TESTS

A special Weston milli-voltmeter was ordered, with which readings were taken from the potential wires, the latter all being brought to mercury cups on a testing table near which the ammeters were also located.

Preliminary tests were made with a small current in order to establish the individual resistance of the 11-ft. sections between the potential wires; this current was then gradually increased and more readings taken together with thermometer readings from thermometers having their bulbs in contact with the pipe at an angle of about 30 degs., the stems projecting through the covering. From these readings a coefficient of .4694 per cent increase of resistance per degree Centigrade was determined, and afterward used in determining temperatures of the various sections. At first it was thought that temperatures could be determined with sufficient accuracy by the thermometers, inserted as above described in the center of each section covered, but, after a preliminary series of readings this was abandoned as inaccurate, owing, no doubt, to the variable contact made by the bulb on the bare pipe. All temperatures were, therefore, calculated by the resistance method.

Current sufficient to heat the pipe to approximately 370 degs. F. (corresponding to a steam-gage pressure of 160 lbs.) was kept on for three days continuously, in order to dry out the various coverings, after which they were allowed to cool off to the air temperature before starting the test. The temperature of the room was kept between 27 degs. C. and 31 degs. C. during the entire test, each section had about 600 readings taken, and where any doubt existed in reference to readings, the entire series was gone over a second and third time with the gratifying result that it was conclusively shown that the test could be repeated with a variation of results not exceeding 2 per cent.

The method of test was to put a current of sufficient quantity through the pipe to heat it to say 220 degs. F., and keep this current on for a sufficient time to enable all sections to maintain a constant temperature (this period was found to be about ten hours) when readings of the milli-voltmeter were taken on each section with simultaneous ammeter readings. As all the sections were in series electrically, the current was, of course, the

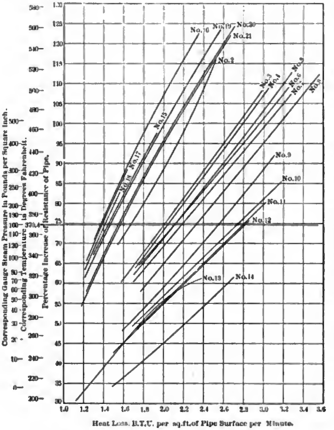
* Abstract of a paper by H. G. Stott read before the twenty-third convention of the Association of Edison Illuminating Companies, held at Mount Washington, N. H., Sept. 9, 10 and 11, 1902.

same, so that no error could arise, due to variation of current.

The object of leaving 2 ft. at the end of each section, or 4 ft. between potential wires, was to avoid any error due to conduction of heat through the pipe. Tests were made to prove the efficiency of this precaution, and showed that no perceptible error was introduced.

A constant temperature having been obtained, it is evident that the watts lost in each section give an exact measure of the energy lost in maintaining a constant temperature, and from the watts lost the thermal units are readily calculated. Fig. 2 shows the result of the test values being reduced to loss in B. T. U. per square foot of pipe surface at various temperatures in the curves, and at a temperature corresponding to steam at 160 lbs. pressure in the table.

After a series of readings had been completed, the current was raised sufficiently to give approximately 50 degs. F. rise in the



G. 2—HEAT LOSSES AT VARIOUS TEMPERATURES

least efficient covering, and maintained constant for ten hours, when another series of readings were taken, and so on until the temperature of the pipe had reached a point far above anything used in practice. The extremely high readings were taken as a matter of interest, as they were gotten when the low efficiency coverings were only at working temperatures.

The first column in Table I refers to the number of the curves in Fig. 2. The second column gives the name of the covering which, in most cases, is sufficiently descriptive, but a brief description of each covering may be of interest.

No. 2. Solid sectional covering 1½ ins. thick, composed of granulated cork moulded under pressure, and then baked at a temperature of 500 degs. F., ⅛-in. asbestos paper next pipe, finished with resin paper and 8-ounce canvas.

No. 3. Solid 1-in. moulded sectional covering, composed of 85 per cent carbonate of magnesia, finished with resin paper and 8-ounce canvas.

No. 4. Solid 1-in. sectional covering, composed of granulated cork moulded under pressure and baked at a temperature of 500 degs. F., ⅛-in. asbestos paper next pipe, finished with resin paper and 8-ounce canvas.

No. 5. Solid 1-in. moulded sectional covering, composed of 85 per cent carbonate of magnesia. Outside of sections covered with canvas pasted on. Finished with resin paper and 8-ounce canvas.

No. 6 Laminated 1-in. sectional covering, composed of nine layers of asbestos paper with granulated cork in between; outside of sections covered with canvas pasted on, ⅛-in. asbestos paper next pipe, finished with resin paper and 8-ounce canvas.

No. 7. Solid 1-in. moulded sectional covering, composed of 85 per cent carbonate of magnesia, out ide of sections covered with light canvas pasted on; finished with hesm paper and 8-ounce canvas.

No. 8. Laminated 1-in. sectional covering, composed of seven layers of asbestos paper indented with ¼-in. square indentations, which serve to keep the asbestos layers from coming in close contact with one another; ⅛-in. asbestos paper placed next pipe, finished with resin paper and canvas.

No. 9. Laminated 1-in. sectional covering composed of sixty-four layers of asbestos paper, in which were embedded small pieces of sponge. Outside covered with canvas pasted on, finished with resin paper and canvas.

No. 10. Laminated 1½-in. sectional covering composed of twelve plain layers of asbestos paper, with corrugated layers in between, thus forming longitudinal air cells; ⅛-in. asbestos paper next pipe; sections wired on and finished with resin paper and 8-ounce canvas.

No. 11. Laminated 1-in. sectional covering, composed of eight layers of asbestos paper with corrugated layers in between, the corrugations forming small air ducts radially around the covering; finished with resin paper and 8-ounce canvas.

No. 12. Laminated 1¼-in. sectional covering, composed of six layers of asbestos paper with corrugated layers, forming longitudinal air cells; outside of sections covered with two layers of canvas pasted on and finished with resin paper and canvas.

No. 13. Solid 1-in. moulded sectional covering, composed of a magnesia compound mostly talc; ⅛-in. asbestos paper next pipe; finished with resin paper, and 8-ounce canvas. This sample was submitted for low temperature work only, such as boiler feed and drips.

No. 14. Solid 1-in. moulded sectional covering, composed of magnesian compound, principally talcfi ⅛-in. layer of asbestos paper next pipe, and finished with resin paper and 8-ounce canvas.

No. 15. "Remanit," composed of two layers wound in reverse direction with ropes of carbonized silk. Inner layer 2½ ins. wide, and ½-in. thick; outer layer 2 ins. wide and ¾-in. thick, over which was wound a net work of fine wire; ⅛-in. asbestos next pipe, finished with resin paper and 8-ounce canvas. Made in Germany.

No. 16. Two and one-half-inch convering, composed of 85 per cent carbonate of magnesia, ½-in. blocks about 3 ins. wide and 18 ins. long next pipe and wired on; over these blocks were placed solid 2-in. moulded sectional covering; outside covered with canvas pasted on. Finished with 8-ounce canvas.

No. 17. Two and one-half-inch covering, composed of 85 per cent. magnesia. Put on in a 2-in. moulded section wired on; next the pipe and over this a ½-in. layer of magnesia plaster covered with canvas pasted on and finished with 8-ounce canvas.

No. 18. Two and one-half-inch covering, composed of 85 per cent carbonate of magnesia. Put on in two solid 1-in. moulded sections with ½-in. layer of magnesia plaster between; two 1-in. coverings wired on and placed so as to break joints. Finished with 8-ounce canvas.

No. 19. Two-inch covering, composed of 85 per cent carbonate of magnesia put on in two 1-in. layers so placed as to break joints and finished with 8-ounce canvas.

No. 20. Solid 2-in. moulded sectional covering, composed of 85 per cent magnesia; outside of sections covered with canvas pasted on. Finished with 8-ounce canvas.

No. 21. Solid 2-in. moulded sectional covering, composed of 85 per cent magnesia; outside of sections covered with canvas pasted on. Finished with 8-ounce canvas.

Nos. 2, 4, 6 and 15 were excluded by the specifications, which stated that "no inflammable material would be considered," but a test was made at the request of the manufacturers in order to give a comparison with the other materials.

It will be noted that two samples covered with the same thickness of similar material give different results; for example, Nos. 3 and 5 and also Nos. 20 and 21, though of practically equal thickness, show quite a perceptible difference in loss per square foot. Upon investigation, the cause of this difference was found to be in the care with which the joints between sections were made. A comparison between Nos. 19 and 20, showing two coverings having exactly the same total thickness, but one applied in a solid 2-in. section, and the other in two 1-in. sections, proved the desirability of breaking joints.

An attempt was made to determine the law governing the effect of increasing the thickness of the insulating material, and for all the 85 per cent magnesia coverings the efficiency varied directly as the square root of the thickness, but the other materials tested

did not follow this simple law closely, each one involving a different constant.

The fifth column of Table I shows the percentage of heat saved by the different coverings, compared to bare pipe, at a pressure of 160 lbs.

In Table II an attempt has been made to reduce all coverings to the same thickness, and thus show the relative efficiency of different types of material at a wide range of pressures. One-inch covering was adopted as the standard, and only those coverings nearly 1¼ ins. thick were used in the comparison, in order to avoid errors in calculating the losses in materials which did not follow the square root law closely.

An inspection of the table shows that the carbonized silk covering is the most efficient, having a relative efficiency of 86.9, while 85 per cent magnesia comes second with 84.2 per cent. efficiency. The two other samples of 85 per cent magnesia show efficiencies of 83.1 and 83.2 per cent. thus confirming in a remarkable way the results on the other samples.

RELATION TO STATION ECONOMY

To determine which covering is the most economical the following quantities must be considered:

1st. Investment in covering. 2d. Cost of coal required to supply lost heat. 3d. Five per cent interest on capital invested in boilers the stokers rendered idle through having to supply lost heat. 4th. Guaranteed life of covering. 5th. Thickness of covering.

From an inspection of the first three quantities it is apparent that the covering which shows a minimum total cost of the three at the end of a specified time is the best covering to adopt, for the loss in heat at the end of ten years may readily cost over three times as much as the first cost of covering. To enable this to be seen more clearly Table III was calculated.

TABLE I.—RESULTS SECURED IN TEST

Covering	Aver. Thick Inch	B. T. U. Loss per sq. ft. at 160 lbs. Pr.	P. C. Heat Saved by Covering
2. Solid cork: Sectional	1.68	1.672	87.1
3. Eighty-five per cent magnesia: Sectional	1.18	2.008	84.5
4. Solid cork: Sectional	1.26	2.048	84.2
5. Eighty-five per cent magnesia: Sectional	1.19	2.130	83.6
6. Laminated asbesto cork: Sectional	1.43	2.123	83.7
7. Eighty-five per cent magnesia: Sectional	1.12	2.190	83.2
8. Asbestos air cell [indent]: Sectional [imperial]	1.26	2.333	82.1
9. Asbestos sponge, felted: Sectional	1.24	2.556	80.3
10. Asbestos air cell [long]: Sectional	1.70	2.750	78.8
11. "Asbestocel" [radial]: Sectional	1.22	2.801	78.5
12. Asbestos air cell [long]: Sectional	1.29	2.812	78.4
13. "Standard" magnesia: Sectional	1.12	....	....
14. "Magnesian:" Sectional	1.23	....	....
15. "Remanit" [silk]: Wrapped	1.51	1.452	88.8
16. Eighty-five per cent magnesia: 2" Sectional and ½" block	2.71	1.381	89.4
17. Eighty-five per cent magnesia: 2" Sectional and ½" plaster	2.45	1.387	89.3
18. Eighty-five per cent magnesia: 2½" Sectional and ½" plaster	2.50	1.412	89.1
19. Eighty-five per cent magnesia: 2½" Sectional	2.24	1.465	88.7
20. Eighty-five per cent magnesia: 2" Sectional	2.24	1.555	88.0
21. Eighty-five per cent magnesia: 2" Sectional	2.21	1.568	87.9
Bare pipe [from outside tests]		13.000	

TABLE II.—RESULTS REDUCED TO COVERINGS WITH A STANDARD THICKNESS OF 1 IN.

Covering	B. T. U. Loss per sq. ft. at 160 lbs. Pr.	P. C. Heat Saved by Covering
3. Eighty-five per cent magnesia: Sectional	2.060	84.2
4. Solid cork: Sectional	2.170	83.3
5. Eighty-five per cent magnesia: Sectional	2.192	83.1
6. Laminated asbesto cork: Sectional	2.395	81.6
7. Eighty-five per cent magnesia: Sectional	2.184	83.2
8. Asbestos air cell [indented]: Sectional ["imperial"]	2.465	81.0
9. Asbestos sponge, felted: Sectional	2.683	79.4
10. Asbestos air cell [long]: Sectional	3.380	74.0
11. "Asbestocel" [radial]: Sectional	2.920	77.5
12. Asbestos air cell [long]: Sectional	3.015	76.8
13. "Standard" magnesia: Sectional	....	....
14. "Magnesian:" Sectional	....	....
15. "Remanit" [carbonized silk] wrapped	1.708	86.9
Bare pipe [from outside tests]	13.000	....

An inspection of the curves showed that before deciding upon what is the most economical thickness of covering to be used, it is first of all necessary to know how long the covering is expected to last. For example, suppose that a temporary plant is being erected which is not likely to be required for more than two years, a 1-in. covering will be the most economical. For covering guaranteed for ten years, as required by the Manhattan Railway Company, 1-in. covering would show a total cost of $53,663, whilst a 3-in. covering would show a total cost of $38,668, making a net saving of $14,995 at the end of ten years, or $1,499.50 per annum, which, capitalized at 5 per cent, represents $29,990.

From the above example it will be seen that while pipe covering is a relatively small portion of the many problems confronting the engineer, yet its scientific solution will yield rich results out of all proportion to the time required to solve it.

I would only add that there seems to be no reason for the former practice of putting on different thickness of covering on different sized pipes, excepting the mechanical difficulty of applying a very heavy covering to a small pipe. This difficulty can be overcome by putting the covering on in two separate layers, and this plan should be used on all sizes in order that the joints may be broken, as poor joints may reduce the efficiency of the best covering 6 per cent or more.

TABLE III—TOTAL EXPENSE—COST OF COVERING AND HEAT LOSS

		$10,000		$20,000		$30,000		$40,000		$50,000		$60,000	
Thickness	First Cost	Per Cent 1st Cost	Per Cent Loss	Per Cent 1st Cost	Per Cent Loss	Per Cent 1st Cost	Per Cent Loss	Per Cent 1st Cost	Per Cent Loss	Per Cent 1st Cost	Per Cent Loss	Per Cent 1st Cost	Per Cent Loss
1.25"	$5,550	55.5	44.5	27.8	72.2	18.5	81.5	13.9	86.1	11.1	88.9	9.3	90.7
2.00"	7,880	78.8	21.2	39.4	60.6	26.3	73.7	19.7	80.3	15.8	84.2	13.1	86.9
2.50"	8,660	86.6	13.4	43.3	56.7	28.9	71.1	21.7	78.3	17.3	82.7	14.4	85.6
3.00"	9,550	95.5	4.5	47.8	52.2	31.8	68.2	23.9	76.1	19.1	80.9	15.9	84.1

A specific number of square feet of pipe surface has been used in working out the total cost, but it is evident that the curves may be used to determine the most economical thickness of covering, irrespective of the total amount of surface to be covered, as long as the cost per square foot of material for different thicknesses varies in the same manner as for 85 per cent magnesia, which has been used in calculating the accompanying tables.

As the geometrical dimensions of the covering are a function of the cost of the increased thickness desired, it will generally be found that increasing the thickness of the material will increase the investment in as was shown in the curves for 85 per cent carbonate of magnesia.

Manhattan Leased by Subway Company

The activity in Manhattan stock, which has attracted so much attention during the last two weeks, is now explained by the official announcement, issued on Wednesday afternoon, that the Interborough Rapid Transit Company will lease the Manhattan on a basis of a 7 per cent dividend guarantee of the latter company's stock by the former.

The lease was authorized Wednesday at meetings of the boards of directors of both companies, the general proposition for such action being approved by both boards of directors. The details of the lease are to be worked out by the officers, under advice of counsel, and the completed document will be submitted for approval to the directors and to the stockholders. The lease will take effect on April 1, 1903, and will be for 999 years. It will cover all the franchises and property of the Manhattan Railway Company. The rental from April 1, 1903, to Jan. 1, 1906, will be the net earnings of the Manhattan Company, not exceeding 7 per cent. After Jan. 1, 1906, the rental will be 7 per cent per annum on the stock of the Manhattan Railway Company guaranteed by the Interborough Rapid Transit Company. The Manhattan Railway Company stock is to be increased at once to $55,200,000, for the purpose of completing improvements already planned; the present stockholders of the Manhattan Railway Company to have the privilege of taking the new stock pro rata at par.

Provision is to be made in the lease for the ultimate increase of Manhattan stock to the total amount of $60,000,000, including outstanding stock, and due provision is to be made for the application of the proceeds of the sale of the increased stock to the further improvement of the Manhattan property.

The Interborough Company will pay $10,000 per annum to keep up the organization of the Manhattan Company, in addition to the dividend rental which shall be paid to the stockholders, and the Manhattan stock will be stamped with a contract of the Interborough Company to this effect. The lease will provide security satisfactory to the Manhattan Company for the payment of the dividend rental.

The present capital stock of the Manhattan Railway Company is $48,000,000 and the increase of $7,200,000 to $55,200,000, therefore, represents an increase of about 16 per cent. Investors estimated that the rights to subscribe would be worth about 7. The bonded indebtedness of the Manhattan Company amounts to $39,883,000.

Statements were given out by Alfred Skitt, representing the Manhattan interests, and August Belmont for the subway owners, embodying the facts here summarized. Mr. Belmen said in part:

"It is believed that this plan, when perfected, will work out a prompt and satisfactory system of interborough transit, both lessor and lessee being thereby engaged in a common effort to stimulate, increase and develop facilities for transportation rather than—as would have been the case if the properties had remained separate—being engaged largely in the effort to divert traffic the one from the other.

"It is not intended by this arrangement that any of the plans for the development of the Interborough system shall be interrupted or departed from. In the meanwhile, however, before these extensions can be completed, the two systems will work in harmony. Nor is it intended to dispense with any additions which are desirable for the Manhattan property. The proposed authorized, but unissued, increase of capital stock of that company beyond the $55,200,000 up to $60,000,000, an important part of the plan, has been provided for to that end.

"It is impossible in any brief statement to give in detail the advantages which—as the negotiations for a lease have progressed—have appealed to those who will be practically identified with the management of the united system, but these advantages affect both economy of operation and convenience of public traffic. As I have said, however, in coming to the conclusion arrived at, it has been considered by the directors of the Interborough Company that they were not alone charged with the duty of caring for the best interests of the stockholders, but also that they carried the responsibility of the management and development of a quasi-municipal enterprise, and they have come to this decision with the conviction that they were acting for the best interests of the city and the traveling public both for the present and the future."

Further details are promised in a later statement to be issued upon the completion of details.

Equipment and Organization for Properly Handling Snow Storms*

BY J. F. CONWAY

A street railway company should begin preparations for its war with the elements while there is peace. At the close of the summer season we should go over all lines and have them carefully inspected. This inspection should include the poles, trolley wires, especially on all curves, and the roadway. All catch basins should be cleaned out, and all waterways, both the natural and the artificial, should be opened for the reception of surface water. If an extended line is to be gone over I would offer as a suggestion that all natural waterways be opened first, as they can more readily be located at this time, while the artificial ones are generally well known to the employees, whose duty it is to look after this kind of work.

Trackmen under a capable foreman should be employed to go over the lines for the purpose of inspection and preparing for the safe operation of plows. All stones that have fallen by the roadway should be removed to avoid the danger of breaking a shear or wing when a plow is running with wings out, and also to eliminate to a certain extent the liability of derailments. All high places, both in between the tracks and on the brows, should be removed and carried away.

In this connection it is a good plan to take a plow that cuts close to the rail, immediately after a rain storm in the early fall, while the ground is soft, and run it carefully over some of the suburban lines. By so doing you will remove many high places that might later give you trouble. It also helps to shape the brow so that when you run out on the first storm your plow will not give you the difficulty you otherwise might have.

Guard rails should be thoroughly inspected, so that no ends may be left to catch the nose, shear or digger and thus cause a derailment at a time when it might cost the tying up of a line. Bolted guards should be cut so that a plow or snow-scraper attached to a car could easily pass over without fear of catching and breaking. Where T-rail is used as a guard at the entrance of switches, or at protected ends of turnouts, it should be put in with the ends bent down and never left with a square end. On sections of track where there is a loam top dressing and a clay bottom, the matter of proper drainage becomes an important factor. In properly placing such a line in a safe and passable condition for the winter, it appears to me best to keep this top down below the top of the rail and provide the very best of drainage possible under the conditions. Water will get in between this top and the clay during a winter storm, and will result in no end of trouble and bother, such as the dragging of motors and gear cases, making it impossible for a plow to get the middle low enough for cars to pass over; especially is this true if the car following has a 33-in. wheel. Care should be used to protect the snow-scrapers on the cars and remove everything that would have a tendency to break or disable a scraper or hanger of the plow. No doubt many men connected with the operating of lines have difficulties to overcome in trying to get cars through when snow is drifting badly, simply because a snow-scraper hanger has been broken either by carelessness on the part of the crew backing a car before lifting the scraper, or by sudden contact with some hidden object. Small as this matter may appear in itself, it has caused many an anxious telephone call trying to locate a belated car and serious inconvenience in properly running plows at a critical period of the storm.

Proper drainage of the roadway is a matter which I think is beginning to get more attention than in years gone by, but it is a part that if well attended to will go far towards maintaining a safe and durable roadbed. City lines should be inspected to remove or replace paving that might be destructive to the equipment of the cars and plows.

Many of us can remember the old horse plows and track sanding devices of horse-car days, when it was necessary to have a man driving the plow who could handle as many horses as it was necessary to hitch on, and when it was absolutely necessary to have enough men on the plow to turn it around at the terminus of the line.

The manner of operating and the type of plow has changed so that the class of men who could successfully run a plow a few years ago would in many cases not be fitted to take out on the road the heavy and ponderous plows of the present time.

For single-track lines on suburban and interurban roads the nose plow is, in my judgment, best adapted to the work, especially where the track is located on the side of the roadway, and I prefer a shear plow for work on double track. The snow plow commonly used is, of course, the single truck, with usually as many types of trucks as there are firms that manufacture plows. It has always appeared to me a mistake on the part of the purchasers to allow this condition of affairs. It would be better if all street railway companies would standardize their snow equipment just as much as possible and avoid the necessity of carrying a large stock of duplicate parts, which certainly must prove very unsatisfactory. I am much in favor of a double truck and four-motor equipment for plows, constructed on lines that will not make them too heavy for the rail or too wide for safely passing cars waiting on sidings or on double track, when there are but 4 ft. between rails. Less trouble would be experienced with plows of this character binding in curves and riding off the rail than there is with the single-truck plow, and they would prove stronger, and better work would be accomplished. Plows of this character could be constructed so that the man operating them could be in a compartment by himself. This compartment could possibly be built out over the nose or shear so that he could look at either side of his plow and know at all times what his plow is doing, and at the same time be where he could direct those working under him. Whatever the type of plow I am of the opinion that it should be fitted with a durable and convenient type of leveler for carrying the snow away from the rail and for leveling along the streets.

It would appear that sufficient attention had not been given to the matter of developing a suitable hand or power brake for the protection of the man who has the responsibility of running plows of the various types through the streets; especially is this true before and after storms. My experience has taught that there is far more liability to accident before and after a storm than during one.

It would appear good policy for street railways to investigate the matter of equipping all plows with a power brake. The necessity for them is as apparent on city as on suburban and interurban lines. Just how they could be placed and suitably protected from the water and snow as plows are at present constructed, is a matter that would require considerable thought and study. However, I am satisfied that our master mechanics could devise some way that would be feasible should they work from the text, "Necessity is the mother of invention." Personally, I consider it a matter worthy of the thought of all men connected with the operation of a road. It is indeed a pleasure after a long and hard

* Paper read at meeting of New England Street Railway Club, Nov. 25.

storm to get to the end of the line and decide it's all over, pick up to return to the house, and hear the foremen say: "We will follow the next regular in." It is at these times that he has not the snow to hold him and he must depend on the brake to steady his plow when passing teams and timid drivers are met on the road.

Plows should be furnished with some kind of an inside gage to indicate to the man running it the distance the shear or nose is from the rail. By this method injury to the plow is less liable to occur, as the man in charge can at any time determine just how far the nose is from the rail, and thus avoid the breaking of castings, etc., by sudden contact with any hard substance. It is also important that a serviceable digger and a convenient attachment for operating it should be on all plows, for very often the success of a plow is dependent on the proper operating of a scraper or digger.

Another matter which has always appeared to me as having been at times overlooked, is the equipment of a plow with a gong of proper size and so placed as to make it convenient to operate. There are times when running through a severe, blowing and drifting storm, that much depends on a proper sounding gong. A foot gong, operated by the old-fashioned plunger or tapper is not very desirable. While it is intended to add to safety it in reality adds to the liability of an avoidable accident. I say avoidable because it appears to me that a tapper should never be operated by foot power, but should be arranged so that any man in the plow could ring the gong, provided the man at the handles, at a critical moment, should be busy looking at his shear.

Gongs should never be placed under a plow, but in front and outside. By so doing you lessen the possibility of placing it where the sound becomes smothered. Gongs operated by battery are used, and are thought by some to be very desirable, but when this is not thought advisable I suggest that a clear-sounding gong could be successfully handled with a pull-strap, conveniently placed.

Precaution and good management would appear to warrant that all plows used on suburban or interurban work be supplied with an extra trolley pole and wheel, that can be used in case of disability of either of those with which the car starts.

It is also desirable to carry on plows used on suburban and interurban lines, where there is liability of accidental derailments, two good lifting jacks. It will also prove convenient if such plows are constructed with some provision made for lifting them bodily by providing a beam in the framing or channel-bar extending outside the plow body for this purpose. What is more annoying to the men in charge than in trying to locate a place to work a jack, when a plow drops off the rail, especially in a soft or awkward place.

During a severe storm, when plows are all out, I do not advise trying to maintain a regular schedule, as many lines are limited for power at these times. It is advisable on outside lines to drop off some of the regular cars, and give the plows the benefit of good power, and free the lines of any unnecessary delay, which is often caused by trying to run the regular schedule.

Serrated wheels are used by some roads on plows and cars, and are considered by some a success. The claim is made that they crack and break the ice on the rail and give better contact. As to whether the final results are better than when using the plain wheel is a matter that appears to me debatable. As I have not had experience enough to warrant an opinion I will leave this matter to your consideration and discussion.

A plow to give the best results would appear to be one whose nose and shear can be operated and placed in position at will, and whose action does not depend upon gravity. The best type of motors for a plow is a debatable question, and I will pass that by, saying that the motor should, I think, be of sufficient capacity to carry the plow with load, and also capable of standing severe strain. We have used a number of types and have had very good success with some of them, but as to which is best for plow service is largely a matter of fancy.

All plows should be fitted with a standard coupling and draw-bar, to correspond to the equipment it is to be among, so that a plow can be hitched to any disabled or stalled car and assist it out of difficulty. It should be the aim of all systems to standardize this part of their equipment.

Previous to a storm, and, in fact, when plows are ready for the winter, they should be assigned to a particular line and a particular section of that line, as I am of the opinion that all work of this character can be better taken care of if the man assigned to a plow thoroughly understands how much he is supposed to look after, and can make a study of the line for any little defect that may be apparent to him.

A foreman should be appointed for each plow, and notified by personal conversation of what he is expected to do in regard to keeping his particular section open for the operating of cars.

It is very essential that you have confidence in your man and that he has confidence in you. When the section assigned to him to look after is known to him don't tie his hands as regards to hiring as much help as is needed to properly care for his track. It has been one of my plans to give to a foreman a time-book when he starts out on a storm, with instructions that if he finds that he should have more men on certain lines to properly care for the track, to hire them and turn the time in to me when he comes in. I also supply them with a number of metallic time checks, on which is stamped a number. When a man is hired a check is given to him. We pay no attention to names, simply pay for this number to whomever presents it. When working a gang of men of any considerable number we simply appoint a time-keeper from among the car men, who, when the men start in to work, passes along the line and takes the record of the check numbers. This is done three times a day, except in case of a large number of men cleaning out a line, when the time is checked six times a day. Time-keepers are kept busy the remainder of the time pushing the work along. In case a man is found loafing we usually speak to him once, if the man does not appear to intend to work he is immediately dropped from the gang, as he is a hindrance to the others.

Plows going out at night should always be provided with an oil headlight, especially if the plow is going on out-of-town lines. This is often found to be an important part of the equipment, in case of accidental derailment or other reasons, when it might be necessary and important for a man to be able to see ahead or under his plow.

A car replacer should be made a part of the equipment of the plow, which should also include a short piece of tram rail, which many times is of great assistance to men should the plow drop off the rail where the ground is soft.

I do not recommend that car-men be instructed to remove trolley wheels and run the car on the trolley harp during a sleet or ice storm, but many times by doing this a line can be successfully operated during bad sleet or frost ice. If this is permitted men should be thoroughly instructed in regard to the danger attached, and given positive instructions always to watch trolley closely when passing around sharp curves and over special overhead construction.

I am strongly in favor of some kind of sleet-cutting device for the trolley, that can either be put on in place of the wheel or that can readily and quickly be clamped on over the wheel. Personally, I prefer the latter, as it can more quickly be put into service and more quickly removed when the necessity for its use is past. There is something of this kind on the market, and perhaps some of the gentlemen present can give us information as to its use.

It is, I think, well and prudent to arrange on suburban lines a plan of sub-stations for supply of sand and salt for use during a storm, but stations of this character should not be drawn from except in case of necessity. It has been a custom with me to place at convenient places out on the lines barrels filled with salt and sand for this purpose, mixed in the proportion of about half and half. I do not advise the use of clear salt except in cases of switches and special work. When running plows, if it is necessary to cut the ice, a mixture of sand and salt at the ratio of two of sand to one of salt, will, unless the storm be of a very peculiar character, give the best results. When sand and salt are mixed the sand has a tendency to stick to the rail, and thus hold the salt on the rail, where it can act directly on the ice. The mixture also gives the plow better traction, as clear salt dropped through a spout or hopper does not stay on a clear rail or on a rail covered with ice, and it is wasteful if not used under the direction of practical and experienced men. It is not the amount of salt used during a storm that helps most, but the placing of that used where it will have the desired effect.

I have never had much experience in the use of snow fences, but from observation I am very much in favor of them. There seems to be quite a diversity of opinion as to what style of fence is best adapted to protect exposed points from becoming packed by drifts. A very simple and cheap fence can be constructed by putting posts into the ground at a sufficient depth to insure stability and simply construct a board fence, not less than 50 ft. from the part of the track you wish to protect. Still, a portable fence built so that it can readily be moved to any location desired, is a very convenient thing to have, and gives, I am informed by those who have used them, very good results.

Many times, when bothered by drifts that are a continual nuisance, it becomes necessary to put on men with shovels, and many times this labor amounts to but little, unless directed by someone in authority. Much labor can at times be saved if the men shovel all snow with the wind, rather than against it, as in many cases men will do. By so doing you will many times cause the drift to form on the opposite side of the street. If the drift

be a deep one and your rail is continually being buried, put your shovelers back on the drift and build up a wind-break, which will many times save you much labor and annoyance, even after the storm has stopped.

I have never had any personal experience with the rotary plow; they do not appear to me, however, as practical, safe or economical for constant use. They are, nevertheless, a very convenient apparatus for cleaning out a line when drifted badly, or when the snow becomes crusted, and with suitable motors and sufficient power it would appear an utter impossibility to stall such a plow in a snow storm. From observation, I believe rotary plows should be mounted on double trucks and equipped with four motors. Such a plow would be more satisfactory in rounding many short curves than a machine of its weight on a single truck and 7-ft. wheel base. A street railway that has many miles of suburban and interurban lines could ill afford to be without a good rotary plow among its snow equipment, for in one bad storm five men could save the company many dollars that now have to be paid out for men and shovels. On long and exposed lines, where the roadbed is sufficiently strong to hold them (for I am informed many of them weigh from 17 tons to 20 tons) they can be successfully operated, but should always be followed by the plow to wing out and cut down between rails, as some of them do not cut close enough to the rail to avoid the liability of hanging up the car following. I am told there is one good quality in a rotary plow, and that is it can fight or it can run at any time, it can advance or retreat at will, for should you find the snow getting in behind all that is necessary is to set the fan at the rear end in motion and run back. One gentleman told me he had run his rotary through a drift 127 ft. long and 7 ft. deep in seven and one-half minutes. When I mentioned that there must have been a good draught to the chimney, he honestly informed me that the funnel could be shifted at will.

In arranging your plans for winter storms you should always have the foreman's address at the office; see, too, that your car house man knows where the foreman lives. I always have my plowmen let me know if they are going out of town and if they will be back in case of storm. I also intend to know just where their house is, and also in what part of the house they sleep. This method will assist, to a great degree, when in the night it becomes necessary to call them. Having made this preparation, stand by your guns, ready to do battle with the elements. When it begins to snow get a move on quickly, put your plows out early. It is much easier to pull in plows that went out early than to pull plows out after storm has got the best of you.

If the foreman does his work and does it well, tell him so, it will have a tendency to encourage him to do even better. Never ask a man to do an impossibility, and above all never ask a man to do a thing you could not do yourself. Be firm and decided in the way you give your instructions, but do not get harsh with the men. It does not pay, and the old adage, "You can get more flies with molasses than with vinegar," will be equally true in a storm, and you are more likely to keep your lines open if your men can be made to feel that what they do is appreciated by their superintendent.

The fact that you are superintendent of the road and he is foreman of a plow makes no less a man of him, and you are in no manner his superior when man to man. The fact that you are superintendent and occupying a position of more responsibility is not of necessity evidence of lack of ability on his part; it may be that he has never had your opportunity.

During a storm, when possible to do so, get out among your plowmen, put on your fighting togs and ride a trip, encourage them by your presence, give them to understand that this work is no boy's play, but a work of necessity and emergency. Be careful to feed your men working on plows, tell them to get plenty of good food if they are where you can't get to them. Don't go home and get a hot dinner yourself and bring him a cold sandwich. Get into the game, so to speak, and if sandwich is to be his lunch let sandwich be your lunch. Experience has taught me that men notice this, and unless you are guarded they lose interest in their work.

I cannot give definite suggestions as to how to attack a storm; conditions will govern this matter to a great extent. Condition of rail and nature of storm will cause you to come to some decision, and no doubt will need no hurrying in the matter. I plan, however, at the beginning of a storm to have all special work and switch points salted first.

I do not allow the use of liquor on plow work. I know there is quite a tendency on the part of car-men to think they must have something of this kind when out in a bad, cold storm, and for this reason have always instructed my men to never allow it on the plow.

I don't know whether that Pennsylvania weather prophet has killed his goose yet and examined the breast bone for spots. He says he can tell what is in store for the winter storms, etc. Let us hope he did not find *snow*.

At the commencement of the Civil War, after Massachusetts troops had been attacked in the streets of Baltimore, and excitement was running high, and when more or less timid ones had formed a committee to wait on the President to give their advice and ask that no more troops be sent through the city, the first question the President asked was, "What, gentlemen, do you advise?" A canal was mentioned, a water trip, etc., and after listening, in a very quiet way, President Lincoln turned to the committee and said, "I thank you very much for your advice, gentlemen, but as there are no tunnels to go under Baltimore, and no railroads around it, and as the men can't jump or fly over it, I shall continue to march Massachusetts troops through the city."

Now the lesson to be derived is, don't dodge responsibility, don't try to get around it, don't attempt to dig under it, but stand on two feet, face the front and march through it. Electricity without work is harmless, it is when you give it something to do that it stings you. A small amount of snow does no harm, it's the heavy storms that we get out on and sting, and face and overcome that causes a good, big smile when it's all over.

Jim Crow Law Unconstitutional

The criminal proceeding instituted against the officers of the New Orleans Railways Company under the Jim Crow law have been dismissed, and the statute declared unconstitutional. On Nov. 19, when the case was called for trial, the attorneys for the company entered a demurrer, claiming the unconstitutionality of the act on two grounds. First, it was claimed that none but judicial officers had the right to decide whether a person was a negro, and, second, the law failed to fix the maximum penalty for a violation, having only the minimum penalty fixed in the act, which was contrary to Act 155 of the Constitution.

The objections were detailed in brief from which the following specifications are quoted:

First.—The said statute, in the first and second sections thereof, seeks to delegate to the officers of street railway companies carrying passengers in their cars in this State the power and duty of determining and declaring the races to which the various passengers belong, and (by reason of such decision) of assigning each to one of the seats set apart for the race to which he is found to belong, all of which is a violation of the provision of the Constitution vesting the judicial power of the State in a Supreme Court, in Courts of Appeals, in District Courts, in Justices of the Peace, and in such other courts as are therein provided for, and also in this regard of the express prohibition contained in Article 96 of said Constitution against conferring judicial powers, except as committing magistrates, upon any officers other than those hereinbefore mentioned, or such as may be necessary in towns and cities, for the enforcement of municipal ordinances.

Second.—The General Assembly of the State, in respect of the offenses sought to be denounced and punished by the third section of the said statute (including the specific offenses in the affidavit herein alleged against the said H. H. Pearson, Jr., which is declared to be a mere misdemeanor) has not undertaken to fix maximum and minimum penalties as required by Article 155 of the Constitution.

And for further reason why he is not required by the law of the land to answer the charge in the said affidavits specified, the said H. H. Pearson, Jr., also says that the penalties fixed in the said Section 3 of Act 64 of 1902, for violations of its provisions by officers of the railway companies are so uncertain, indefinite and indeterminate that the said section is susceptible of being carried into execution, and does not permit any satisfactory determination as to the court vested with jurisdiction for the trial of offenses against its provisions.

Judge Aucoin rendered his decision, maintaining the demurrer, and ordering the affidavits dismissed.

Assistant District-Attorney Ferguson, who was present for the State, will give notice of an appeal and the constitutionality of the new law will be finally decided from the Supreme Bench.

Forty-Sixth Meeting of the American Society of Mechanical Engineers

The forty-sixth meeting of the American Society of Mechanical Engineers will be held in New York from Dec. 2 to 5. The headquarters of the society are at No. 12 West Thirty-First Street, where professional sessions will be held on Tuesday and Friday. On Wednesday and Thursday sessions will be held in the Sturtevant House banquet room.

The convention will be opened at 8:30 p. m. on Tuesday evening, Dec. 2. As the president of the society, Edwin H. Reynolds, is unfortunately ill and not able to be present, a paper, by Sidney A. Reeve, on "A Rational Solution of the Problem of Weights and Measures," will be taken up for discussion.

The second session will be held at the Sturtevant House on Wednesday morning, Dec. 3, at 10 o'clock. Reports of council, tellers and of committees, standing and special, will be received, and action on the proposed amendments to the rules will be taken at this session, also any new or general business outside of the professional papers.

Until the hour of adjournment after the executive business has been concluded papers will be taken up as follows: "The Metric System," by F. A. Halsey; "Entropy Analysis of the Otto Cycle," by S. A. Reeve.

Wednesday afternoon and Friday afternoon are left without definite assignment.

At the third session, to be held on Wednesday evening, at 8:15 o'clock, the following papers will be considered: "Apparatus for Obtaining a Continuous Record of the Position of an Engine Governor," by J. C. Riley; "Fly-Wheel Capacity for Engine-Driven Alternators," by W. L. Slichter; "Heat Resistance the Reciprocal of Heat Conductivity," by William Kent. There will also be topical discussions on "Smoke Consumption," "Elastic Resistance," "Oil Burners," "Oil Separation from Steam," "Oil-Tempering of Steel."

The fourth session will be held on Thursday at 10 a. m. Papers will be taken up as follows: "A 44-ft. Pit Lathe," by J. M. Barnay; "Finer Screw Threads," by Charles T. Porter; "A Surveying Instrument in the Machine Shop," by C. C. Tyler; "Gift Propositions for Paying Workmen," by Frank Richards; "Deflections of Beams by Graphics," by W. Trinks.

On Thursday afternoon it has been arranged that the stations of the Interurban Street Railway Company, at Ninety-Third Street; the Manhattan Elevated Railway Company, at Seventy-Fourth Street, and the Waterside Station of the New York Edison Company, at Thirty-Eighth Street, shall be open to members, numbered badges being sufficient to secure admission to any of these plants. As soon as a suitable party is formed at any station a guide will conduct them over the plant to explain features of interest and answer questions. No fixed itinerary has been outlined, but all three stations will be open between the hours of 1:30 p. m. and 5 p. m. The Interurban Street Railway Company has very generously offered to furnish free transportation for members and guests to and between stations for this afternoon.

On Thursday evening a reception and conversazione will be given at Sherry's, Forty-Fourth Street and Fifth Avenue. Members and guests will be received by the acting president and president-elect, and dancing may be expected after the reception. It has been arranged that supper shall be served from 10 to 12 o'clock continuously, instead of having it at a definite hour at which all must be served.

The closing session will be held on Friday morning, at 10:30 o'clock. Papers will be presented as follows: "Rotary Pumps," by J. T. Wilkin; "Filing System for Office Use," by H. M. Lane; "Analysis of Commercial Value of Water Power, per Horse-Power per Annum," by A. F. Nagle; "Centrifugal Machines," by Y. B. Vida; "Oil-Testing Machine and Results," by A. Kinsbury.

Storage Battery

A new type of storage battery has been brought out by the Smith Storage Battery Company, of Binghamton, N. Y., the chief claims for which are 40 per cent decrease in weight; 30 per cent increase in compactness; 30 per cent decrease in cost and a substantial increase in efficiency. The battery is of the lead-plate type, but instead of using ordinary jars the cells are arranged in trays in which the lead plates themselves are utilized for holding the electrolyte. The gridded plates are then formed into oblong trays, pointing toward the bottom, so as to permit of nesting.

In making up one of these batteries any desired number of trays can be nested on top of each other, separators of perforated sheets of hard rubber or other suitable acid-proof material keeping the trays from contact with each other. As nested, there is sufficient space between the trays to hold the electrolyte, which is as much in contact with the bottom of the tray above it as with the inside of the one which holds it. This permits of an equal chemical action upon the upper side of one plate and the under side of the one above it.

In preparing the plates, the under side of each tray is chemically treated to become oxide, and the upper side peroxide of lead. This makes the upper side of each tray the positive side and the under one the negative side of what in other batteries would be a single cell.

By adding another tray to the nest, the potential is increased by 2 volts, the same as adding another cell to an ordinary battery. The under side of the bottom tray and the upper side of the upper one are plain, and are inactive. The voltage of any battery will accordingly be twice as much as the number of trays minus one. A battery of eleven trays will accordingly give 20 volts, being the same as an ordinary battery with ten cells. In fact, the discharge potential is 2.1 volts per cell for a good share of the time on a normal discharge.

For regular work there is no connection between the plates of the battery exceept the electrolyte, the use of "jumpers," between the plates, as in other batteries, being unnecessary. The negative terminal is connected to the top of the upper tray, positive terminal to the top of the bottom tray.

It is possible, however, to obtain any combination of series-multiple or multiple-series connections that can be obtained in any battery, by attaching terminals to as many of the trays as it is desired, and cutting in or out additional trays as the service demands. The voltage of that part of the battery used will always be practically twice as much as the difference between the numbers of the cells used. Thus, current taken from the top of the third and the bottom of the seventh trays will give 8 volts, and the potential between the upper side of the fifth and the under side of the twelfth will be 14 volts.

One of the advantages of this type of battery is its extremely low internal resistance. The discharge is at all times from the entire surface of all of the plates, and at the latter part of the discharge the current does not have to come up from the bottom part of the soldered joints or loose connections, as in other styles of batteries. For this reason the battery can be charged in a rapid or uneven manner without fear of buckling. Inasmuch as the discharge is from the entire surface of all of the plates, it makes little difference as to the length of time in which it is accomplished, or how changeable may be the demands for current.

The arrangement of the trays also results in obviating another trouble that is frequent in most styles of batteries. That is the deposit in the bottom of the jars of active material which is apt to cause a short-circuit between the plates. Such deposits usually come from the positive plate. With this battery, the positive side being up, there is no tendency for this loosening, and if it should occur, all particles which become free in this manner will lie just where they were before without danger of causing a short-circuit.

Pennsylvania Tunnel Permit Granted by New York Railroad Commissioners

The State Railroad Commissioners of New York have granted the application of the Pennsylvania, New York & Long Island Railroad Company for permission to construct a tunnel railroad in New York, for the purpose of connecting the Pennsylvania and Long Island roads. Testimony regarding the proposed new system was given by Samuel Rea, fourth vice-president of the Pennsylvania; Charles M. Jacobs, one of the engineers in the proposed work, and Charles A. Cone, a real estate broker of New York. Interesting facts were furnished by them in reference to the future operation of the system and the effect of the improvement on the conditions of business and the value of property.

Change of Control in Railways Company General

The announcement is made that control of the Railways Company General, which was organized by W. W. Gibbs in 1899, has passed from the Investment Company of Philadelphia into the hands of a group of Philadelphia and New York capitalists, headed by Evans R. Dick. Practically no change in the management will ensue. The capital of the company is $1,200,000, the par value of shares is $10, and the last recorded sales were at 4¼. Evans R. Dick continues as president and John J. Collier as secretary and treasurer. Mr. Collier is reported to have said of the change:

"The future of the company will be unaffected by the transfer. The Investment Company of Philadelphia has simply sold out its interest in the Railways Company General, consisting of 42,200 shares out of 120,000, to a syndicate of New York and Philadelphia men, headed by Evans R. Dick. It is the belief of the management that the company will be strengthened rather than weakened by the deal, the members of the purchasing syndicate being chiefly men now connected with the company."

One of the many instances that show how economies are worked in small cities where electric railways are operated is furnished in Northampton, Mass., where the city saved over $7,000 this year by transporting crushed rock for highway construction by electric cars instead of doing the work by teams.

Discussion of the Aurora, Elgin & Chicago Railway

The Chicago Electrical Association held a very largely attended meeting the evening of Nov. 21, at which Howard Brooks, assistant electrical engineer of the Aurora, Elgin & Chicago Railway Company read a paper on the electrical features of that road. The points brought out at the meeting were mainly those covered by the article in the Souvenir number of the STREET RAILWAY JOUNAL of Oct. 4, last. Some figures were given in the discussion by E. Gonzenbach, the electrical engineer of the company, regarding energy consumption of cars in actual service, which were not included in the article mentioned. It was stated that the recording wattmeter readings at the sub-stations showed a consumption of 123 kw-hours per car hour, and that the cars made a schedule speed of about 28 miles per hour, so that the energy consumption per car mile was 4.39 kw-hour. The cars make about 65 miles per hour on a level, at a maximum speed. They weigh 74,325 lbs. The current at full speed is 400 amps. Mr. Gonzenbach stated that they could be brought up to a speed of 60 miles per hour in 35 seconds, with a maximum current of 1200 amps.

Regarding the ability of the cars to make fast runs Mr. Brooks said that on one occasion a car behind time in regular service made 33.9 miles in 38 minutes, with 6 stops, or 53 miles an hour. Another time the same run was made in 42 minutes, with 7 stops.

The fluctuations in the power house load are very great. Seven cars make a good load for a 1500-kw generator.

The Twenty-Second Annual Convention of the Sherwin-Williams Company

The twenty-second annual convention of the Sherwin-Williams Company, held at Cleveland during the first week of November, was the largest and most successful in the history of the company. Each year the convention has increased in size, importance, and interest, until it is now considered by the management the chief event of the business year. By means of these annual meetings, the officials keep in close touch with the representatives, get a better insight into trade conditions, and the representatives obtain a fuller knowledge of the paint business.

The convention marked the close of the most successful of the many successful years of the Sherwin-Williams Company. It has been a year of expansion along all lines. The increase in sales has far exceeded the estimates; a linseed oil plant in which the company is crushing, treating and refining its own linseed oil, has been established at Cleveland; the plants at Chicago, Montreal and Newark have been materially enlarged; a new Southwestern division has been established at Kansas City, and the export trade has increased rapidly.

Although careful attention to business with valuable results was the feature of every session, social pleasures were not neglected. The annual banquet was held in the Cleveland Chamber of Commerce Auditorium, Friday evening. All the Cleveland employees and the visiting representatives were present, and six hundred sat down at the tables. After dinner speeches were delivered by Mr. Sherwin, Mr. Cottingham and representatives of the various divisions. The prizes for the different factory competitions were presented to the winners by President Sherwin, and souvenir badges were given to all at the banquet.

Turbo-Generators for Massachusetts Railway Plants

The Massachusetts Electric Company has recently contracted with the General Electric Company for ten 2000-kw turbo-alternators. The machines are to be used in three new generating stations, which, together with their sub-stations, will represent a capital outlay of $2,500,000. These plants are intended to increase the generating capacity of the Old Colony and Boston and Northern systems, and enable the companies to discontinue a number of small, inefficient stations. These new stations are to be located at Danversport, to serve the Boston and Northern lines, and the others at Quincy and Fall River, in the territory of the Old Colony system.

Annual Meeting of the Westinghouse District Managers

The district office managers of the Westinghouse Electric & Manufacturing Company, representing all the principal cities of the United States, spent last week in their usual annual visit to the works and offices of that company at East Pittsburgh. On the evening of Nov. 19 a very enjoyable dinner, in honor of the visitors, was given at the Duquesne Club, at which the engineers and executive officers of the company were also present.

New Equipment for Nashville

Percey Warner, receiver and general manager of the Nashville electric light and street railway system, who, during the past week, has been at the Waldorf-Astoria in New York, has completed contracts for the equipment of the electric light and street railway plants of Nashville for about $1,000,000. Contracts covering lighting and apparatus, cars, etc., were placed with the General Electric Company, J. G. Brill and other companies, and include an order for an electric locomotive. The present ownership of the Nashville system has made plans for the expenditure of $3,000,000 for extensions and betterments. It includes additional trackage, the construction of up-to-date car houses and the equipment of the entire street railway system with long double-truck cars in place of the present rolling stock, which have all been of the single, small truck variety.

Annual Meeting of the New York Railroad Club

The annual meeting of the New York Railroad Club was held at Carnegie Hall Nov. 21, and there was a good attendance. Papers were read on the subject of the discipline of employees by Messrs. Mitten, Wheatly, Strickland, Ketcham and others. Some of these papers are published in this issue, and others will appear in following issues of this paper. Officers for the ensuing year were elected as follows: President, H. H. Vreeland; first vice-president, W. W. Wheatly; second vice-president, A. M. Waitt; third vice-president, W. F. Potter; treasurer, C. A. Smith; executive members, G. W. West, W. McIntosh, H. S. Hayward; finance committee, W. B. Albright, R. M. Dixon, D. M Brady

More Increases in Wages for Street Railway Men

Following closely the announcement of increases in wages for the employees of the Philadelphia Rapid Transit Company, Syracuse Rapid Transit Railway Company and the Georgia Railway & Electric Company, comes announcements of increases in wages for the employees of the Trenton Street Railway Company, of Trenton, N. J.; Scranton Railway Company, of Scranton, Pa.; Lebanon Valley Street Railway Company, of Lebanon, Pa.; Wilkesbarre & Wyoming Valley Traction Company, of Wilkesbarre, Pa., United Traction Company, of Reading, Pa.; Chester Traction Company, of Chester, Pa.; Schuylkill Valley Traction Company, of Norristown, Pa., and the Portland Street Railway Company, of Portland, Maine.

Announcement of the increase at Trenton was made Dec. 18. It results in an advance of 5 per cent. The men are at present receiving $2 a day, under the increase will receive $2.10 a day, or 17½ cents an hour. Although announcement of the new wage schedule was not made until Nov. 18, it became operative Nov. 14. This is the fourth time the wages of the employees of the company have been increased during the last few years, the rate being increased from $1.60 a day. The last increase was given about a year ago, when the rate was increased from $1.80 a day to $2.

The increase to the employees of the Scranton Railway Company amounts to a 5 per cent advance. The new schedule, which goes into effect Dec. 1, is 18 cents an hour for the first year, 19 cents for the second year, and 20 cents for the third year and thereafter. The increase was solicited by the men, and, as a result of the conference between the company and its employees, it is said that several modifiactions in the merit system of discipline which prevails will be modified.

The wages of the employees of the United Traction Company, of Reading, are increased from 16 2-3 to 17½ cents an hour. This will mean a raise of about $37 a year in the wages of each employee, and an increase in the pay roll of the company of about $12,000 a year.

The increase on the Lebanon Valley Street Railway is from 15 cents to 16 cents an hour; that at Wilkesbarre amounts to $2 a month, but the details of the increase on the lines of the Chester Traction Company are not available. The increase for the employees of the Schuylkill Valley Traction Company affects 200 men and means an increase in the pay roll of about $7,500 annually. This advance is one cent an hour. The increase announced by the Portland Street Railway Company is 10 cents a day, fixing the rate of pay at $1.85 a day. The advance benefits 300 men.

All street cars on city and suburban electric railways in and adjacent to Salt Lake have been equipped with mail-boxes for the convenience of residents who live at a distance from the post-office.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED NOV. 18, 1902

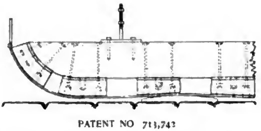
713,599. Trolley Pole; T. C. Buder, St. Louis, Mo. App. filed April 4, 1902. The harp sleeve can turn on the end of the pole when the wheel passes a curve in the wire, and in doing so it rises slightly to ease the wheel.

713,601. Rheostat; F. E. Case, Schenectady, N. Y. App. filed May 10, 1902. A series of resistance grids mounted in an open frame adapted to be secured under a car.

713,689. Brake-Shoe; W. D. Sargent, Chicago, Ill. App. filed Jan. 23, 1902. The brake-shoe is strengthened by a strengthening piece of ductile metal having a backward-outstanding flange extending longitudinally of the shoe and at one side thereof.

713,741. Means for Preventing Accidents at Railway Crossings; C. E. Brown, Johnstown, Pa. App. filed April 16, 1902. A gate at a railway crossing cannot be lifted to allow a trolley car to cross until the conductor goes to the other side of the track and operates a circuit closer.

713,742. Contact Shoe for Electric Railways; W. M. Brown, Johnstown, Pa. App. filed Nov. 30, 1901. A shoe having a flexible face permitting it to yield when passing over button contacts.



PATENT NO 713,742

713,790. Railway Track Structure; H. B. Nichols, Philadelphia, Pa. App. filed March 25, 1902. The ends of rails crossing each other at an angle are set in a metal plate, which is firmly secured in place but easily and quickly removable.

713,828. Automatic Releasing Device for Safety Trolleys; A. C. Wolfe, Denver, Col. App. filed Feb. 6, 1902. A centrifugal governor operates to release the spring from the trolley pole when the upward movment of the pole is abnormally great.

713,858. Latch for Controller Handles; F. B. Corey, Schenectady, N. Y. App. filed April 12, 1902. A mechanical arrangement for enforcing a step by step movement of a trolley handle containing a latch.

713,933. Railway Track Structure; A. Angerer, Ridley Park, Pa. App. filed July 29, 1902. Relates to means for fastening the wear-plate at the intersection of two tracks so that it may be easily removed.

714,021. Controller for Electric Motors; L. G. Nilson, New York, N. Y. App. filed May 15, 1902. Details.

714,068. Railway Track Structure; C. B. Voynow, Philadelphia, Pa. App. filed July 29, 1902. Relates to means for securing the wear-plate to the base-plate at the point where two rails cross at an angle. An extension is formed upon the wear-plate which projects into the base-plate, and a curved locking member is inserted through an opening in the wear-plate to engage said extension and base-plate.

714,076. Truck Side Frame; C. T. Westlake, Granite, Ill. App. filed May 5, 1902. The web of the frame has a bolster recess at its center, flanges extending transversely from the web at the sides of the recess to form truck columns, links pivotally mounted within said recess and a bolster connected to the lower ends of the links as required, to allow the bolster to swing endwise.

PERSONAL MENTION

MR. C. A. COFFIN, President of the General Electric Company, was elected last week a director of the United States Mortgage & Trust Company.

MR. JACOB WENDELL, JR., of Wendell & MacDuffie, sailed Nov. 25 for Europe, where the company has a large business, and where Mr. Wendell will stay until the middle of January.

MR. FREDERICK L. MERRILL, formerly of the Chicago office of the Westinghouse Electric & Manufacturing Company, has purchased an interest in the Standard Railway Materials Company, with J. H. McGill. This company has offices at Omaha Building, Chicago, and represents the R. D. Nuttall Company and the A. & J. M. Anderson Company. Mr. Merrill's experience and acquaintance as salesman in the Chicago territory make him well fitted to handle his new business well.

MESSRS. WATSON, RAVEN and CUDWORTH, engineers of the Northeastern Railway, of England, are in this country making a study of the application of electric traction to heavy railroad service. This railroad company, which is one of the main trunk lines in England, has decided to engage extensively in electric traction, and the visit of its engineers to this country is in connection with this proposed installation. Their visit is indicative of the great interest felt in electricity by the main railway lines of England, which, at present, seem to be giving more attention to the subject than the steam railroads in this country. It is predicted by some who are well acquainted with the railroad conditions of both countries that England will before long lead this country in the practical application of electricity to heavy electric railroading.

MR. S. S. NEFF has recently been engaged by W. E. Baker & Company, of New York, as superintendent of construction, operation and traffic in their various street railway enterprises. Mr. Neff has had a long and successful experience in both steam and electric railroad engineering. He was for ten years with the Pennsylvania Railroad in the maintenance and construction department, after which for four years he acted as superintendent of the Cornwall Railroad. He then accepted a position with the Great Northern Railroad as division superintendent, where he served for two years, resigning this position to build the Lake Shore & Indiana Railroad for the Cincinnati & Cleveland Iron Company and Jones & Laughlin. After the completion of this work he entered the electric railroad field as superintendent of the Union Elevated Railroad, of Chicago, with which company he remained four years. The most difficult engineering problem Mr. Neff helped to solve, however, was the construction and placing in operation of the Boston Elevated Railroad. Mr. Neff went with the company during the early period of the construction of this line, and he was superintendent of the elevated system in Boston for two years. With a man of Mr. Neff's experience and ability at the head of their construction, operation and traffic department, W. E. Baker & Company can handle any engineering problem which may present itself in the electric railway field.

MR. CHARLES C. BENSON, who for the past three and one-half years has acted as superintendent of the Citizens' Street Railway Company, of Newburyport, Mass., has left for San Juan, Porto Rico, where he will act as manager of the San Juan Light & Transit Company. Mr. Benson was born in Manchester, Me., June 4, 1866. He attended the public schools of that town and afterwards took a business college course at Augusta, Me. In 1886 he entered the employ of the West End Street Railway Company, of Boston, and in a short time became foreman of the construction gang for that company. He afterwards entered the firm of Woodbridge & Turner, contractors. After a short stay with that firm, in 1888, he entered the employ of the Thomson-Houston Company as constructing engineer, and while with the company assisted in installing street railway lines in many important cities in the United States. He was for some time in the employ of the Boston Electric Light Company, from which company he resigned to become connected with the Newburyport Street Railway Company. Bringing to this company an experience so varied he was especialy well qualified for the work of regenerating the system. Physical rehabilitation of the system took place, and the operating management was placed on a firm basis. As a token of the appreciation of the valuable services rendered by Mr. Benson the employees of the company presented him with a handsome diamond ring.

CHAS. C. BENSON

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Nov. 26, 1902.

The important development of the week in the money market is the freer offering of time money. Up to a week ago the unwillingness of bankers to lend on time contracts, especially for the shorter periods of sixty and ninety days, was widely commented upon as one of the most unfavorable features of the general financial situation. It was taken to mean that conservative institutions saw no immediate prospect of easier conditions, and were so doubtful of there being a sufficiency of funds to go around that they wished to discourage fresh borrowing as far as possible. On the contrary, when time money began to come forward in greater abundance, and even to equal the amount of the demands, it naturally encouraged the view that in conservative quarters the situation was considered to be very much improved. The basis for this opinion lies in the comparative strong position of bank resources, occasioned first by the wholesale liquidation of speculative holdings during the last few weeks, and second, by what appears to be the termination of the currency movement to the interior. Both last week and the week before the inland exchange ran slightly in favor of New York, the local banks gaining directly each time something over a million dollars. Banking authorities report that money is beginning to flow back from the West and South, while the only important movement in the other direction is that to New Orleans, where financing the sugar crop will create a demand for another month at least to come. Imports of merchandise do not slacken, and consequently the excessive customs revenue continues. But, owing to an increase in government expenditures, the Treasury is drawing less from the New York banks than it was either in October or in the early part of this month. Meanwhile sterling exchange hovers around the gold shipping point, and gold exports are still a possibility for the not distant future. The main check consists of the efforts which the Bank of England is making to prevent gold from leaving London. It has succeeded in forcing up London discounts sharply, and by this means causing an advance in sterling exchange at Paris. This advance in turn inures to the benefit of the New York market, by raising the specie export point. The indications are that while local bank reserves will decline and money rates remain around their present level from now until after the new year settlements, there will be no uncomfortable strain.

The Stock Market

The operations in the stock market during the last week have been influenced to a very large extent by the extraordinary rise in Manhattan Elevated stock. An advance of 25 points from the low price of a fortnight ago is explained by the announcement to-day of the lease of the elevated lines to the subway company. The majority of people in Wall Street had accepted the report that the road was to be leased or acquired by the new Interborough Rapid Transit or Subway Company, on a gradually ascending dividend guarantee. At the same time it was held in many well-informed quarters that if this was true it was only a part of the "deal," and that when the final disposition of the elevated lines was made it would be in a manner both satisfactory and profitable to the New York Central Railroad. There are also strong intimations that a substantial addition to Manhattan's capital will shortly be announced, and that the subscription rights to the new issue will be of sufficient value to account, to a considerable extent, for the recent advance in market quotations. Beyond question the present supply of Manhattan stock in the market is exceedingly limited, and the rise in the stock so far from resulting in a distribution has seemingly left holdings even more concentrated than they were before. The other traction stocks have quite naturally been favorites in speculative circles, but that their rise is anything more than sympathetic may well be doubted. In Brooklyn Rapid Transit and Metropolitan the supply of floating stock is hardly less limited than in Manhattan.

The recovery in the general market has proceeded with great rapidity, showing not only that the previous liquidation was very thorough, but also that a short interest of large dimensions was built up, which had to beat a precipitate retreat. Aside from the "traction deal" the important influences in the rise have been the easing of time money, and the widespread advance in freight rates inaugurated throughout the country. This latter development relieves the fears occasioned by the recent more or less compulsory raising of wages to the railroad employees, and its significance for the situation both immediate and future can scarcely be overestimated. The probabilities are that some reaction will succeed so sharp an upturn in prices, and, indeed, during the last few days a reaction of this sort has already appeared in numerous quarters. But confidence, which was severely shaken in the early part of the month, has now been restored, and the financial outlook, as a whole, is regarded more hopefully than for a long time past.

Philadelphia

The local traction stocks in Philadelphia have been left to follow the course of the general speculation during the week, without any particular efforts to accelerate the advance. This is shown by the exceptionally small volume of transactions which have averaged only a few hundred a day. It is worthy of favorable comment, therefore, that the principal stocks have gone up as easily as they have. Philadelphia Rapid Transit rose a point to 17¼, and Union Traction moved forward from 46⅞ to 47¼. Philadelphia Traction is unchanged at 98, and scarcely anything has been done in American Railways, which has merely held steady around 53¾. Railways Company General was firmer at an advance from 4¾ to 5, and thirty shares of Fairmount Park Transportation were reported at 25. Bond sales for the week included Electric People's Traction 4s at 98½, United Railways 4s at an advance from 88¼ to 90, Consolidated Traction of New Jersey 5s at 110, and Union Traction of Indiana 5s at 100¾.

Chicago

Only scattering sales are to be noted in the Chicago traction share market this week. Three hundred Northwestern Elevated common sold at 33, which is a recovery of 1½ per cent from the recent low point. The increase in the daily average traffic on this system during November is said to be some 17 per cent over last year. A few lots of Metropolitan Elevated common changed hands at 38, and of the preferred between 85 and 87. South Side sold at 107, and Lake Street at 9¼. Chicago City Railway in odd lots brought 210, but nothing has been done in Union Traction. There are no new developments regarding the reported merger of these two properties, but the feeling in financial circles is growing that a deal of some sort under the serveillance of Mr. J. P. Morgan is under way.

Other Traction Securities

Boston stocks have, as a rule, sympathized with the improvement in general market conditions during the week. Boston Elevated sold up to 156, later reacting to 154. Massachusetts Electric common rose a point and a half to 37¼, later losing the greater part of the gain. West End common sold at 94¾ and 95, and the preferred at 113½. No business worth mentioning, however, was done in any of these issues. Transactions in the Baltimore market have also been very light throughout the week. Nashville Railway stock, which recently went up as high as 6½, dropped to 3½. There were no dealings in the 5 per cent certificates. United Railway of Baltimore issues have held exceptionally firm, the income bonds particularly rising a point to 69. The general mortgage 4s sold up fractionally to 95, and the stock to 14, later receding to 13¾. The only other traction sales in Baltimore were Newport News and Old Point Comfort 5s at 107½, and Anacostia and Potomac 5s at 99. The complete record of transactions on the New York curb since last Wednesday morning is as follows: Brooklyn City Railroad at 247 and afterwards at 245½, Washington Traction (100 shares) at 16, the preferred at 45, American Elevated at 1, North Jersey Traction (10 shares) at 30, New Orleans common at 14⅞ to 15, the preferred at 48 to 49, the 4½ per cent bonds at 79¼ to 79, and Interborough Rapid Transit, the full paid stock rising violently from 104 to 123, while the stock on which 40 per cent has been paid, started at 107 and rose to 123. This movement is, of course, associated with the advance in Manhattan Elevated on the Stock Exchange.

Iron and Steel

It is now feared by authorities in the iron trade that the scarcity of fuel will continue throughout the winter months, and that it will continue to restrict, as it is now doing, the output of pig iron and steel. Buyers of pig iron who held off, expecting an easier situation after the ending of the coal strike, have come into the market as eager bidders, and it will require the utmost exertion of the conservative trade interests to hold prices in check. The trouble lies altogether with the freight congestion, which renders the railroads absolutely unable to handle the business offering to them. Demand for steel rails is reported to be, if anything, heavier than before. Quotations are as follows: Bessemer pig iron, $21.75 and $22.00; steel billets, $30.00 and $31.50; steel rails, $28.00.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Nov. 18	Closing Bid Nov. 25
American Railways Company	53	53½
Aurora, Elgin & Chicago	a37	32
Boston Elevated	155	154
Brooklyn R. T.	58¼	61¼
Chicago City	210	211
Chicago Union Tr. (common)	15	15
Chicago Union Tr. (preferred)	45	45
Cleveland Electric	84	88
Columbus (comomn)	58½	58½
Columbus (preferred)	106	106
Consolidated Traction of N. J.	69	69¼
Consolidated Traction of N. J. 5s	110¼	110½
Detroit United	86	b95
Electric People's Traction (Philadelphia) 4s	98¼	98⅜
Elgin, Aurora & Southern	a51	57
Indianapolis Street Railway 4s	86½	—
Lake Shore Electric	12	12½
Lake Street Elevated	9	9
Manhattan Railway	142	153⅞
Massachusetts Elec. Cos. (common)	35¾	36
Massachusetts Elec. Cos. (preferred)	96	96½
Metropolitan Elevated, Chicago (common)	36	37
Metropolitan Elevated, Chicago (preferred)	85	85
Metropolitan Street	137	139
New Orleans Railways (common)	14¾	15
New Orleans Railways (preferred)	48	48½
North American	119	118½
Northern Ohio Traction (common)	a67	—
Northern Ohio Traction (preferred)	92½	—
North Jersey	32¾	31
Northwestern Elevated, Chicago (common)	31½	32½
Philadelphia Rapid Transit	16¾	17
Philadelphia Traction	98	98
St. Louis Transit (common)	28	28
South Side Elevated (Chicago)	105	107
Syracuse Rapid Transit	31	30¾
Syracuse Rapid Transit (preferred)	76	76
Third Avenue	123	126
Toledo Railway & Light	30	b37
Twin City, Minneapolis (common)	114	116
United Railways, St. Louis (preferred)	—	—
United Railways, St. Louis, 4s	84¾	84⅝
Union Traction (Philadelphia)	46½	46⅝
Western Ohio Railway	26	27

a Asked. b Last sale.

Metals

Quotations for the leading metals are as follows: Copper, lake, 11⅜ and 11½ cents; lead, 4⅛ cents; tin, $25.90; spelter, $5.35.

HAVERHILL, MASS.—The Railroad Commissioners hava approved an issue by the Haverhill & Andover Street Railway Company of shares of capital stock amounting at par value to $80,000. This issue is authorized to provide for paying in part floating indebtedness incurred by the company in the construction and equipment of its lines.

DANVERS, MASS.—The Railroad Commissioners have approved an issue by the Middleton & Danvers Street Railway Company of capital stock amounting at par value to $32,000. The issue is authorized to provide for paying in part floating indebtedness incurred by the company in constructing its lines.

WORCESTER, MASS.—The stockholders of the Boston & Worcester Street Railway Company voted to increase the capital stock of the company from $750,000 to $1,000,000.

MILFORD, MASS.—The Railroad Commissioners have been petitioned by the Milford & Uxbridge Street Railway Company for authority to issue additional bonds to the amount of $225,000 for the purpose of paying its floating indebtedness and for additional equipment.

BOSTON, MASS.—The Railroad Commissioners bave approved an issue of $60,000 original capital stock by the Reading, Wakefield & Lynnfield Street Railway Company; $32,000 original capital by the Middleton & Danvers Street Railway Company, and $80,000 original capital by the Haverhill & Andover Street Railway Company.

BOSTON, MASS.—The Boston *News Bureau* says it is understood that the general results of the Boston Elevated Railway Company for the year ended Sept. 30 are not quite as satisfactory as those of previous years in that the normal increase in earnings was not maintained.

WEBB CITY, MO.—The deal for the purchase of the Southwest Missouri Electric Railway by Stone & Webster, of Boston, has been declared off.

EDGEWATER, N. J.—It is reported that the New Jersey & Hudson River Railway & Ferry Company has secured control of the Newark & Hackensack Traction Company.

SYRACUSE, N. Y.—It is stated that the recently formed Syracuse & Ontario Railway Company is negotiating for the purchase of the property of the Oswego Traction Company.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company reports earnings as follows:

October	1902	1901
Gross receipts	$304,216	$270,953
Operating expenses	140,225	118,061
Earnings from operation	$164,091	$152,890
Fixed charges	77,733	75,664
Net earnings	$86,358	$77,235
Ten months		
Gross receipts	$2,971,411	$2,611,117
Operating expenses	1,331,645	1,186,901
Net earnings	$1,639,866	$1,424,216
Fixed charges	765,966	736,437
Net earnings	$873,900	$687,779

SYRACUSE, N. Y.—The Syracuse Rapid Transit Railway Company reports earnings as follows:

Quarter ended Sept. 30	1902	1901
Gross receipts	$182,741	$166,796
Operating expenses	101,224	91,525
Earnings from operation	$81,517	$75,271
Receipts from other sources	1,572	1,572
Gross income	$83,089	$76,843
Fixed charges	57,075	57,021
Net earnings	$26,014	$19,822

SYRACUSE, N. Y.—There has been filed for record a mortgage in favor of the City Trust Company, of New York, trustees, given by the Auburn & Syracose Electric Railroad Company for $2,000,000, to secure a bond issue. Over $1,000,000 of the bonds have been placed with N. W. Harris & Company, of New York.

DELAWARE, OHIO.—The Delaware, Berkshire & Sunbury Electric Railway Company, which plans to build an electric railway from Delaware to Sonbury, has issued bonds to the amount of $150,000, secured by a mortgage.

DAYTON, OHIO.—It is reported here that the syndicate headed by A. E. Appleyard, of Boston, is negotiating for the purchase of the Springfield Street Railway, of Springfield, and the People's Railway Company, of Dayton. The Appleyard lines operate over the tracks of both companies in the respective cities.

TOLEDO, OHIO.—It is stated that within two weeks title to the Detroit & Toledo Shore Line Railway will be vested in the Grand Trunk Railway. The Grand Trunk Railway will pay $1,500,000 for the property, which consists for the most part of a double-track line extending from Toledo to Trenton, Mich. To cover the extension of its lines into Ohio territory the Grand Trunk will issue $2,000,000 in bonds, paying for the completed portion of the shore line the amount stated, and utilizing the remaining $500,000 to extend the road north from Trenton to Detroit and to reballast the completed portion.

PITTSBURGH, PA.—The Philadelphia Company reports earnings as follows:

October	1902	1901
Gross earnings	$1,146,297	$1,019,527
Operating expenses and taxes	654,258	562,202
Net earnings	$492,039	$457,325
Other income	125,354	32,025
Total income	$617,393	$489,350
Deductions	115,269	43,587
Balance	$502,124	$445,763
Fixed charges	330,767	265,845
Surplus	$171,357	$179,918
From Jan. 1 to Oct. 30		
Gross earnings	$11,256,273	$9,911,059
Operting expenses and taxes	6,380,066	5,407,596
Net earnings	$4,875,207	$4,503,454
Other income	1,354,701	436,948
Total income	$6,229,908	$4,940,194
Deductions	921,746	373,589
Balance	$5,308,162	$4,566,606
Fixed charges	3,366,617	2,648,569
Sorplus	$1,941,545	$1,918,036

PHILADELPHIA, PA.—The stockholders of the Philadelphia & West Chester Traction Company will vote Jan. 12, 1903, on a proposition to make a new mortgage to secure $600,000 of 4 per cent $1,000 fifty-year coupon bonds, interest payable Jan. 1 and July 1. They will be put aside of the new bonds, soch as will be necessary to retire the existing $400,000 first mortgage 5 per cent bonds of 1898, which are subject to call at 105.

SPOKANE, WASH.—Control of the Spokane & Montrose Motor Railroad has pased into the hands of J. P. Graves, of Spokane.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition. *b* All capital stock owned by Detroit United Ry.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Oct. '02	65,687	36,333	29,291	12,601	16,692
	1 " " '01	51,479	28,709	22,710	12,438	10,272
	6 " June '02	318,957	185,902	133,575	77,556	56,019
	6 " " '01	268,967	164,458	104,510	63,491	41,016
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,782	*317,476	196,216	111,133	58,117
ALBANY, N. Y.						
United Traction Co.	1 m., Sept. '02	132,600	81,990	50,616	23,860	26,756
	3 " " '02	114,645	251,730	162,897	71,598	91,299
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Oct. '02	17,107	10,084	6,811	......	
	1 " " '01	16,884	9,261	7,391	......	
	1 " " '02	82,930	44,875	37,085	......	......
	1 " " '01	80,044	60,777	20,727	......	
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,969,496	7,336,597	3,582,899	2,896,329	698,510
	12 " " '00	10,435,994	6,928,110	3,506,884	2,982,839	476,006
Massachusetts Elec. Cos.	12 m., Sept. '01	5,778,151	3,915,496	1,862,648	937,206	925,412
	12 " " '00	5,518,857	3,659,356	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., Sept. '02	1,124,984	607,581	616,402	......	......
	1 " " '01	1,080,159	664,611	415,548	......	......
	3 " " '02	3,587,779	1,881,118	1,705,965	......	......
	3 " " '01	3,411,106	2,032,245	1,378,852	......	......
	12 " June '02	12,780,508	*8432214	4,347,186	......	......
	12 " " '01	12,101,198	*7970635	4,130,563	......	......
BUFFALO, N. Y.						
International Tr. Co.	1 m., Sept. '02	321,355	171,525	150,831	77,502	82,329
	1 " " '01	255,322	106,934	146,988	81,931	61,057
	3 " " '02	1,010,518	506,664	512,854	235,741	277,113
	3 " " '01	791,450	311,745	410,725	245,793	250,932
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., Oct. '02	40,735	27,240	13,494	13,469	25
	1 " " '01	39,180	24,702	11,478	13,842	611
	8 " " '02	430,003	256,992	182,045	108,082	73,961
	8 " " '01	324,180	211,870	112,290	110,049	2,201
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Oct. '02	15,731	6,548	9,183	......	......
	1 " " '01	15,254	6,312	8,941	......	......
	10 " " '02	163,139	60,405	93,743	......	......
	10 " " '01	117,112	63,430	54,582	......	......
CLEVELAND, O.						
Eastern Ohio Traction Co.	1 m., Oct. '02	17,386	10,142	7,234	6,098	1,140
	10 " " '02	161,071	89,663	71,408	51,574	19,864
Cleveland, Elyria & Western	1 m., Oct. '02	28,245	16,030	12,215	......	......
	1 " " '01	22,736	12,611	10,124	......	......
	10 " " '02	249,211	138,081	110,130	......	......
	10 " " '01	208,759	113,870	95,540	......	......
	12 " Dec. '01	249,290	136,995	112,494	57,058	55,371
	12 " " '00	179,608	102,821	77,904	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Oct. '02	16,213	9,655	6,558	......	......
	1 " " '01	15,640	8,288	7,361	......	......
	10 " " '02	160,657	86,630	74,027	......	......
	10 " " '01	139,824	71,801	68,022	......	......
	12 " Dec. '01	161,161	*85,102	77,969	72,500	5,950
	12 " " '00	141,112	*69,582	71,530	72,500	†980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.				12,825	22,558	20,385
	1 m., Aug. '02	96,118	*53,290	28,794	15,807	12,927
	1 " " '01	74,525	*45,741	252,130	115,230	100,969
	8 " " '02	591,156	*311,027	209,169	125,328	82,841
	8 " " '01	535,784	*327,615			
DETROIT, MICH.						
Detroit United Ry.	1 m., Oct. '02	302,368	171,367	130,053	......	......
	1 " " '01	267,081	153,504	113,577	......	......
	10 " " '02	2,886,[illegible]	1,623,824	1,257,290	......	......
	10 " " '01	2,412,921	1,382,306	1,190,557	......	......
	12 " Dec. '01	2,919,171	*1530762	1,382,010	652,277	679,129
	12 " " '00	2,575,277	*1439069	1,136,219	616,409	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Oct. '02	34,920	21,269	13,600	......	......
	1 " " '01	31,449	19,710	12,281	......	......
	4 " " '02	175,523	96,110	77,[illegible]	......	......
	4 " " '01	156,850	81,900	75,[illegible]	......	......
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Oct. '02	46,585	26,254	20,331	9,590	10,742
	1 " " '01	39,674	22,523	16,156	9,181	6,975
	10 " " '02	443,845	233,288	209,597	96,411	113,186
	10 " " '01	373,946	204,074	169,872	91,559	78,313
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Oct. '02	33,648	21,041	12,607	8,833	4,374
	1 " " '01	29,576	16,961	11,614	8,333	3,290
	10 " " '02	341,880	200,145	141,735	83,833	58,301
	10 " " '01	304,144	170,289	133,856	83,333	0,523
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction *a*	1 m., Aug. '02	24,340	12,033	12,307	......	......
	1 " " '01	16,849	9,025	7,821	......	......
	6 " June '02	111,972	60,838	51,134	......	......
	6 " " '01	80,340	61,464	28,876	......	......
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Oct. '02	41,747	22,648	19,099	16,512	2,587
	5 " " '02	288,249	115,854	112,395	81,753	30,642
LONDON, ONT.						
London St. Ry. Co.	1 m., Oct. '02	11,645	7,408	4,237	1,911	2,326
	1 " " '01	10,105	6,856	3,749	1,957	1,792
	10 " " '02	127,317	78,230	49,086	22,195	26,891
	10 " " '01	116,814	72,274	44,539	19,800	24,739
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Oct. '02	239,858	114,902	124,951	67,814	57,137
	1 " " '01	206,812	99,249	107,563	63,409	44,154
	10 " " '02	2,254,794	1,081,410	1,173,383	664,625	508,758
	10 " " '01	1,992,000	977,529	1,014,471	641,810	389,661
	12 " Dec. '01	2,442,342	1,185,881	1,256,460	755,180	501,660
	12 " " '00	2,220,698	1,129,787	1,090,911	804,865	286,047
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Oct. '02	304,317	140,226	164,091	60,233	103,857
	1 " " '01	270,962	118,054	152,908	58,167	94,734
	10 " " '02	2,971,411	1,331,846	1,639,566	590,967	1,048,599
	10 " " '01	2,611,118	1,186,907	1,424,216	561,437	862,778
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Oct. '02	181,408	96,415	84,996	15,962	68,995
	1 " " '01	166,071	86,210	80,850	15,884	65,466
	12 m., Sept. '02	2,046,239	1,135,176	911,062	......	......
	12 " " '01	1,900,686	1,105,287	795,418	......	......
NEW YORK CITY.						
Manhattan Ry. Co.	12 m., Sept. '02	11,588,546	5,545,395	6,039,151	2,712,069	3,326,082
	12 " " '01	10,455,872	5,328,649	5,127,223	2,683,192	2,444,031
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,738,972	2,148,964	1,151,140	992,824
	3 " " '00	3,798,090	1,699,649	2,098,381	1,139,467	947,914
	12 " June '02	15,866,641	7,385,893	8,480,758	4,815,421	3,665,337
	12 " " '01	14,720,706	6,755,131	7,965,636	4,534,009	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	3 m., Sept. '02	16,401	6,135	10,266	4,008	6,258
	3 " " '01	16,372	6,867	9,495	4,200	5,295
	12 m., June '02	56,065	29,118	26,947	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,036
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co.	1 m., Oct. '02	9,027	5,706	3,317	2,083	1,234
	1 " " '02	37,696	21,586	16,110	8,433	7,777
	12 " June '02	60,795	*30,392	30,403	23,126	7,277
PHILADELPHIA, PA.						
Union Traction Co.	12 m., June '02	14,118,158	6,402,238	7,716,920	*6637781	1,078,088
	12 " " '01	13,431,651	5,886,186	7,545,494	*6734329	861,806
American Railways	1 m., Oct. '02	95,673	......	......	......	......
	1 " " '01	82,190	......	......	......	......
	1 " " '02	449,068	......	......	......	......
	1 " " '01	345,182	......	......	......	......
	12 " June '02	1,009,549	......	......	......	......
	12 " " '01	841,296	......	......	......	......
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Sept. '02	93,702	46,063	47,639	24,533	22,866
	1 " " '01	82,428	45,854	36,578	24,949	11,692
	9 " " '02	881,852	483,691	398,161	233,361	164,800
	9 " " '01	758,110	449,852	308,558	242,018	66,540
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Sept. '02	61,164	33,545	27,619	19,065	8,304
	1 " " '01	53,392	29,098	24,300	19,025	5,275
	3 " " '02	184,214	101,224	83,090	57,075	26,015
	3 " " '01	168,388	91,536	76,842	57,081	19,761
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Oct. '02	124,498	60,494	64,004	38,833	25,171
	1 " " '01	114,068	54,617	60,050	37,818	22,237
	10 " " '02	1,198,349	607,079	596,474	391,641	204,833
	10 " " '01	1,073,766	515,302	558,264	339,543	218,721
	12 " Dec. '01	1,311,084	*636,407	674,677	415,169	259,509
	12 " " '00	1,182,517	*616,945	565,572	409,051	156,521
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,270	133,288	53,982	......	......
NEW BRIGHTON, S. I.						
Staten Island Elec. Ry.	8 m., June '02	56,638	35,622	21,016	25,000	†3,984
	8 " " '01	56,936	36,600	20,336	25,000	†4,663
YOUNGSTOWN, O.						
Youngstown-Sharon Ry. & Lt. Co.	1 m., Sept. '02	39,618	*22,401	17,217	......	......
	8 " " '02	114,528	*63,040	51,488	......	......
	6 " June '02	198,050	*110,391	87,659	......	......

Street Railway Journal

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THE WORCESTER & SOUTHBRIDGE STREET RAILWAY

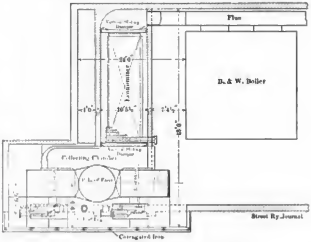
For several years Worcester has been the most active center of street railway construction in the Eastern States. The amalgamation of nearly all the lines in and about the city into the Worcester Consolidated Street Railway Company gave the opportunity to increase greatly the facilities for local traffic and improved the suburban and interurban service of many of the roads brought under the control of the general management; yet, in spite of the fact that the Consolidated operated a large number of lines extending to adjoining towns, there were left many routes which offered tempting inducements to the promoters of interurban railway enterprises. The most recent of these, the Boston & Worcester, was described in these pages two months ago. Another road which was opened this year, and which has just closed a most successful summer season, is that operated by the Worcester & Southbridge Street Railway Company, and forming the subject of this article.

Massachusetts has been conservative in the matter of its street railways, as in other things, and the managements of its two principal systems, the Boston Elevated and Worcester Consolidated, have adhered to simple direct-current distribution. The necessities of the newer roads, however, have prevented this policy from being made general throughout the State, and some of the finest examples of high-tension distribution work for long railways are now to be found there. Second to none in excellence of construction and operation is the Worcester &

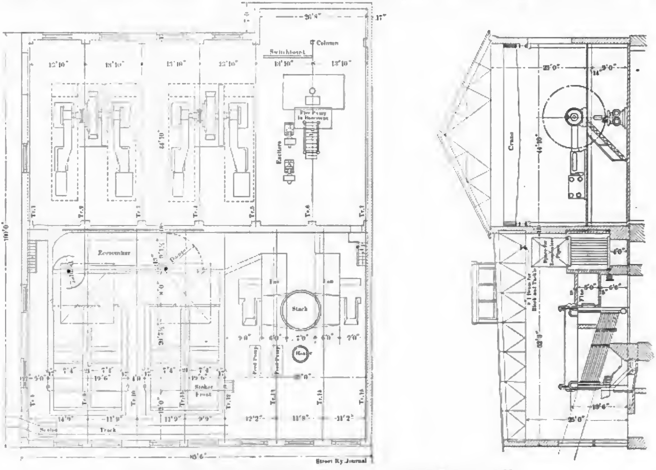
ENGINE ROOM IN CHARLTON POWER HOUSE

Southbridge. This road runs from Worcester to Southbridge, a distance of about 20 miles, owns more than half its right of way, and controls the Southbridge & Sturbridge Street Railway Company, over whose tracks it has entrance to the center of Southbridge. It also controls the Worcester, Rockdale & Charlton Depot Street Railway Company, the connecting link between the Auburn & Worcester line and the tracks of the Worcester Consolidated, and by arrangement with the latter road can bring its cars directly to the City Hall Square, the heart of all the radiating lines. The following towns act as feeders: Southbridge, Sturbridge, Brimfield, Wales, Charlton, Brookfield, Oxford, Webster, Dudley, Leicester, Auburn and Worcester.

POWER HOUSE AT CHARLTON, MASS



ECONOMIZER AND MECHANICAL DRAFT

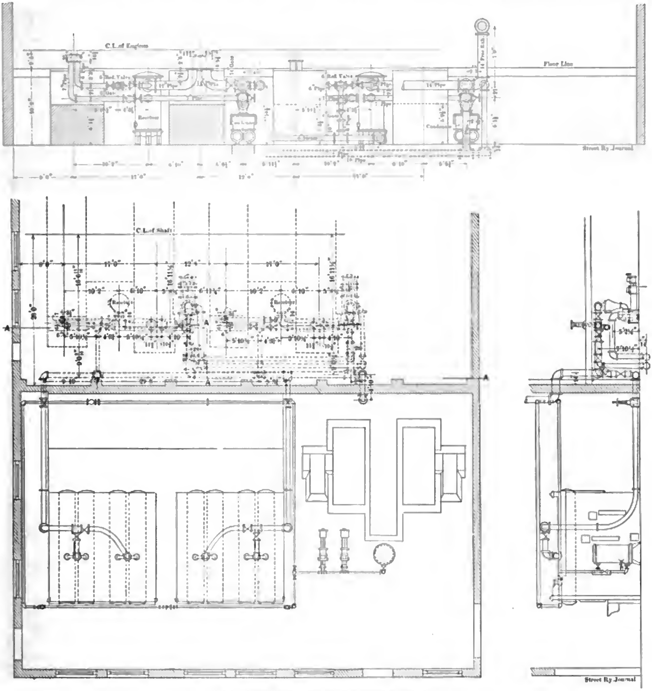


PLAN AND SECTIONAL VIEW OF POWER HOUSE AT CHARLTON CITY, MASS.

The prospects are very bright for the extension of the road and the building of branches. Already material is on the ground for the building of a branch from North Oxford to Rockdale and Leicester. The capacity of the power station is ample to accommodate much larger loads than is at present required of it, but should an increase be necessary the building can readily be enlarged and one or more additional generators be installed. The transmission is at 11,000 volts, so that the line might be considerably lengthened without changing the type of central station or sub-station equipment. That such extension will be made in the near future in the direction of Hartford is practically assured, and, when completed, this system will provide a direct and almost straight line from Worcester to Hartford, a distance of about 62 miles.

The 20 miles of road already completed run through a

magnificent New England country, with fine scenery throughout the entire distance. The service which has been provided has made this route a most enjoyable pleasure and excursion run for summer trips, but the arrangement of the closed cars is such that even in the colder weather there will probably be much pleasure riding. A half-hour schedule is at present in operation, and the service is such that, although a single-track road, there is little trouble in keeping the runs up to the time-table and preventing delays at the turnout.



PLAN AND ELEVATION FOR STEAM PIPING

POWER STATION

The power station, which supplies the entire line, is at Charlton City, a little more than half way between Worcester and Southbridge. The site is on an old water privilege, which allows ample water for condensation for the present plant, with sufficient surplus for supplying a duplication of the apparatus now installed should occasion require such enlargement. This water is excellent for boiler feeding purposes as well.

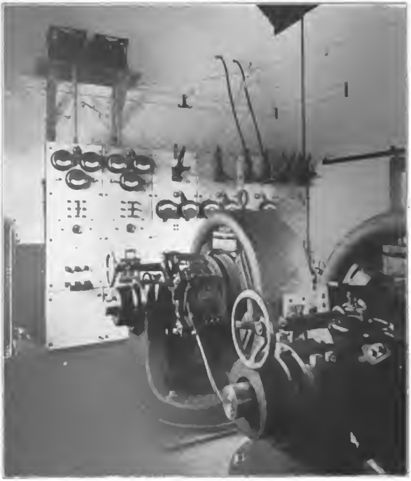
The building is a handsome brick structure with granite and terra-cotta trimmings, and is located on the banks of the stream supplying the condensing water. It has 85 ft. 8 ins. frontage by 100 ft. deep, and is subdivided by a brick wall into an engine room 44 ft. 6 ins. deep, and a boiler room. Under the floor of the engine room is a basement 9 ft. high, which is well lighted and contains the condensers, fire pumps, large transformers, some of the heavier rheostats, oil room, etc. The engine room is 23 ft. high at the sides and 45 ft. to the peak of the roof. At the end of the engine room is a shipping platform and large doors, while the entrance for ordinary usage is at the front. At the side of this entrance the front wall projects out considerably, giving accommodation for the high-tension switchboards.

ONE OF THE SUB-STATIONS.

The building has damp-proof granite underpinning extending entirely around it. The roofs are made of fire-proof material, terra-cotta slabs supported on steel trusses and evened off with cement to receive black slate for the pitched roof, and tar and gravel on the level portions. The boiler room is ventilated by two deck houses on the roof immediately above the boilers, each 12 ft. square, and fitted with pivoted sash, while sufficient ventilation is given to the engine room by the large windows extending up into the peak of the roof at the gable ends. The floor of the basement under the engine room and that of the boiler room are made of concrete cement. The engine room floor is constructed of masonry arches supported by steel girders, and consists of crushed stone and Portland cement concrete. All foundations for engines and generators are laid up in solid brick work in Portland cement mortar and thoroughly grouted in liquid Portland cement. All visible masonry, including settings for fans, pumps, condensers, etc., and all ceilings, are coated with water fire-proof paint.

The boiler equipment consists of four 300-hp water-tube boilers made by the Babcock & Wilcox Company, arranged in two batteries of two boilers each. The safe working pressure for these boilers is 160 lbs. Roney mechancial stokers, operated by Westinghouse engines, are attached to each boiler. Induced draft is supplied by two engine-driven, direct-connected fans, placed at the base of the stack. This stack extends a few feet only above the roof, the mechanical draft being depended upon at all times. As each fan is large enough to operate a plant of twice the size of the one now installed, no difficulty from lack of draft is possible even should one of them become entirely disabled. Above the boilers are placed economizers made by the Green Fuel Economizer Company. The mechanical scrapers for keeping the tubes of these economizers in a clean condition are operated by shafting belted to the fan engines at the base of the stack. The feed-water is passed through a National feed-water heater supplied with steam from the auxiliaries, and is raised to a temperature of about 290 degs. F. before entering the boilers. Two Dean feed pumps, either of which is large enough to supply the four boilers, are installed. Between the engine room and the boilers is the Holly steam loop and gravity return system, which returns all water of condensation to the boilers, the steam jackets with which both the high-pressure and low-pressure cylinders of the engines are fitted being connected thereto.

Behind the boiler house is a well, from which ample condensing water can always be obtained, as it is supplied from the creek before mentioned. The coal pockets are also behind the building. Tracks, turntables, cars, etc., furnished by the C. W. Hunt Company, of New York, are laid so as to facilitate the handling of coal, and a weighing scale is placed at the entrance to the boiler room. The piping, which, like the rest of the plant, was designed by Westinghouse, Church, Kerr & Company, of New York, is of extra heavy pipe. No elbows are used, the pipes being bent. The pipe covering was furnished by the H. W. Johns-Manville Company, of New York. The piping between the boilers and engines is placed under the engine room floor. In the spaces between the machinery foundations are placed two Worthington jet condensers. These run at a speed of from 19 r. p. m. to 22 r. p. m., and their dimensions are 8-in. x 12-in. x 14-in. x 10-in. stroke.



ROTARY CONVERTER IN SUB-STATION

The two engines are of the cross-compound type, 16-in.

and 32-in. by 42-in. stroke. They represent the latest form of the well-known Rice & Sargent design, and were built by the Providence Engineering Works. Both high-pressure and low-pressure cylinders are jacketed with live steam, and between the two cylinders, underneath the floor, is a superheating receiver. The rated capacity of each engine is 600 hp. Wright governors are used, and the Monarch engine stop has been installed on the engine throttles and on the condensers.

The generators are double-current machines with both the direct-current commutator and alternating collector rings at the same end of the armature. They have a capacity of 400 kw each, and the entire load can be taken from the machine as either direct current or alternating current. This is a great advantage in a railway system of this type, as the traffic at times is extremely heavy near the end of the road, while at others it is quite evenly distributed throughout the entire length. The direct-current voltage is 550 volts, the alternations are 3000 per minute, and the speed 115 r. p. m. The generators are separately excited, but have a compound winding from the direct-current side. On account of the alternating-current regulation they are not over compounded. Arrangements are made at the switchboard so that the shunt winding can be excited from the direct-current side of the machine if desirable, but in general the induction-motor exciter sets are used on the field.

The generators are separately excited by two direct-connected motor-driven exciters. The motors are Westinghouse Type C induction motors, 20 hp, 335 volts and 720 r. p. m. They take current directly from the alternating end of the double-current generators without transformation. In starting, the "auto-starter" is used. This consists of a resistance box on which is placed a double-throw switch. In one position the right connections and combinations of resistance are made for starting the induction motor, and when up to speed it is put directly into circuit by throwing over the switch. The motors are connected by a flexible coupling to 550-volt direct-connected generators of 15-kw capacity. Either one of the exciter sets can furnish enough current for both generators.

The transformers which convert the generator current at 335 volts to the line current at 11,000 volts are placed in the basement. The floor above them is open, so that at all times they are ready for inspection. There are three transformers of 200 kw each and of the oil-cooled type.

The switchboard apparatus is all of Westinghouse standard make. The low-tension board, containing the 550-volt trolley current and the 335-volt alternating current from the generators, sets out into the room, leaving considerable space behind it. This space is increased by the extension forward of the front wall, and a roomy alcove is made for the high-tension apparatus. The low-tension board and a high wire fence at each end prevent access to this part of the station. There are seven panels of blue Vermont marble on the low-tension board, three being used for alternating current and four for direct current. Alternating current is used for lighting the power station and car house, auxiliary switchboards being placed in both buildings for this purpose. A storage battery is provided, and, by means of throw-over switches on the lighting boards, the circuits can be connected to this source of current when the plant is shut down.

There is a traveling crane running the entire length of the engine room. This crane has a capacity of 20 tons, and was built by the Whiting Foundry Equipment Company. A steam-driven Westinghouse air compressor is installed in the basement which furnishes compressed air for blowing dust out of the generators, etc. This compressed air is also used in connection with the automatic oiling system. The oil is circulated by means of gravity and is forced to the upper tank by the compressed air.

INTERIOR OF CAR HOUSE

Cross filters are used for purifying the oil. There is a fireproof oil room in a corner of the basement. This room is 8 ft. by 12 ft., built of brick, with iron doors, and so arranged that the lubricating oils and grease can

CAR HOUSE OF WORCESTER & SOUTHBRIDGE RAILWAY

be placed in it directly from a car on an adjacent track. In the basement is also a Worthington fire pump having a capacity of 1000 gals. per minute, or four good 1¼-in. smooth-nozzle streams.

SUB-STATIONS

There are two sub-stations, one at North Oxford, on the road to Worcester, and the other near the Southbridge terminus. Each of these stations is equipped with six 75-kw oil-cooled step-down transformers, and two 200-kw rotary converters. The switchboards consist of two alternating-current panels, two direct-current panels and a double feeder panel. There are also high-tension alternating lightning arresters and circuit breakers. Besides being built with large waiting rooms for passengers, the sub-stations will form an important adjunct in the development of the freight and express business contemplated by the company.

CAR HOUSE

The main car house is situated at Charlton City, near the power station. It is directly on the railway, and contains the operating offices of the company. The dimensions of the main building are 90 ft. 8 ins. wide by 191 ft. 8 ins. deep, and there is an addition on one side used as a supply house, etc., 22 ft. by 42 ft. The capacity for storage is twenty-eight cars of the largest type. On one side two tracks are partitioned off from the main room, making a paint shop 104 ft. in depth, and on the other side a repair shop 62 ft. in depth is made by enclosing two tracks. The car house is built of brick with granite foundations and sandstone window ledges and trimmings. The roof is supported on steel trusses and columns, and is covered with tar and gravel on flat portions and black slate on the pitched roofs. The doors extending across the entire front of the car house, as well as those closing the paint shop and repair shop, are of the steel rolling type, made and erected by the Kinnear Manufacturing Company, of Columbus, Ohio. The interior is lighted by large windows in the exterior walls, and by 8-ft. x 22-ft. skylights placed in the roof.

The ground floor of the supply house offers accommodation for repair wagons, two stalls for horses, and a fireproof oil room. The second floor is utilized for storing supplies of a costly or delicate nature; there is also provided a room having a capacity of 1500 cu. ft. for sand, which feeds by gravity to an outlet at the floor level of the car house. The entire surface of the main floor has been excavated to the depth of 4 ft. and concreted and so graded as to drain to a given point.

At the corner of the main building is a two-story addition used for office purposes, etc. On the first floor is the employees' lobby, or lounging room, 16 ft. by 22 ft., containing a fireplace, reading table and lockers. The locker room proper adjoins this room, as do also bath and toilet rooms. The second floor contains the general office, superintendent's private office, supply room, lavatory, etc. The finish of this portion of the building is red oak, with floors of Southern rift pine. The windows are provided with screens, outside awnings and shades, making a very pleasant interior. In the basement of the office is a low-pressure 60-hp tubular boiler, used for heating the entire

AN ELEVATED CROSSING

car house. There is also a hot-water heater for supplying the bath fixtures. Two standpipes are located in the car house, each fitted with 100 ft. of 2½-in. linen hose, and outside are five two-way hydrants. These are all connected with the fire pump in the power station. In addition,

chemical fire pails are distributed throughout the entire building.

ROLLING STOCK

The equipment consists at present of twenty long, double-truck cars, eight closed and twelve open. These were all built by the Osgood Bradley Car Works, of Worcester, and are equipped with Laconia trucks and Westinghouse No. 49 (35-hp) motors. The closed cars are 42 ft. 4 ins. over all, with 32-ft. car bodies. The width is 7 ft. 10 ins., height inside 8 ft., and height from head of rail to top of roof 11 ft. 4½ ins. The cars are finished in cherry, with plate-glass double windows, 24 ins. x 26 ins. and 10 ins. x 26 ins., fitted with spring-rolling Pantasote curtains on Hartshorn rollers, and equipped with fixtures made by the Curtain Supply Company, Chicago. The cars are of the straight-sided type, with vestibules 4 ft. 8 ins. at each end. Folding doors are used at the sides of the vestibules, and single sliding doors at the end of the cars. The vestibule shades for these latter doors are on vertical rollers at the side of the jamb, and unroll as the door is closed. They were supplied by the Trolley Vestibule Shade Company. The capacity is forty-eight passengers, and the seating arrangement is similar to that originated in Worcester some years ago and found to be very satisfactory where the traffic is made up of mixed local and long-distance riders. At the center of the car are five walk-over seats on each side, and at the ends are longitudinal seats. The seats are covered with red plush, and were furnished by the Heywood Brothers and Wakefield Company, of Wakefield, Mass. The walk-over seats are of the well-known Wheeler pattern, with grab handles at the upper corner. At the ends of the cars hold-straps are provided for standing passengers. The cars are painted a handsome olive green with neat gold lettering.

The open cars are 44 ft. 9 ins. over all, 7 ft. 1 in. wide at the sills, and 7 ft. 6 ins. wide at the seat rail. They are 7 ft. 6 ins. high inside, and the distance from head of rail to top of roof is 11 ft. The cars have bulkheads fitted with plate-glass windows, but no vestibules. The roofs are of the steam-car type. There are fifteen benches, eleven of which have reversible backs. The finish is of ash with solid bronze trimmings. Pantasote side curtains which can be pulled down to the floor of the car in bad weather are placed between the side posts.

The trucks for both open and closed cars are of a type perfected especially for this class of service, and built by the Laconia Car Company Works, of Boston. They have a wheel-base of 5 ft. 4 ins., and the diameter of the wheel is 33 ins. A ⅞-in. flange is used. Each truck carries two of the 35-hp motors, making a total of 140 hp per car. The gear ratio is 18 to 64. The other electrical equipment comprises two trolleys, two controllers, two circuit-breaker switches, fuses, lightning arresters, etc. Arc headlights are used made by the Dayton Manufacturing Company, of Dayton, Ohio. Both open and closed cars are equipped with the Standard Traction Brake Company's system of motor-driven compressors and air brakes, and are supplied with whistles, as well as gongs.

There is also operated a parlor car, which can be used as a directors' car or leased to private parties. This car is very handsomely fitted up with mirrors, buffet, writing desk, etc., and is equipped with wicker easy chairs, instead of fixed seats. The buffet is supplied with glasses, plates and silverware, every article being marked with the name of the car, "Huguenot." There are smoking and toilet rooms and every convenience ordinarily found on the steam roads. Arrangements are being made with connecting lines so that this car can be operated on any road in the State, and it has already become so popular with excursion, theater, wedding and special parties that engagements are booked for months ahead.

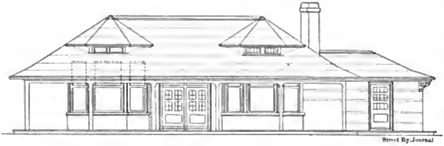
Several express, baggage and mail cars have been ordered from the Wason Manufacturing Company, of Springfield. These will be used for the freight and express business, as well as for carrying the mails. A special compartment in each car for the use of the mail clerks will be fitted up.

STATION AT PINEHURST PARK

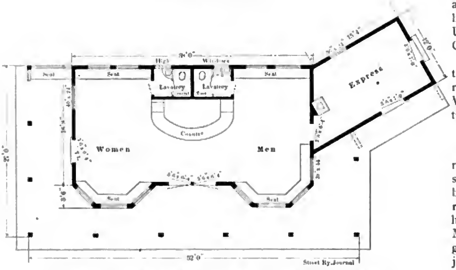
THE ROAD

No expense has been spared in making the permanent way, overhead construction, waiting stations, etc., of the Worcester & Southbridge Railway up to the best standards of electric road building in the country. The larger portion of the line runs on the company's own right of way, and about half of the entire line is rock ballasted, the remainder being gravel. The rail is a 70-lb. T. A. S. C. E. section, laid in 60 ft. lengths on 6-in. chestnut ties placed 20 ins. center to center. The overhead material was manufactured by the Albert & J. M. Anderson Manufacturing Company, of Boston. Mr. John P. Coghlin, of the Page Electric Company, Worcester, was the road's electrical engineer, and in addition to the laying out of the power plant also erected for the company all the overhead work. Plain iron brackets attached to wooden poles spaced 70 ft. apart support the trolley wire. Double trolley wires are used, obviating the necessity of overhead switches at the turn-outs, as well as giving sufficient carrying capacity to dispense with other feed-wires from the main and sub-stations. The trolley wire is of the grooved type, held firmly in screwed clips without soldering. No. 0000 B. & S. gage is used. The 11,000-volt three-phase transmission lines are carried at the top of the poles on heavy porcelain insulators with extra wide petti-

coats. supplied by C. S. Knowles, of Boston. A feature of interest is the placing of signboards bearing the names of the stops along the line. These are suspended from brackets on the poles, and are painted white with black lettering. Eight waiting stations have been erected at



FRONT ELEVATION



GROUND PLAN OF WAITING STATION AT CHARLTON CITY, MASS

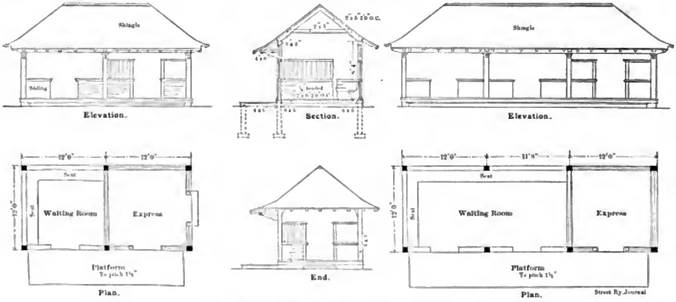
points along the line. A portion of each station is adapted to handling the express business, while the remainder is devoted to the accommodation of the road's patrons. These stations will be open in the summer time, but in winter glazed sash are placed around them. The accompanying illustrations show the general types placed along the road, and the more pretentious one built at Charlton City.

Besides five instruments connected with the exchanges of the New England Telegraph & Telephone Company at different points of the line, the road has a private telephone system of its own, and a private exchange with switchboard at the company's office in Charlton City, and is used as a despatcher station. Each car is provided with a portable telephone outfit, and connection to the line wires can be made at any place by means of a jointed pole carried in the car and equipped with contacts at the end. There are also telephones at the turnouts, sub-stations, etc., all connected to a main switchboard in the general office. All despatching is done by telephone. The road is also thoroughly protected against accident by an automatic block signal system put up by the United States Electric Signal Com-Company, West Newton, Mass.

The entire electrical equipment of the power plant, sub-stations and rolling stock was furnished by the Westinghouse Electric & Manufacturing Company.

OPERATION

By a twenty-five-year traffic arrangement with the Worcester Consolidated, the Worcester & Southbridge can carry its passengers directly to City Hall Square, in the heart of the trolley systems of central Massachusetts, where transfers are given to the other lines. At a point just outside of Worcester, when leaving the city, conductors and registers are changed, and on approaching the city a Worcester Consolidated conductor and register are put on at New Worcester, where the companies' tracks connect. The rush to Pinehurst Park and Prospect Park, on the Southbridge road, in the town of Auburn, last season taxed the facilities of the road to the utmost, and far exceeded the most sanguine hopes of the officers. Arrangement are now being made for the building of a thoroughly up-to-date theater at Pinehurst Park.



COMBINATION PASSENGER AND EXPRESS STATIONS

These are two of the most picturesque pleasure grounds near the city of Worcester, and the company's business last season shows how highly they are appreciated by the people. To provide for the increased traffic expected for next year additional turnouts and tracks are being provided between the parks and the city and additional open cars. Two other resorts are being fitted up farther down the line,

TYPICAL VIEWS ALONG THE ROADWAY

which will, it is hoped, divert some of the attendance from the present resorts.

The present schedule provides for a half-hour headway. It is intended to shorten this next season, probably at least 15 minutes. The distance of about 20 miles between Worcester and Southbridge is made in 75 minutes. The steam railroad time-table makes the time between the two stations from 70 minutes to 120 minutes.

The handling of freight and express matter is to be made a special feature by the management. The waiting stations described, together with special accommodations and arrangements at the terminals, among which is the securing of a large terminal near the Boston & Albany Railroad station in Worcester, give excellent facilities for competing with the old express service. It will be possible for the storekeepers in Southbridge to use the private telephone line of the railway company in ordering goods in Worcester and receive them within a few hours, while shopkeepers in both Southbridge and Worcester can send goods to the respective terminal and have them delivered to all parts of the system. Deliveries are made several times a day. Stamps sold by the railway will be used to prepay express charges, greatly simplifying the clerical work. The express cars will also carry United States mail.

ORGANIZATION

The officers of the Worcester & Southbridge syndicate are: Fred Thayer, president; Wilford A. Bailey, secretary, treasurer and general manager; George W. Wells, vice-president, and E. L. Parker, auditor. O. Willis Rugg, of Worcester, is engineer, and George M. Thompson, of Wakefield, Mass., consulting engineer and appraiser. The board of directors consists of Fred Thayer, Wilford A. Bailey, Edmund L. Parker, Samuel H. Colton, Frank D. Perry, Calvin D. Paige, George W. Wells and Albert B. Wells. The direct supervision of the road is under the superintendent, Leavenworth Wheeler, whose office is at Charlton City. H. W. Culver is chief engineer of the power station, and C. F. Harding, electrical engineer.

Third-Rail Electric Traction in Italy

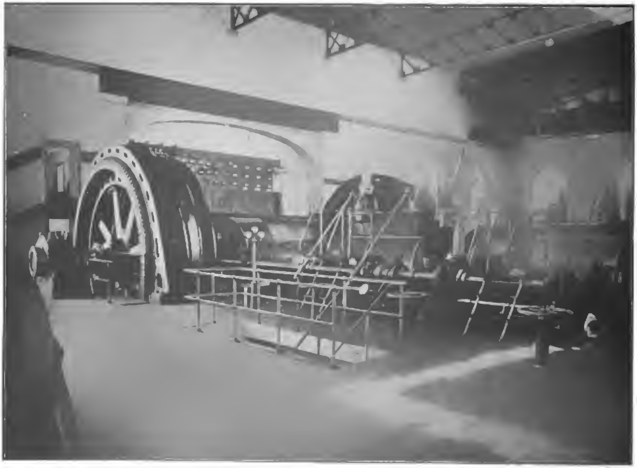
One of the very few interurban lines in Europe, and one of the few converted steam railroads in the world, is the third-rail electric railway between Milan and Porto Ceresio in Italy. This line is a part of the system of the Mediterranean Railroad Company, one of the largest railroad companies of Italy, and a description of some of the important features of the line was published in the STREET RAILWAY JOURNAL for August, 1901. At that time particulars were given of the distribution system and the rolling stock. They will not be repeated here, but a description will be given of the steam plant which has not been described, and which possesses a great number of novel features. The steam plant, although a very complete one, is for temporary use only, as the company is developing a water-power which is eventually to furnish power for the entire line, as well as for other industries in the neighborhood. On the completion of the hydraulic plant, now under construction, the steam plant will be used as a reserve.

The entire line, including power stations, was installed for the Mediterranean Railroad Company or to give the company its Italian title, "Società per le Strade Ferrate del Mediterraneo," by the "Compagnie d'Electricité Thomson-Houston de la Méditerranée." At present 47 miles of the line are in operation from Milan to Porto Ceresio, but the company proposes to extend the electric service to certain branch lines extending from Gallarate to Arona and to Laveno, which will comprise 25 miles more of track. The maximum schedule speed of the electric cars is from 50 miles to 60 miles an hour.

PARABIAGO SUB-STATION AND CROSSING OF HIGH-TENSION LINES WITH TRACK

The generating station of the plant is situated at Tornavento on the Ticino River.

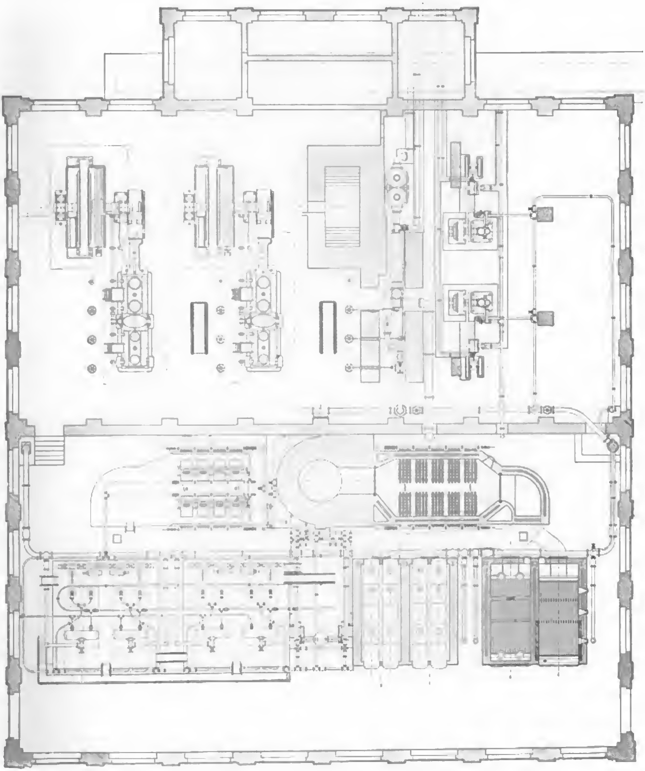
The present steam generating station consists of three high-tension, three-phase, 25 cycle alternators supplied by the General Electric Company, with a normal rating of 750 kw, but capable of working up for a short time to 1400 kw. Each alternator is coupled directly to a horizontal



GENERAL VIEW OF POWER STATION AT TORNAVENTO

tandem-compound steam engine. These steam engines, as well as the boiler plant, were supplied by the well-known firm of Franco Tosi, of Legnano. Although coupled to single-crank engines and driving rotaries, no trouble has that poppet valves are used, which, though popular in Europe, are not in common use in this country for engines of the size of those in this plant.

The three horizontal tandem compound condensing en-



PLAN OF POWER STATION AT TORNAVENTO, SHOWING PIPING

been experienced in the synchronizing and the parallel running of the alternators. Since a number of very competent engineers had, during construction, expressed their doubt as to this result, it may be of interest to give in detail some particulars of the design and construction of the steam plant. The engines are also of interest, from the fact gines are of the following dimensions: Diameter of high-pressure cylinder, 29 ins. (725 mm); diameter of low-pressure cylinder, 48 ins. (1200 mm); length of stroke, 54 ins. (1350 mm). The number of r. p. m. is 94, and with an initial steam pressure of 147 lbs. (11 atm.), the engines develop from 1500 hp to 2000 hp each. In view of the

great and instantaneous variations of load the engines are of especially heavy construction. Both engines are jacketed and the steam has to pass through the jacket to reach the steam valves. The cylinder heads are also jacketed in connection with main jacket.

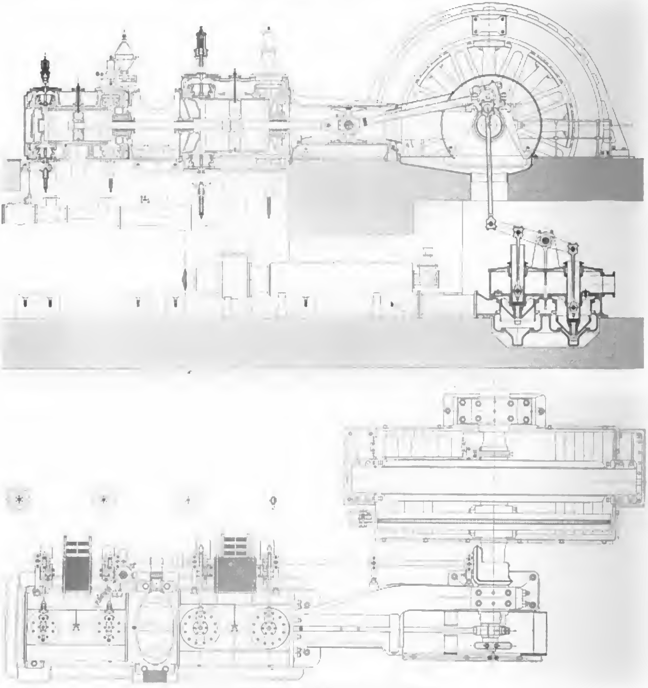
The low-pressure cylinder is connected to the bayonet frame and the high-pressure behind, so as to reduce the heat transmitted to the frame.

Each cylinder has four valves for the distribution of steam. These, as shown in the cylinder sections, are four-seated poppet valves by which the valve lift is reduced, and quick closure is obtained without throttling the steam.

The steam and exhaust valves of the low-pressure cylinder, as well as the exhaust valves of the high-pressure cylinder, are moved by means of cams which can be adjusted by hand to change the amount of load and compression. The valve gear for the high-pressure steam valves is a patented trip device, the advantage claimed for which is that the valve can be raised slowly, and thus without shock from its seat, and then opened quickly. As will be seen, rolling levers are used with air buffers of special device. Silent running is thus obtained, especially with small loads.

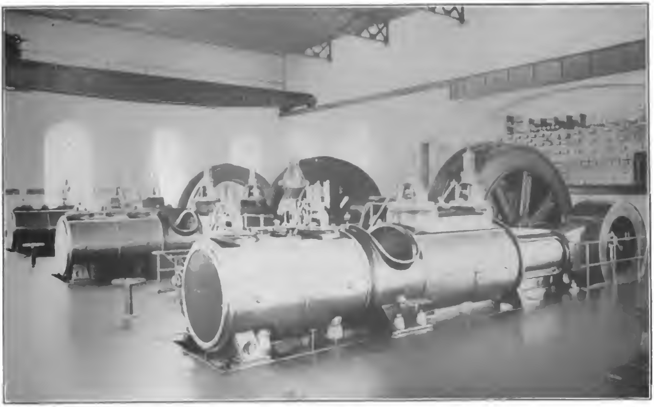
The governor is of the high-speed Porter type, driven from the revolving gear shaft by means of a worm gear. It will regulate the cut-off in the high-pressure cylinder from 0 to 60 per cent. The cut-off in the other cylinders can be varied by hand. The speed of the engine can be changed by means of a weight sliding on the governor lever.

The pistons are made in one piece. The piston rings are in two halves, and to renew them or set them out it is only necessary to disconnect the piston rod from the cross head and slide the piston and rod backward until the rings clear the end of the cylinder. The adjustment or joint of the rings against the surface of the cylinder is effected by a



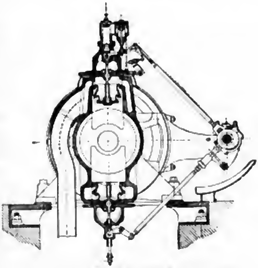
PLAN AND SECTION OF 2000-HP ENGINE

number of flat springs equally divided around the inner circumference of the ring, where they are held in slots cut into projecting lugs. The low-pressure piston is also easily accessible between the two cylinders.



THREE ENGINE AND GENERATOR UNITS, TORNAVENTO

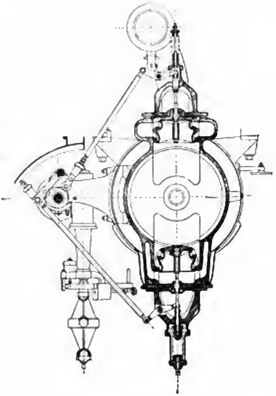
The bayonet frame is cast in one piece with the crank bearing, and rests on three supports. The crosshead guide is bored with recesses at both ends so that the slippers will obtain oil at each end of stroke. The crank shaft is of Siemens-Martin steel in one piece, and carries, adjoining each other, the flywheel of 18 ft. ½ in. (5500 mm) diameter, weighing thirty-seven tons, and the revolving part of the alternator. The crank bearing and the outboard bearing have babbitt metal lined bushes in four pieces, adjustable by means of set screws. The crank, which is shrunk on the shaft and keyed, the connecting rod, the cross-head and the crank-pin are all of Siemens-Martin steel, finished bright.



SECTION THROUGH HIGH PRESSURE ADMISSION AND EXHAUST VALVES

The Duplex single acting air pump is driven from the crank-pin by means of a connecting rod and beam. Suction valves are omitted so that the resistance to the water entering the pump is reduced and a good vacuum obtained. The passages for the flow of water and air are of ample size in order to secure noiseless running at high speed, and the delivery valves are made easily accessible.

Both cylinders have direct lubrication to the inside; the horse-power cylinder has an additional oil supply through the steam valves. These oil supplies are fed from a sextuple pump, which draws from one oil receiver. The oil storage and pump are mounted in a very compact form on the brace



SECTION THROUGH LOW PRESSURE CYLINDER, SHOWING ADMISSION AND EXHAUST VALVES

between the high and low-pressure cylinders, and the pump is driven from the gear shaft by two eccentrics.

The lubrication of all the journals and guides is made continuous from a reservoir placed about 10 ft. above the engine-room floor, and special care is taken to make the oil flow rapidly over the surfaces which it has to lubricate, and then discharge through pipes into an oil filter located in the basement. From there the cleaned oil is pumped up again in the reservoir, and in this manner an abundant lubrication with little loss of oil is effected. This is also facilitated by the ample provision of oil trays and splashing guards.

INTERIOR OF SUB-STATION AT PARABIAGO

THIRD RAIL AND HIGH TENSION LINE NEAR BISUSCHIO

THIRD-RAIL EXPANSION JOINT, WITH PLATE REMOVED

The two vertical tandem compound high-speed condensing engines are of the following dimensions: Diameter of high-pressure cylinder, 11 ins. (275 mm); diameter of low-pressure cylinder, 16 ins. (400 mm); length of stroke, 12 ins. (300 mm).

The number of revolutions per minute is 270, and with an initial steam pressure of 147 lbs. (11 atm.) the engines develop from 85 hp to 125 hp each.

The two cylinders are cast in one piece, and have an

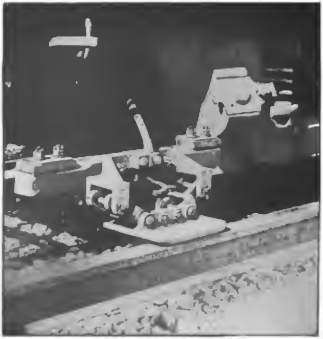
automatic metallic piston rod packing in the intermediate head. None of the cylinders of these engines is jacketed, but they are well covered with non-conducting material, and an exterior finish is made with planished sheet iron.

The distribution of the steam in both cylinders is effected by means of two balanced piston valves of the Tosi pattern. They are placed on the same rod and operated by one eccentric controlled by a shaft governor, which varies the cut-off from 0 to 50 per cent of the stroke.

VIEW OF TRACK AT STATION, SHOWING COVERED THIRD RAIL

The frame is of the double-branched or "A" shape, cast together in one piece with the two bearings. The guides on this class of engines are bored. The hub of the fly-wheel is shaped into a small pulley to drive by belt the horizontal double-acting air pump placed underneath the floor with the condenser. This pulley is flanged for direct coupling to the exciter.

The boilers, of which there are eight, are also from the Tosi works, and are of the water-tube type. Each boiler has 312 sq. ft. (290 sqm.) heating surface, and 60.8 sq. ft. (5.65 sqm.) grate surface. Each boiler has 144 tubes, 17 ft. ½ in. (5500 mm) long. The diameter of each of the two cylindrical steam and water drums is 3 ft. 7 ins. (1100 mm), and their length is 25 ft. 7 ins. (7810 mm).



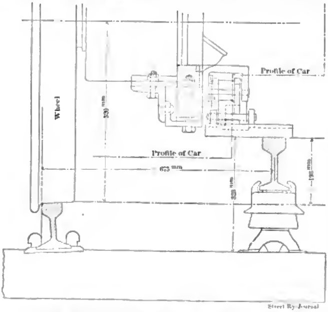
CONTACT SHOE ON MOTOR CAR

The water tubes are inclined and fixed at each end into two headers, which are of approximately rectangular shape, and which connect on the top into two water legs terminating in the water drums. The two sides of the header are connected rigidly together by a strong and well-studied sys-

STANDARD MOTOR CAR AND TRAIL CAR

tem of braces. The outer plate of the header is provided with round holes, one opposite the end of each tube, for inspecting and cleaning the tubes or changing them. These holes are closed by means of hand hole plates of pressed steel, and keep perfectly tight without packing, being only ground. The front of the boiler rests on a fixed support, the back on rollers, so that the boiler can expand freely without injurious tensions. The masonry serves only as enclosure, but does not carry any part of the boilers. The boilers steam rapidly and have a large steam reserve capacity, so that a steady pressure is obtained. The system of piping, which is very similar to American practice, is clearly shown in the plan view.

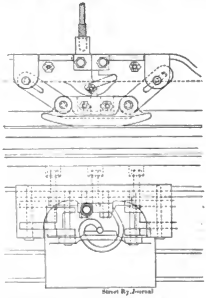
MAP SHOWING RAILWAY AND TRANSMISSION LINE



CROSS SECTION OF THIRD RAIL, SHOE AND HANGER

Two large economizers of 5812 sq. ft. (540 sqm.), composed of thirty-two vertical cast-iron tubes connected by cross tubes, have been installed. The scrapers for these economizers are driven by electric power.

A description of the distribution system was published in a previous issue together with views of the third-rail adopted, which is 90-lb. T, mounted on reconstructed granite insulators. This rail is supported in an iron cap on top of the insulator, and the joints are bonded by a concealed flexible copper bond of 0.31 sq. ins. (200 mm²) section. To avoid creeping, the rails are connected by single plates in groups of ten each, and the middle of each section is anchored. Cross-bonds are used every 325 ft. (100 m).



SIDE ELEVATION AND PLAN OF SHOE

The shoe, which was not illustrated in the previous article, is also of novel shape. It has a bearing surface 12½ ins. long by 10 ins. wide (317 mm x 254 mm), and is hung to one side of the center so that it will clear a guard carried over the third rail in the switch yards and at the stations. This guard is not shown in the sectional diagram, as it is not used on straight tracks, but is illustrated in the half-tone illustration, which shows one of the locomotives and cars near the sub-station at Parabiago and in the view of the track near the stations.

Developing Freight on the Lake Shore

The Lake Shore Electric Railway will commence the development of its freight business on a broader scale after Jan. 1. Heretofore there have been no through freight shipments over the road because of insufficient power. The company proposes to undertake the experiment of operating freight cars between midnight and 5 a. m., when the tracks are not occupied by passenger cars. It is believed the towns along the line will offer little objection to the operation of standard freight cars during the night. The company expects to secure a large amount of business from through shipments from other connecting roads. The Toledo & Western Railway, which, as is well known, operates freight cars, recently secured an order for a large shipment of sugar beets from Michigan to Fremont, over the Toledo & Western and Lake Shore Electric roads, but the Lake Shore Company was forced to refuse the business owing to lack of facilities for handling it.

The Belgian Government, says the Brussels correspondent of the London Times, has received from an Anglo-American capitalist in London an offer to construct the proposed electric railway between Brussels and Antwerp. The capitalist offers to deposit £2,000,000 as a guarantee of good faith and to finish the line, including the tunnel under the River Rupel, within eighteen months.

Street Railway Wheels in Europe

Strange as it may seem to American readers, the car wheels used on most of the city tramways in Europe are not of chilled iron, but are of steel, that is, the tire is of steel, and is shrunk on to a separate center which is usually of wrought iron. The construction of a wheel of this kind can easily be understood from Fig. 1, which shows the side view and section of a standard wheel used by the Brussels Tramways. Fig. 2 is a section (three-quarters actual size) of the tire, the rim and a portion of one of the spokes of the same wheel. The weight of this wheel, which may be considered typical of European wheel practice, is about 170 kg (374 lbs.), of which the tire weighs 100 kg and the hubs, spokes and rim, 70 kg. The diameter of this particular wheel is 762 mm at the thread and 707 mm at the flange. When a tire develops a flat spot it is turned down on a lathe and the thickness of the tire is usually sufficient to allow of its being turned down twice. A new tire can then be put on the wheel, which is done by the usual process of shrinking it on.

The cost of a complete wheel with new tire varies according to local conditions. In Brussels it is 104 francs ($20.80), while the cost of a tire by itself is about 35 francs. To this, of course, must be added the cost of taking the axle out of the car, pressing off the wheel, heating the old tire so as to slip it off, and shrinking on the new tire. The cost of turning down the tire, which is done on a

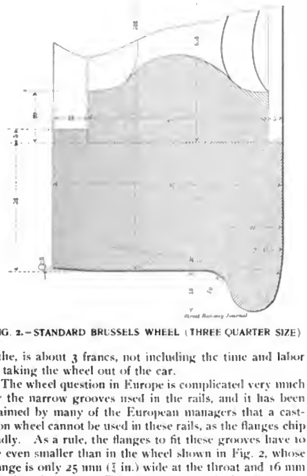


FIG. 2.—STANDARD BRUSSELS WHEEL (THREE QUARTER SIZE)

lathe, is about 3 francs, not including the time and labor of taking the wheel out of the car.

The wheel question in Europe is complicated very much by the narrow grooves used in the rails, and it has been claimed by many of the European managers that a cast-iron wheel cannot be used in these rails, as the flanges chip badly. As a rule, the flanges to fit these grooves have to be even smaller than in the wheel shown in Fig. 2, whose flange is only 25 mm (1 in.) wide at the throat and 16 mm (⅝ of an in.) deep. Thus the Compagnie Parisienne de Tramways uses a wheel with a flange only 13 mm x 13 mm. Originally, this company employed a much larger flange, viz., one 20 mm x 20 mm, but with the low speeds used, the smaller flange has given no trouble from derailment. The rails used on this line have a groove 28 mm x 28 mm. In Hamburg, where the groove in the rail is 32 mm x 32 mm, the wheel flange has a depth of 14 mm.

In Brussels, where the rail groove is 30 mm deep x 32 mm wide, some experiments were made with cast-iron wheels, but they did not prove very satisfactory, and the steel wheels are now used exclusively. The average life of the present tires is given by Mr. Dugniolle, engineer of the company, as about 65,000 km. At a cost for the tire of about 35 francs, plus 6 francs for two turnings, this is equal to an average of 63 centimes per 1000 km, not count-

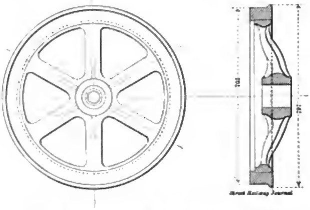


FIG. 1.—STANDARD WHEEL OF THE BRUSSELS TRAMWAY

ing the cost of removing the wheel from the car. The cast-iron wheels used in Brussels rarely ran up to 60,000 km.

The trouble experienced from chipping with chilled iron wheels in Europe cannot be attributed entirely to the narrow groove used, however, because although most American roads use a wider groove than that employed in Europe, rails have been laid on a number of systems in America where the groove is certainly no wider or deeper than almost any in Europe, yet chilled iron wheels have given no trouble. For instance, the rail used by the Capital Traction Company, of Washington, D. C., has a groove only 1 in. (25 mm) wide and 1 in. (25 mm) deep. This is, perhaps, the narrowest groove of any used in the United States, although the Havana Electric Railway Company uses a rail with a groove 1 in. (25 mm) wide and 1⅛ in. (29 mm) deep, and the Boston Elevated Railway, on parts of its surface lines, uses a grooved rail with groove 1⅜ in. (34 mm) wide and 1 3/16 in. (30 mm) deep. The principal difference in practice, however, is that it is the universal rule in America to lay a different type of rail for curves, i. e., one in which the groove is made wider and of a different form, while in Europe, as a rule, the same rail is used for curves as on straight track. On the Capital Traction lines of Washington, for instance, where the straight rail has a groove 1 in. wide, the curve rail has a groove 1¼ in. (31.5 mm) wide and it is, perhaps, to this fact of not widening the groove on curves that the greater part of the flange chipping experienced in Europe may be attributable.

A few companies on the Continent are using chilled iron wheels. The street railway in Milan is one of these. The rail groove in Milan is 31 mm wide and 35 mm deep, and the average life of a chilled iron wheel, according to Mr. Daveri, superintendent of construction of the Milan system, is 40,000 km before being ground, and about 15,000 km after the wheel has been once ground. All the car wheels on the Milan system are of chilled iron, and they are considered superior to steel-tired wheels.

The largest user of chilled iron wheels on the Continent of Europe is the city of Buda-Pest, where both tramway companies and the underground railway company use

wheels of this character almost exclusively. The underground railway, which is laid with T-rails, uses a wheel of the section shown in Fig. 3, while the surface wheels have a center flange, as shown in Figs. 4, 5 and 6, for running Stadtbahn electric line equipped with one motor only, and *B* and *C* for cars on the same line with two motors. *D* is an underground railway wheel for use with T-rails, and *E* and *F* are sections of 600 mm wheels. These latter

FIG. 3.—SECTION (HALF SIZE) OF WHEEL USED ON THE BUDA-PEST UNDERGROUND RAILWAY

FIG 4.—SECTION (HALF SIZE) OF WHEEL FOR HAARMANN AND SLOT-RAILS BUDA-PEST SURFACE LINES

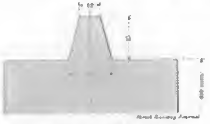


FIG. 6.—SECTION (HALF SIZE) OF WHEEL FOR HAARMANN AND SLOT-RAIL

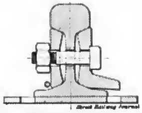


FIG. 8.—SECTION OF STANDARD T-RAIL

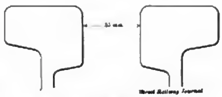


FIG. 9.—SECTION OF CONDUIT SLOT, BUDA-PEST

on the Haarmann rails and slot rails of the side conduit used in Buda-Pest. The Haarmann rails used on the Stadtbahn (surface) line, from whom the accompanying wheels are of small diameter, to economize height in the car. The Budapester Elektrischebahn also used chilled iron wheels exclusively for its surface cars. All the chilled

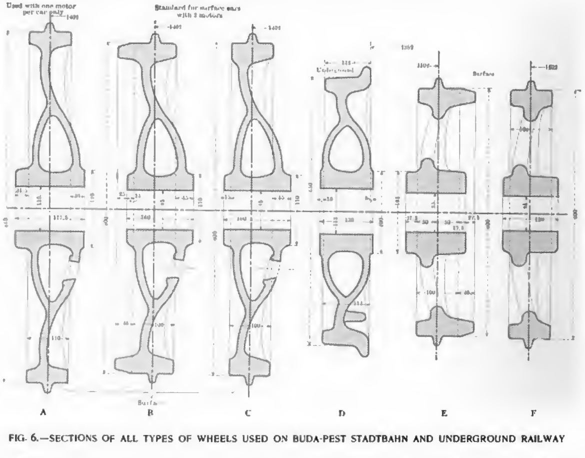


FIG. 6.—SECTIONS OF ALL TYPES OF WHEELS USED ON BUDA-PEST STADTBAHN AND UNDERGROUND RAILWAY

sections were obtained, through the courtesy of Mr. Stromszky, chief engineer of the company, have a depth of groove of 26 mm and a width on straight track of 35 mm and on curves of 45 mm. In Fig. 6, *A* shows the complete section of a wheel for a surface car on the iron wheels used by all the roads in Buda-Pest are obtained from Ganz & Company, and are of the "Griffin" type.

The wheels on the underground railway are 650 mm in diameter, and the average life of the steel wheels on this line, when they were employed, was about 120,000 km with

two turnings down of the tire. Chilled iron wheels, however, have been in use since August, 1899, and a record of all of these wheels (ninety in number) which have been employed from that time to Jan. 1, 1902, shows that all are still in good condition, so that their total life is yet indeterminable. The highest record made by any of these wheels up to this time has been 138,575 km, but twenty-four out of the ninety now in use have made over 100,000 km, and, as stated, none of them is yet worn out.

The life of the wheels on the surface lines of Buda-Pest has naturally not been so high, as the wear on the flanges has been greater, but a number of these wheels have run over 120,000 km. The average life for the 600-mm diameter wheels has been considerably over 50,000 km. The 850-mm chilled iron wheels have been in use only since March, 1901, and as none has worn out or been discarded for any reason, their average life cannot be stated, but between March, 1901, and January, 1902, seventy-six of these wheels in service on the Stadtbahn had run more than 30,000 km, and all were in good condition. The following figures show the kilometers run of ninety-five 600-mm diameter wheels taken in consecutive order from the records of the company, and extending far enough back so that most of the wheels recorded in them have worn out from one cause or another. In these records the asterisks indicate wheels that are still in good condition, *f* those discarded for flat spots, *s* for sharp flanges, *b* for broken hubs, and *p* because no suitable mate could be found for them. For convenience in comparison, the asterisks, which, as stated, indicate the wheels which were in good condition on Jan. 1, 1902, when the record was made, and the *p*, which indicates that the wheels were discarded for no fault, are placed in front of the record in each case.

RECORD IN KILOMETERS OF NINETY-FOUR 600-MM DOUBLE-FLANGED WHEELS, BUDA-PEST STADTBAHN (SURFACE ROAD)

* 60,953	42,188 *f*	15,079 *f*	*104,045
* 92,523	70,603 *b*	*120,659	*p* 99,675
89,797 *s*	111,962 *s*	89,797 *s*	98,400 *s*
p 99,675	118,849 *s*	111,962 *s*	98,400 *s*
*129,424	94,066 *s*	*129,424	121,071 *f*
94,066 *s*	98,400 *s*	110,132 *s*	96,169 *f*
* 63,761	95,938 *s*	121,017 *f*	110,132 *s*
118,849 *s*	95,938 *f*	98,400 *s*	106,445 *s*
* 63,761	74,631 *f*	42,069 *f*	* 63,135
* 93,238	42,069 *f*	* 98,219	* 85,585
* 93,162	74,134 *s*	* 34,050	89,936 *f*
* 98,219	* 93,162	89,936 *f*	58,323 *s*
74,613 *f*	74,613 *s*	86,019 *s*	58,323 *b*
70,436 *b*	* 62,042	* 65,508	79,478 *b*
* 73,117	* 66,177	* 41,073	84,047 *s*
* 37,834	* 73,117	31,299 *b*	* 73,117
* 73,117	* 37,834	62,175 *s*	* 37,834
62,175 *s*	* 62,042	* 34,722	* 37,834
* 62,042	84,047 *s*	* 62,042	39,194 *s*
* 51,833	* 68,060	* 63,106	* 65,557
* 68,460	* 58,082	* 65,537	* 65,537
38,028 *b*	39,194 *s*	75,782 *f*	49,798 *f*
53,522 *f*	69,211 *f*	82,225 *f*	82,968 *s p*
82,968 *s p*	46,831 *b*	.....	.....

Figs. 7 and 8 show the standard rails on which these wheels ran, and Fig. 9 the outline of the conduit slot, which, according to the system used in Buda-Pest, forms also one service rail for the car wheels on the lines equipped with the underground trolley. Fig. 10 shows the complete steel wheel and axle used on the gearless locomotives on the underground railway, and Fig. 11, the chilled wheel and axle employed by the motor cars on the same railway, and which are equipped with gears and sprocket chains.

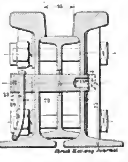


FIG. 7.—SECTION OF STANDARD HAARMANN RAIL

Rouen is another city in which cast-iron wheels are now supplanting steel-tired wheels. The chief trouble found in Rouen with the steel-tired wheel was the rapid wear of the flange. The steel wheels had to be taken out about once every four months, and about 5 mm in thickness of the tread of the wheel, i. e., 10 mm of its diameter, was removed by a lathe. The company reports that it took about a day to turn down the tires and flanges of two pairs of wheels in this way on one lathe, although the lathe had two saddles, which are worked simultaneously, and it required four men two hours to put the tire on the hub.

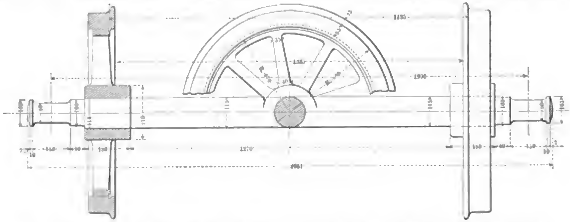


FIG. 10.—MARTIN STEEL WHEEL USED IN GEARLESS LOCOMOTIVES OF BUDA-PEST UNDERGROUND RAILWAY

Most of the English railways are, at present, using chilled iron wheels, but there seems to be a tendency toward the employment of steel wheels. The chief charge brought against the chilled iron wheels is the chipping of the flanges. This, as stated, may be largely due to the practice of using the same rail on straight track and on curves. It is also, of course, always more liable to occur when a very narrow rail groove is used. Such a groove requires a thin wheel flange, and it is difficult to cast a flange of this kind and give it enough chill to make it stand the wear, and yet not carry the chill all the way through the flange. A long thin wheel flange which is chilled all the way through is naturally liable to chip, but it seems probable that with a narrow rail groove a stubby chilled flange would wear as long as a steel flange of the same depth. Of course, grooves as narrow and shallow as many used in Europe invite trouble, no matter what type of wheel is used, and would be actually unsafe if it were not for the very slow speed at which the cars run.

There is probably no single department in railway operation where there is such a great opportunity for improvement in European railway construction and operation as in that of rail sections, and it is a somewhat peculiar fact that no effort has seemingly been made, either by manufacturers or by the street railways associations, to standardize the rail-heads in use. The number in use is enormous particularly in England, where the type of rail-head is very often dictated by the local city engineer, who wishes to establish a record for originality by insisting upon a new type of head. A good idea of the variety of sections in use can be obtained from Fig. 13, which is a reproduction of twenty different rail-heads of different cities in Europe, most of them in Great Britain. As will be seen, the grooves run anywhere from $1\frac{1}{4}$ ins. to $\frac{7}{8}$ in. in width, and 1 in. to $\frac{5}{8}$ in. in depth. Some have a flaring groove and others a very contracted one. The heads of the rails range from $\frac{3}{4}$ in. to $1\frac{3}{8}$ ins. in width. The cities from which these sections are taken were selected at random, and undoubtedly a much greater variety of patterns could have been obtained by using some of the very narrow grooves employed in some cities. A "composite" section of the wheels using these rails is given in Fig. 12. As will be seen, the wheels represent almost as wide a diversity of practice as exists in rails.

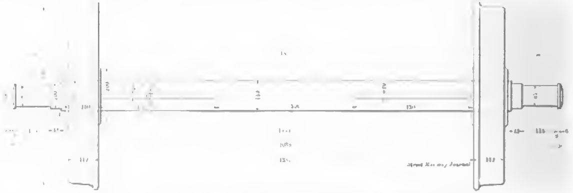
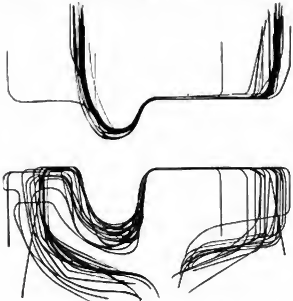


FIG. 11.—CHILLED IRON WHEEL USED ON BUDA-PEST UNDERGROUND RAILWAY



FIGS. 12 AND 13.—COMPOSITE DRAWING, SHOWING A NUMBER OF SECTIONS OF WHEELS AND RAILS USED IN EUROPE

The general shape of the "composite" section shown in Fig. 12 is, on the whole, not bad for a full grooved rail, although a more flaring lip, as mentioned below, would help the wheels clean the dirt out of the groove. The extremely narrow head in the case of one rail and the peculiar projecting lip in the case of another rail, the latter intended, doubtless, to carry vehicle traffic, will be noticed. The fishing surface under the head is about at the inclination which would be found in American rails, but in the fishing surface under the lip, the reader will notice a marked curve, somewhat in the form of an elongated S lying horizontally. The effect of this, we should think, would be to make it very difficult to hold the angle-plates in place on this side of the rail, and a straight surface at this point would be better.

Many of these sections, however, are so nearly alike that the total number could be reduced to two or three at most, without the sacrifice of any essential in construction. If such a reform should be instituted, and it is one to which the city authorities, as well as the associations, could well turn their attention, it is to be hoped that a self-cleaning section will be adopted; that is, one in which the dirt is crowded out of the groove by the wheel flange, and not packed in by it, a fault which exists in too many of the sections now in common use. Such a section offers practically no more obstruction to vehicular traffic than those now in common use, and would be much cheaper to operate over, and will greatly reduce the possibilities of derailment.

Interurban Road for Porto Rico.

It is stated that the Vandegrift Construction Company, of Philadelphia, has in contemplation the construction of an electric railway from Catano to Ponce, a distance of 70 miles, and the development of water power for lighting and railway service. It is proposed to construct a line of ferry-boats between Catano and San Juan, on the San Juan Bay, and thus cut off 10 miles of track, which would be required to connect the two cities by rail. It is also planned to build several piers on the Catano side of the bay, to allow ocean-going steamships to dock. Passenger and wagon traffic will be carried on the ferryboats, and until the concessions for the construction of the piers are granted heavy freight for export trade will be carried out into the bay on lighters and loaded on the steamers. The road will pass through the coffee, sugar and fruit belts of the island, which are densely populated, and the belief is that large quantities of freight will be handled. Electric locomotives will be used for freight work. It is said that the plan for power development calls for the building of a power house of 5000 hp in the mountainous district of the interior of the island.

The Rolling Stock of the Manhattan Railway Company

In the issue of this paper for January 5, 1891 (International edition for January), an extended account was published of the power station, transportation system and third-rail construction of the Manhattan Elevated Railway in New York. At that time it was impossible to publish a description of the rolling stock used for the new electric equipment, from the fact that the details had not been fully decided upon. Through the courtesy, however, of J. S. Doyle, master mechanic of the company, this paper is able to present in the accompanying inset sheet and following pages full particulars and working drawings of the cars and trucks now in use on the Manhattan Elevated Railway. Two types of cars are used, open and closed. The company has at present 1286 cars of the closed type and 36 of the open type, and also are about to contract for 60 additional open cars. Of the closed cars 850 are motor cars and 436 trailers. Of the closed cars 310 were constructed by the Wason Manufacturing Company and 50 by the American Car & Foundry Company at its Wilmington shops. Of the open cars 25 were built by the Jewett Car Company and 11 by the American Car & Foundry Company. The remaining cars of the equipment have been remodeled from cars used in the old service.

It is the practice of the company to operate the cars in trains. With a six-car train, which is a standard train, the first, third, fourth and sixth are motor cars. With a five or a four-car train, the first, third and fourth are usually motor cars. Five-car trains will, however, not be used to any extent as soon as the platforms on the Sixth Avenue line are extended to allow the use of six-car trains. With a three-car train the first and third are motor cars. None of the open cars is equipped with motors.

MOTOR CARS

Although it might seem that there is not much variety possible in car construction, the cars of the Manhattan Company embody a number of novel features, certain of which, such as the type of motor cab adopted, constitute great advances in the construction of cars for elevated railway service. Everything considered, this cab is probably as interesting a new feature of the Manhattan rolling stock as any other portion. It was designed and has been patented by the company's engineer, and, as will be seen, can be converted, when not in use as a cab, to form a part of the seating space of the car. When used as a cab a swinging glass door cuts off all interference with the motorman by the passengers, and, as no passengers are allowed on the front platform, an unobstructed view is obtained of the track ahead by the motorman, who is provided with a seat facing the direction in which the car is going. While in this cab the motorman has all the protection and comfort that passengers have, and it is needless to say that the motormen themselves are very much pleased with such an arrangement, and much prefer it to the outside cab.

The objection to inside cabs has previously been that they took up valuable seating space, but it will be noticed that when this cab is not used by the motormen that the door closes in and protects the controlling apparatus. At the same time the motorman's seat is turned down, forming a seat for two passengers.

STANDARD CLOSED MOTOR CAR, MANHATTAN

It might be interesting to compute how much gain such an arrangement makes in dollars and cents to the Manhattan Railway, where additional space during rush hours actually means additional nickels taken in. The seat mechanism is simple and durable, and has given no trouble. The right-hand ends of each motor car are finished off in this way with motorman's cabs, so that either end of any motor car can be used by a motorman.

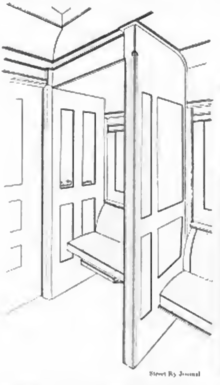
A few of the general dimensions of the motor-car bodies follow:

	Feet	Inches
Length of car body on center line over end plates..	47	1
Length of car body over end sills	39	8
Extreme width of car over eaves..................	8	9½
Extreme width of car over side sills	8	6
Extreme width of car over window-sills	8	9⅛
Width between truss planks	7	9
Height of car from top of rail to top of dome roof not to exceed	12	10½
Height of car floor over top of rail	3	10⅛
Height of platform over top of rail	3	9
Height of center of draw bar over top of rail	2	4½

All timber used in the under frame is selected long-leaf yellow pine, except needle beams and end sills, which are of white oak. The end sills are secured to the intermediate sills with double tenons and four 1-in. iron rods passing

VIEW OF MOTORMAN'S CAB

through the end sills and hooked over the bolster. As shown in the floor plan, there are two 4⅞-in. x 7⅞-in. side sills, two 3½-in. x 4⅞-in. center sills and two 3½-in. x 4⅞-in. intermediate sills. The side sills are placed with their

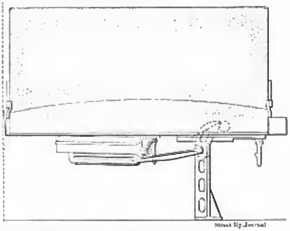


MOTORMAN'S CAB TRANSFORMED FOR USE BY PASSENGERS

outer faces 4 ft. 3 ins. from the longitudinal axis of car, and the center sills have their inner faces 5¼ ins. from same axis, while the outer faces of intermediate sills are 2 ft. 1⅞ ins. from the same axis.

The body bolsters are made of two wrought-iron plates 8 ins. wide and ⅞ ins. thick, placed flatwise with the ends fastened together at each end. The upper plate is let into the bottom of the side sills ½ in. and secured to the body of the car by two ⅞-in. bolts through each longitudinal sill. The plates are spread at the center to 6 ins. clear space. The needle beams are of white oak, 5 ins. wide and 5 ins. deep at the ends and 6 ins. deep at the center, and each timber is strengthened by a ¾-in. round truss-rod.

The cars are strengthened by longitudinal truss-rods 1¼ ins. in diameter, two in number, with ends upset to 1½ ins. and about 6 ins. long for threads.

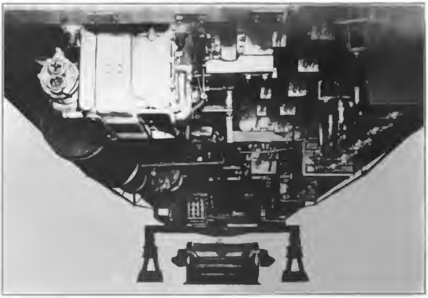


SEAT IN MOTORMAN'S CAB, LOWERED FOR USE OF PASSENGERS

The corner and door posts are made of a composite piece of straight-grained white ash and whitewood, and the side posts of yellow pine.

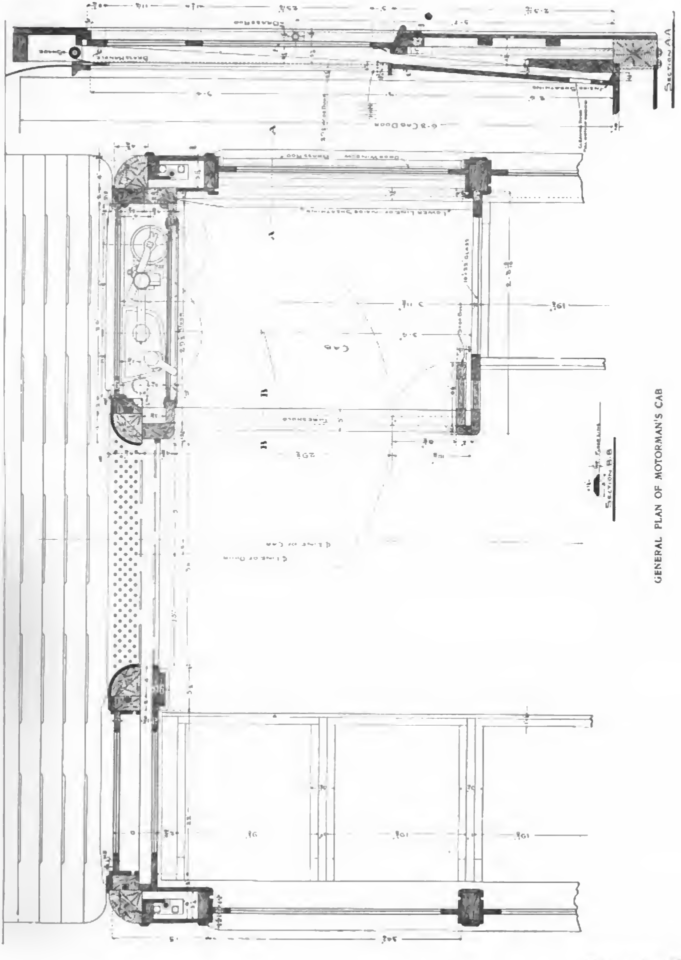
The truss plank is of long-leaf yellow pine in one piece for the full length of the car, with outer face gained out ¼ in. for each post, and is secured to each post by two 3-in. screws. The diagonal bracing under each window is of white ash.

The roof is supported by five principal car lines which

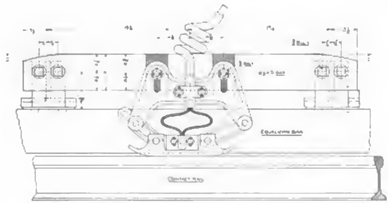


VIEW UNDER MOTOR CAR, TRAILER END

are made up of 1¼-in. wrought-iron bar forged to the shape of the roof and sandwiched between two white ash car lines ¾ in. thick, bolted together. There are also sixty-four white ash lower intermediate car lines secured to the bottom of the rail of the clear story, and thirty-two clear-



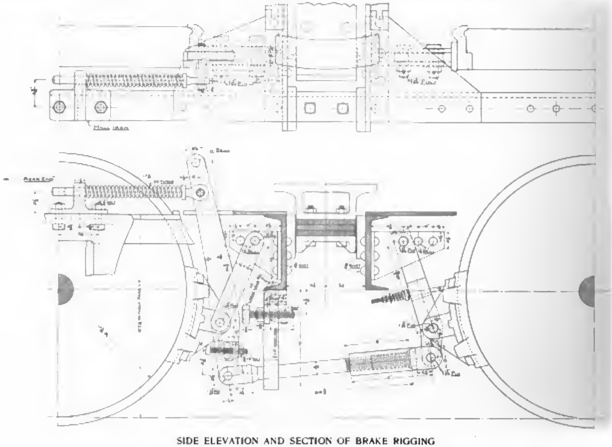
GENERAL PLAN OF MOTORMAN'S CAB



SIDE ELEVATION OF CONTACT SHOE AND HANGER

story intermediate car lines. All of white ash. The roof boards are of kiln-dried whitewood ⅞ in. thick and 3¼ ins. wide, covered with cotton duck.

The trailer end platform is 8 ft. 7 ins. wide and projects beyond the end sill 2 ft. 9 ins. measured along the outside of the side sills. It is supported on four platform sills of white oak, the side and center sills being reinforced with a ¾-in. plate.

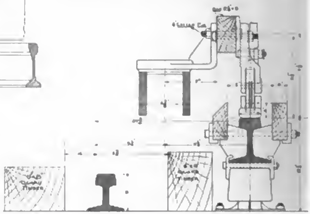


SIDE ELEVATION AND SECTION OF BRAKE RIGGING

The motor end platform is supported by rolled open-hearth steel I-beams and channel. There are two 6-in. 14.75-lb. I-beams fastened to the bolster and extending to the buffer timber, with outer ends connected by one 10-in. 25-lb. channel. The platform sills are yellow pine or white oak, 3½ ins. x 4 ins., fitted between the end sill and the buffer timber.

The platform gates are the Manhattan standard, operated by Gold's patent gate lock.

The inside finish of the cars is mahogany throughout, with twelve windows along each side of car body, all of which, with the exception of the cab windows, have two sash each. The sash of the cab side windows is in one piece, and is opened by dropping the sash into a pocket between inside and outside finish. The sash of the end window in the cabs is in one piece, and is arranged to raise 12 ins. Pantasote



CROSS SECTION OF SHOE AND HANGER

curtains, with Curtain Supply Company's fixtures, are used throughout the car.

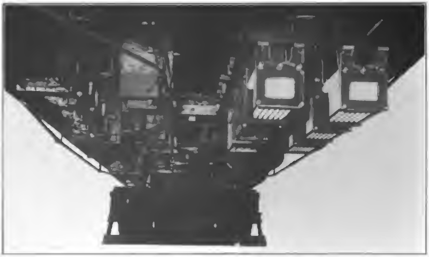
The head linings are of three-ply whitewood or birch finished in a light cream color with stencilled ornaments in gold leaf. The effect is to give a very light appearance to the car, especially at night. The fact that the voltage is very constant on the line also improves the lighting effect. For lighting the cars twenty-five 16-cp lamps are used. In addition, there are five lamps in each end of each car for head-lights, markers and cab lights. All five

of the switches for the car-light circuits are mounted in a sheet-iron box, and quick-break lever switches are used, instead of the ordinary snap switches.

Hale & Kilburn spring seats and backs, Van Dorn couplers and Consolidated electric heaters are used.

The heater connections are somewhat different than those ordinarily employed. There are three coils in every heater, all exactly alike. The object of having the coils alike is so that the number of repair parts will be reduced, and so that different coils can be energized at different times, so that each coil gets practically the same amount of use. In this way, when one coil is worn out the entire heater can be discarded. The three circuits are labeled on the switches Nos. 1, 2 and 3, and during winter weather signals are posted at the terminals by the direction of the superintendent telling the conductors what heat switches to throw in. Each circuit takes approximately 8 amps., so that during severe weather 24 amps. can be used to heat the cars. The three switches on the heaters are of the quick-break lever type, and are mounted in a sheet-iron box at the opposite end of the car from the light switches.

The cars are equipped with the Westinghouse automatic



VIEW UNDER MOTOR CAR, MOTOR END

TRUCK AND SHOE

air brakes and engineer's valve, operated by a separate General Electric motor compressor on each car.

The compressor used is the CP-14 direct-connected type, such as the General Electric Company is now building in several different sizes. It has a piston displacement of about 20 cu. ft. per minute. As this is the first large installation of direct-connected compressors, it is interesting to know that these compressors are giving very good results. The direct-connected type was adopted because it was thought best, if possible, to get a compressor without gears and pinions, and the large number of wearing parts which a geared compressor necessarily has.

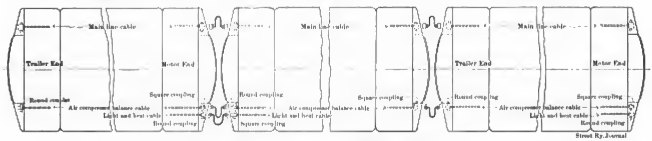
The automatic governor, which, with the compressor, was described briefly in the Street Railway Journal for October, 1901, is of the MB type. It is similar to previous General Electric governors in that a flexible rubber diaphragm is used, but otherwise it is of a new design. It is operated entirely pneumatically and so no magnet coils are needed. At the same time a quick make and break on the contacts is secured.

A through air reservoir line is used which is connected to all the reservoirs in the train. In order to equalize the work that the different pumps do, a train-line circuit is also run from car to car which so connects the governors and pumps that the closing in of any governor starts all the pumps at once. This train-line wire carries current for all the pumps, so as to do away with any complications, such as relays.

The weight of a motor car with equipment complete is 51,800 lbs., divided as follows: motor-car end, 31,600 lbs.; trail-car end, 20,200 lbs. The motor trucks complete with gears, but without motors, weigh 10,100 lbs. The trailer trucks weigh 7000 lbs. each. Each motor complete with gears weighs 4420 lbs. each.

ELECTRICAL EQUIPMENT

Each motor car is equipped with two G. E.-66 motors (125 hp), both of which are mounted on the same truck,



PLAN OF TRAIN SHOWING METHOD OF COUPLING

and the train unit-control system of the General Electric Company is employed. Both system and motor were described in the Street Railway Journal for October, 1901.

Mention should also be made of novel type of fuses used, and which were adopted largely to avoid all possibility of

the use of a fuse or circuit breaker, which, with the large currents employed, would make much smoke or noise as it opened, and thus startle the passengers. The fuse is a copper ribbon with 7½ ins. between terminals, 1¼ ins. wide and 10 mils. thick, and has a ½-in. hole drilled in the center of it. This is the first time, so far as is known, that a fuse of this nature has been used. The good results obtained are due to the fact that there is a very small amount of metal in the fuse, although there is a great deal of radiating service. This fuse will carry constantly practically 300 amps., and will open 400 amps.

The chief point in favor of a fuse of this nature is that it is absolutely reliable, and that all the copper that is burned away is practically vaporized. Generally when one of these fuses blows, only a very small amount of the fuse burns away, as the ribbon is so flexible that, due to the heating action of the current, the ends turn themselves back. In this way quite often not over 1 in. of the middle of the fuse is melted away when a heavy short-circuit is opened, and very little smoke results.

There has been so much talk during the past year in regard to the danger from fire of elevated cars that it is gratifying to know the Manhattan Company has so installed the electrical apparatus and wires that the fire risk has been reduced to a minimum. The wires themselves being much more likely to cause fire than the apparatus, especial attention has been given to this part of the equipment. The insulation of the leads to the cast-grid resistance boxes has been removed between the resistance box and just below the floor. It was not thought advisable to remove the insulation from the leads to the contactors, so, instead of removing the insulation, an asbestos hose has been slipped on over the insulation. Asbestos cloth tape 3 ins. wide has also been used to wrap the cables. The bottom of the car and any place where there is any possibility of an arc has also been thickly covered with asbestos sheeting. The same precautions have been used with the motor equipment and controllers. There is practically no wood on any of this apparatus, moulded insulation, which is practically fireproof, being substituted for the wood. Fireproof paint has also been used wherever practicable.

OPEN CARS

The proposition to run open cars on a railway elevated for its entire length was one to which the managers of the Manhattan Railway Company gave considerable thought before a decision was finally reached. The cars have proved very popular, however, and by the system adopted of closing all the entrances before the car starts no trouble has been experienced in the way of accidents to passengers.

The general dimensions of the open cars are as follows:

	Feet	Inches
Distance between center of trucks	33	2
Distance between wheels of each truck	5	0
Diameter of truck wheels	2	6
Length of car body on center line over end-plates	47	1
Width over side sills	8	6
Height of platform over top of rail	3	10⅛
Height of center of draw-bar over top of rail	2	4½

STANDARD OPEN CAR, MANHATTAN RAILWAY

The timber used in the under frame is of long-leaf yellow pine, except the needle beams and end sills, which are of white oak. The side sills are 4¼ ins. x 7¾ ins. with a 8-in. x ⅜-in. steel plate running the full length of the sills. The center and intermediate sills measure 4⅜ ins. x 3 ins. The needle beams, which are white oak, are 5 ins. wide and 5 ins. deep at the ends and 6 ins. deep at the center. The cars are also strengthened by two longitudinal truss-rods extending from bolster to bolster, 1¼ ins. in diameter with ends upset to 1½ ins.

All seats, with the exception of the end ones, have reversible backs. The door-operating mechanism is of wrought-iron, with the sliding bars moving on rollers. The lever for operating the doors is on the end platform.

The weight of the open car body is 16,000 lbs. The trucks weigh 6700 lbs. each, making the total weight of an open car 29,400 lbs. Each bench holds six passengers, and passengers are not allowed to stand up between the seats.

MOTOR TRUCKS

Four hundred of the motor trucks were supplied by the American Car & Foundry Company, and 464 by the Wason Car Company, upon specifications of the Manhattan Railway Company. They are of the swing-bolster type, with 6-ft. wheel base, and the principal characteristics of both motor and trail trucks is their cheapness and simplicity.

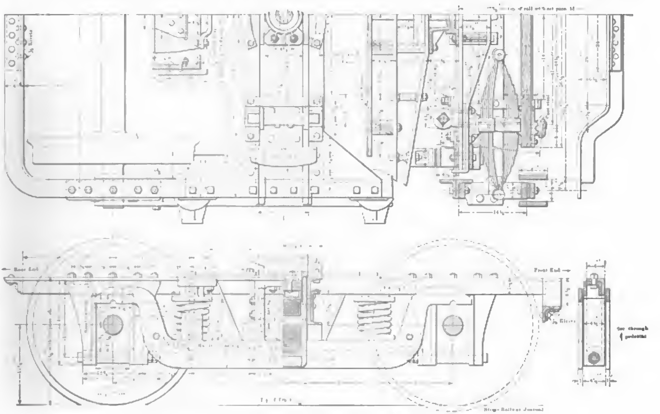
The frame is rectangular and made of angle-iron 4 ins. x 3½ ins. x ⅝ in., 14.6 lbs. per foot. The transoms are made of 10-in. channels, 30 lbs. per foot, connected to the truck frame by ½-in. steel gusset plates, securely riveted and bolted as shown. The bolsters are open-hearth steel plates 8 ins. wide by ⅞ in. thick, placed flatwise and fastened together, as shown in the section. The steel has a tensile strength of 60,000 lbs. per square inch and an elongation of 22 per cent in 8 ins. The spring-plank is made of an 8-in. channel, 13.75 lbs. per foot, with an oak plank fitted to the channel. The pedestals for the journal boxes are of cast steel, and the equalizer bars are of steel 1 in. x 6 ins. in section. The journal boxes are of malleable iron. The journal brasses used are of phosphor bronze lined with babbitt. The phosphor bronze employed follows the Manhattan composition, viz.: 77 per cent copper, 8 per cent tin and 15 per cent lead. The babbitt is made up of 12.50 per cent tin, 1.25 per cent copper, 16 per cent antimony, and 70.25 per cent lead.

The third-rail shoes are of cast-iron, and are somewhat lighter in weight than those ordinarily employed. Although there is not much possibility for variety in pattern in the way of third-rail shoes, one or two points in connection with this part of the equipment is worthy of notice. Owing to the constant vibration to which the shoe and hanger are subjected, rivets are used in the links and elsewhere where possible, instead of bolts, and the "shunts," or leads, from the shoe to the hanger are made in two cables bent out in each direction so as to reduce the danger of breaking. As shown in the cross section the hanger is also made with a toothed slot, where it is bolted onto the truck frame, so that its height can be adjusted without difficulty.

MOTOR-CAR TRAILER TRUCKS

The motor-car trailer trucks have been remodeled from the former trucks used in steam operation, although a few new trucks were purchased from the Baldwin Locomotive Works. They have a 5-ft. wheel base, instead of one of 6 ft., as with the motor trucks.

The truck frame is made of 3-in. x 1¼-in. wrought-iron bars, with reinforced corners. The bolster is made of three pieces of white oak 9 ins. deep, and two 7½-in. x ½-in. wrought-iron or steel plates, the plates being placed between the timbers, and the whole securely bolted together, making outside dimensions 9 ins. high by 12 ins. wide by 5 ft. 6¾-ins. long. The springplank is 2½ ins. x 12½ ins, white oak, 5 ft. 2 ins. long, supported at each end by swing hangers. The pedestals for the journal boxes are of cast iron. The equalizer bars are of forged steel 1 in. x 3 ins., and the center plates of cast steel. The journal boxes are of cast iron.



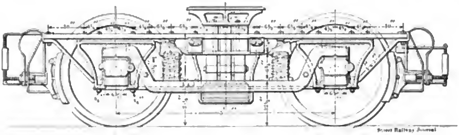
MOTOR TRUCK, GENERAL ASSEMBLY

WHEELS AND AXLES

An important innovation has been made in the design of the wheels used on motor trucks by casting one of the wheels with an extended hub to carry the motor gear. This arrangement, the invention of Messrs. Doyle and Brinckerhoff, of the Metropolitan West Side Elevated Railway, of Chicago, is also used on that road, and is, of course, intended to prevent the breaking of the axle. The breaking of an axle is a serious matter even on a surface railway, but it becomes doubly so on an elevated railway, and for this reason the improvement is one which seems very commendable. A solid gear is used with this patent

hub. While not new, this practice has the obvious advantages of eliminating all bolts and danger of the gear becoming loose.

The cast-steel wheel centers are 28 ins. in diameter, and are fitted with Midvale steel tires, giving a total outside diameter of 34½ ins.



SIDE ELEVATION NEW TRAILER TRUCK

The axles are of acid open-hearth steel, with a tensile strength not less than 80,000 lbs. per square inch, and elastic limit not less than 40,000 lbs. per square inch. The journals are 4¼ ins. in diameter and 9½ ins. long, without collars and with large fillets at inside. The lateral motion is taken up on the journal brass keeper. The trailer wheels have cast-iron centers, with a fused steel tire, and are 30 ins. in diameter.

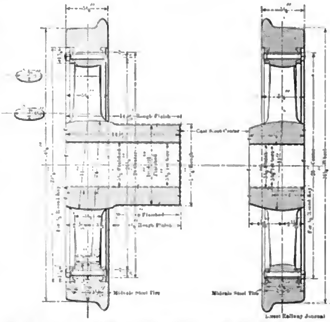
SLEET-CLEANING DEVICE

The electrical equipment of the Manhattan Railway Company was put in operation on the Second Avenue division this spring, so that as yet the company has not had any experience with sleet on the third rail. There is no doubt that this at present is the most serious problem with which third-rail roads have to contend. This question, however, has already been taken up and two types of apparatus have been designed for removing snow and sleet from the contact rail. The first is that of a steel brush operated by means of an air cylinder, and the second, an oil and salt water atomizing or spraying machine.

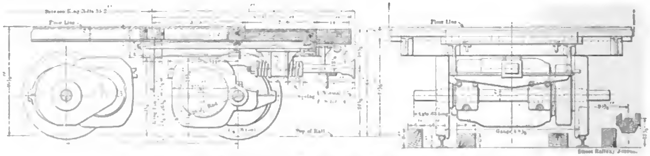
Each motor car is equipped with four steel snow brushes, and there are four motor cars in each six-car train, which necessitates providing means of placing twenty-four snow brushes in action without causing a delay to the train service. With the large number of trains on the Manhattan system, this could not be done any other way than automatically. The brushes are therefore mounted on a piston in an air cylinder, and the four-scraper cylinders on each car are operated by means of a single air cock by the motorman. If the general superintendent decides to put the scrapers in action a notice to this effect is sent to each station superintendent, who displays a sign instructing the motorman to throw the air cock and put the brushes in service. In this way all the scrapers on the entire line can be put in operation within two minutes after the general superintendent decides it is necessary.

In addition, there are ten equipments of oil and salt-water spraying machines on each of the four lines of the system. This spraying machine consists of a tank which contains either oil or salt water, and this material is delivered through an atomizing nozzle located above the contact rail. The object of the oil and salt-water machine is to provide an auxiliary means of preventing sleet from forming on the third rail.

One of the difficulties in removing snow and sleet from a third-rail system, up to the present time, has been the time required in getting the apparatus into action, and, second, improperly designed apparatus. One of the advantages of this system is that all the brushes and also the auxiliary salt-water and oil machines can be got into action within three or four minutes.



MOTOR TRUCK WHEEL, SHOWING EXTENDED HUB FOR SOLID GEAR



MOTOR END OF MOTOR CAR, LONGITUDINAL SECTION AND END ELEVATION

The Monterey Street Railway Combpany, of Monterey, Mex., which was recently organized with American capital for the purpose of building an electric traction system of the city of Monterey, in addition to acquiring some 30 miles of horse roads, has purchased the Empresa lines, which gives the new concern control of the entire street tramway system of that city. Some 70 miles of road will be converted into electric traction. The American interests are represented by the Baltimore banking house of Sperry, Jones & Co.

STREET RAILWAY ACCOUNTING

CONDUCTED BY J. F. CALDERWOOD, ASSISTANT TO THE PRESIDENT BROOKLYN RAPID TRANSIT COMPANY, AND MEMBER INSTITUTE OF SECRETARIES OF LONDON.

The Standard Form of Report Adopted at Detroit

BY J. F. CALDERWOOD

Editorial comment on the principal action taken at the Detroit Convention of the Street Railway Accountants' Association, viz., that on the report of the committee on the standard form of report for street railways, has been withheld from these columns partly owing to the same pressure of work which prevented the writer from attending the meeting, partly to allow opportunity for other expressions of opinion on the subject, but more particularly to enable the writer to review the action of the association as recorded in the minutes of the meeting. The publication of these minutes has come at a date too near the time of going to press to allow of an extended treatment of the matter in this issue, but in the near future it will be taken up in detail and given the attention which many of the radical departures from the established system formerly endorsed by the association deserve. It is to be hoped, in the meantime, that members who had the good fortune to be present at the convention, as well as the others who are now in possession of the proceedings, will send to the writer such comment on the form of report adopted as seems warranted. That the best friends of the association cannot fail to take a great interest in an action of so much importance is, of course, out of the question, and it is probable that many of them feel the sentiment of regret expressed by a member last month at the change from a form of report which has received the endorsement of so many State boards of railroad commissioners, and has been adopted on roads operating some 40 per cent of the total mileage in the country.

The Standard Form of Report

BY H. D. EMERSON

The standard form of report for electric railways, as submitted by the committee to the Street Railway Accountants' Association at Detroit, is of particular interest to those, like the writer, who are called upon to analyze corporation reports and determine therefrom the earning power of securities. We are handed the figures covering the operations of a property and a copy of balance sheets, and we are expected to determine whether the price asked for a specific security is high or low, and give the reasons as deduced from the figures presented. Heretofore the reports of many electric railway companies have been deficient in some of the essential items of information, and the suggested form has been examined with much interest and its details carefully considered.

The income account, as suggested, is a long way in advance of the old form, but appears on the face of it to contain too much detail, and I do not think a readjustment would entail any more work upon the accounting department or eliminate essential items. Primarily an income account should be a condensed statement of the total business of the corporation for the year, and should indicate two entirely different things. It should show first, the total and net profits, and second, the disposition of those profits. The meaning of the word income is well understood, and should not be misused.

The question of the disposition or handling of certain individual items, whether they be charged in one place or in another, is a question which should be discussed on its abstract merits and not from the individual standpoint of any particular corporation. It seems to me that this point was well brought out in the discussion by the association, and unquestionably the advocates of the new form are correct. There can be no question but that the carrying of a net amount into an income account does not exhibit clearly the business done; consequently, the contention that all earnings should be carried into schedule A is unquestionably correct. The English language is a live language, it is true, but at the same time it will not do to neglect dictionary definitions. The sums received for sale of power or the rentals of track or terminals are unquestionably earnings. Taxes, on the other hand, are unquestionably expenses, and any statement of earnings or profits of the company which does not first deduct these expenses is unquestionably misleading to that extent, and in this respect both old and new form are lame.

The functions, however, of a periodical statement or report are not ended when they have shown the items required by investors, but should also show details sufficient to enable judgment to be passed upon improved efficiency in the management of the property or to demonstrate retrogression. In the discussion before the convention this point was brought out, and some of the gentlemen insisted that the inclusion of certain items in schedule A would tend to affect operating ratio. It is just as well to call attention to the fact that the comparisons of the operations of properties by comparing the operating ratio is a fad, which, fortunately, is so thoroughly understood to be a fad that it is not used by up-to-date statisticians. Comparisons are purely relative, and depend for their value and accuracy upon the number of parallel conditions existing in each case. The actual expense of operation is affected by so many conditions that the percentage which the cost of operation bears to earnings is neither a guide nor an index to the relative value of the different properties.

It is, however, a fair guide when applied to the same property continuously or when comparing immediately succeeding or preceding periods. To illustrate, a comparison of the operating ratio of a street railway company now and ten years ago is absurd on the face of it, and it is just as absurd to draw any conclusion as to the relative efficiency of management of two different properties for the same year. Brooklyn Rapid Transit and Manhattan will immediately occur as an excellent illustration.

The income account, as presented, does not seem to be thoroughly consistent, and the titles of some of the items are misleading. But this is easily corrected. There is no reason why details of the principal items, gross earnings and operating expenses, should be carried into schedules and then the details of miscellaneous income be set forth in the general income account. It is clearly understood and should be practically admitted by all accountants that there are two separate and distinct parts to an income account, and that items in one should never be confused with the other. The operations of the plant and the profit produced therefrom must be clearly and distinctly shown, and then afterwards the disposition of that profit should be recorded. How would the following do for the form for general income account, all details being carried into schedules:

Gross earnings from operation..........	$000,000
Less operating expenses..........	000,000
Net earnings from operation..........	$000,000
Add other income..........	000,000

Total income	$000,000
Less fixed charges	000,000
Net income	$000,000
Less dividends	000,000
Surplus to profit and loss	$000,000

With this form of income account the general results of the workings and operations of the property are disclosed at a glance, and if the investigator desires to go into details he can turn to the various schedules showing the item under each principal account, and thus ascertain for himself the comparative efficiency of the management.

The disposition of earnings remaining after charges and dividends have been paid is not a matter which pertains to the business of the corporation for the particular year, and so it should be carried into the profit and loss account and added to the balance brought forward from previous years; specific deductions, readjustment of charges or accounts should be made in the profit and loss account, and there shown as debits or credits.

The considerations underlying the determination of a particular form of report are twofold. It shoud be the aim to produce a simple, comprehensive but easily understood summary of the business of the corporation for the benefit of the management and its security holders, and second, this form should be so devised as to entail the smallest amount of labor on the accounting department, and yet produce results in such detail as will enable mistakes to be corrected and improvement appreciated. Perhaps a better form of income account than the one suggested by the committee might be devised, but the form, as reported, follows sufficiently near established forms, well known and understood by the great majority of investors, to be thoroughly satisfactory to them. If it be accepted by the gentlemen in charge of the accounts of the principal street railways, and the specific definitions of the various items argued upon be followed by their subordinates, the results produced will be much more intelligible to the investing public than statements heretofore submitted. This will tend to produce confidence in the integrity of earnings and will tend to raise street railway investments to a higher plane and broaden the market for this class of securities.

Some Disputed Points Concerning Transfers

BY ARTHUR WENTWORTH

In the very interesting paper at the recent Detroit convention by C. D. Meneely, on the "Registration of Transfers," the point was made that there exists a wide diversity of opinion among railway men as to whether or not transfers should be registered. If anything will serve to dispel these differences of opinion it is such discussions of the subject as that given by Mr. Meneely. There is really not such a wide divergence of opinion as would at first appear to be the case. Mr. Meneely is an advocate of the registration of transfers—for his road. It does not, however, appear that he is of the opinion that the local conditions of other roads may not make the non-registration of transfers advisable. He practically admits the correctness of the position of the advocates of non-registration when he says: "Undoubtedly the fact that the transfers of other lines cannot be turned in at a cash value (under non-registration) prevents the conductor from obtaining fraudulently, either directly or through an intermediary, the transfers of intersecting and transferring lines and converting the transfers so obtained to his own dishonest gain." This makes it perfectly clear that it is not the act of registration which gives the transfer a cash value to the conductor, but the act of substitution of the transfer for a cash fare. When there is no substitution the transfer has no cash value. Mr. Meneely admits that registration of transfers makes substitution easy, but in doing so he is speaking primarily of the practice of registering transfers and cash fares together on a single register.

Will Mr. Meneely not also admit where transfers are registered separately from cash fares that substitution can be effected without great difficulty? Let us assume that a conductor has obtained through a trade twenty transfers of a connecting line which he wishes fraudulently to substitute for cash fares. Now, it is evident that if the conductor has registered faithfully all of his cash fares on a separate clock he must of necessity turn in cash equivalent to the cash fares registered, and he cannot therefore make the substitution. This is the fact upon which the advocates of separate registration build their argument that separate registration is preferable to single registration. But is it not an easy thing for a conductor when he collects cash fares to register them as transfers without exciting the notice or suspicion of his passengers, who are not, as a rule, watchful? This species of fraud can be detected only by a secret-service operator on the car. The uniformed inspector who boards the car en route can not detect it, because if he counts the transfers in the possession of the conductor it will appear that the substitution has been made when the fares were registered. Cash fares board cars at nearly all transfer points, and in a crowded car not even the watchful secret-service operator can always tell whether the conductor collects transfers or cash from his passengers. In a small load he might do so, but conductors who pilfer are themselves very cunning and watchful. When they ring up cash fares on the transfer register they usually select the opportunity favorable for it, and that opportunity occurs many times each day at heavy transfer points on crowded lines. To ring up cash on the transfer register away from transfer points requires more assurance and boldness, but it is undoubtedly frequently done without detection. The percentage of trips covered by secret-service men on a large road is so small in proportion to the whole, and the percentage of rides in which the registration of cash on the transfer register could be detected is so much smaller that it is hardly worthy of serious consideration. We have, therefore, three points upon which nearly all will agree, viz.: First, that registration of cash and transfers on one single register encourages, promotes and makes easy the substitution of transfers for cash fares, and, second, that separate registration of transfers renders substitution a little more difficult, but still enables it to be practiced to a great extent, and, third, where registration of all fares is on one clock a failure to register is equal to a failure to register a cash fare.

It would be interesting to know precisely what advantages the advocates of registration of transfers claim for their theory, but, unfortunately, Mr. Meneely in his paper did not tell us. He argued against non-registration, but his negative arguments will hardly be relied upon to establish the case in favor of registration. The only thing he said in favor of registration was: "It will be conceded, I think, by all practical street railway men that the ideal method of protecting revenue, assuming one uniform rate of fare, and a sure method of preventing transfer trading, would be to register all fares and transfers upon a single register. Under the above assumption the advantages of such a method are obvious." All practical street railway men will not agree with Mr. Meneely in conceding registration of all fares on a single clock to be the ideal method, even

if transfer trading were entirely eliminated, for the reason that every failure to register a transfer is equal to failure to register cash, and the chances of failure to register cash are multiplied by the number of transfers received. The only advantage of registration of transfers that the writer has ever heard of is that it enables secret-service men and uniformed inspectors to check the conductor to better advantage; that it enables the conductor to check himself, or any observing passenger to discover whether all fares are registered. This advantage appears to be entirely nullified by the fact that trading in transfers enables the dishonest conductor to steal by substitution and at the same time register every fare that gets on his car. If any conductor wishes to be dishonest he will naturally select the safest, easiest and most profitable way.

Again, quoting Mr. Meneely: "While the non-registered transfer may not be used by the conductor in this particular manner, its value has not been one whit diminished to the traveling public, to whom the conductor may, within limits, determine by the accounting, either sell or give away rides on the company's cars, which would otherwise go to swell its earnings." The selling or giving away of transfers could not be practiced to any great extent without detection, because it would require the collusion of a great many people to make it profitable. Where so many people are concerned it would be difficult to keep the practice a secret. Moreover, transfers are not like unlimited tickets that are good until used. They have the date of issue printed on them, and must be used on that day, and must be used within a specified fifteen minutes which is shown thereon, and must be used at a specified transfer point. The selling or giving away is not something that is distinctive of the method of non-registration. It may be done just as easily when registered as when not registered, therefore the argument does not apply to non-registration with any force. It is not quite clear what Mr. Meneely means when he says: "The non-registration of the transfer does not eliminate its cash value, except to the extent of preventing trading between conductors, and the consequent substitution of transfers for cash fares." It is not apparent what cash value the transfer has unless it can be substituted for cash. May we not prevail upon Mr. Meneely to be a little more explicit? The opinion appears to be warranted that if the managers and the accountants, who seem to be on one or the other side of this really important question, will take the trouble to state their views clearly it will be found that they differ very little on the essential points.

An ideal method of protecting the revenue and the reason for each step is as follows:

METHOD	REASON
Register cash fares only, and register each one as collected.	Everybody's attention will be focused on the cash. The only way conductors can steal will be through a failure to register cash fares.
Non-registration of transfers.	To destroy their value as substitutes for cash and thereby prevent trading.
The state of the register to be recorded and cash turned in, if practicable, at the end of each round trip. On many roads it cannot easily be done, but the method is ideal.	As a safeguard to the revenue and to avoid giving the conductor opportunity to tamper with day card or trip sheet, as may be done when register is recorded and money turned in at end of day's work.
Transfers to be turned in or placed in a conveniently located box at the end of each round trip, which can always be arranged in one way or another.	To facilitate accounting and avoid opportunity for conductor to juggle with the returns.
To provide an automatic self-recording register which will record on paper the closing number of each half trip.	To show without the aid of register takers the infallible record of each half trip, the record to be turned in by conductor with his cash and checked by the receiver.

Summing up all that has been said, the great and important question remains of devising some method of checking the cash fares and knowing whether they are all registered. The only method known at present is the employment of register inspectors and secret-service agents of a high order of intelligence and loyalty, and laying out their work in the most careful and systematic manner. If the considerable amount of money which some roads are spending to watch the registration of transfers and prevent trading, and money spent for the placing of transfer agents at points where lines operating from the same depot intersect one another, could be saved and devoted solely to watching the registration of cash fares it stands to reason that better results could be obtained. Likewise, if a self-recording register can be found (and two or more are now on the market) the money now being spent for register takers may be also devoted to the purpose of protecting the registration of cash fares. The registration of transfers brings with it so many attendant expenses and complications that it would be better to abandon it and simplify the situation by devoting all the energy and the money available to improved methods of safeguarding the registration of cash fares. The accountants should not deceive themselves by hugging the theory that non-registration of transfers violates the cardinal principle that conductors must account for all passengers carried. Registration is not accounting, but is merely one of the aids to accounting in the same manner as is the case with the gas meter or water meter. It is not intended that all passengers shall be registered or accounted for, since policemen, firemen and employees wearing the proper uniform and badge are usually carried free without registration. The advocates of non-registration claim that the transfer passenger is sufficiently accounted for when the ticket upon which he rides has been collected and returned to the company. His nickle and the transfer issued to him have presumably already been accounted for, and the return of the transfer through the proper channels and within the proper limitations should complete the transaction in all essential respects.

Desires Method of Computing Loss from Transfers

CHICAGO UNION TRACTION COMPANY, ACCOUNTING DEPARTMENT

Chicago, Nov. 20, 1902.

Editors Street Railway Journal:

To comply with a decision of the Supreme Court, this company and the Chicago Consolidated Traction Company have increased the transfer privileges on their lines. I should be very glad to obtain the opinion of your readers among the accountants how shall I arrive most accurately at the loss that will be likely to follow from these increased facilities given the public? Answers through the columns of the Journal will doubtless interest all of our members.

F. E. Smith, Auditor.

As a result of the refusal of the employees of the Havana Electric Railway Company, of Havana, Cuba, to join the general strike of union laborers ordered for Nov. 24 in sympathy with the cigarmakers, the company experienced considerable difficulty in operating cars, and at one time had to abandon the service temporarily.

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DECEMBER 6, 1902.

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Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the JOURNAL *when of general interest, otherwise by letter.*

Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our news columns.

All matters intended for publication in the current issues must be received at our office not later than Wednesday of each week.

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The recent consolidation in New York of the elevated and underground systems has given rise to considerable speculation as to the economy which will be effected by uniting the two properties. In many of the theories which have been advanced a considerable economy in the cost of power has been suggested, but we do not believe that this will result in much, if any, saving, as the amount of power required on the united system could be generated practically as cheaply in two power stations as in one. There will be, of course, some saving in the distribution, as the present Manhattan station can supply the East Side lines of both systems while the new Interborough station can supply the West Side lines; but the principal economy will come in other directions. It will be partly in administration and general expenses, but will lie principally in the fact that the two lines will not be obliged to compete with each other, and, consequently, that the schedules can be so arranged that the maximum desirable operating efficiency can be secured at all times. Another very important advantage will lie in the fact that the extensions of the two systems will not parallel each other. The lower part of New York is so arranged that the main transportation lines have of necessity to be built on the few north and south avenues, but it is not to be expected that the two systems will always remain as they are. Additional mileage will necessarily have to be built in the rapidly developing section of the Bronx, and here the district can be divided so that the extensions will not parallel each other to any extent. In other words, the economies to be effected will lie largely in the department of operation, and this will be considerable, as has been shown by the experience in Brooklyn in the consolidation of the elevated and surface systems.

A problem of most vital interest to street railway companies at this season of the year is that of the removal of snow from the tracks, and in this connection the paper and discussion on this subject at the last meeting of the New England Street Railway Club brought out a number of points which seem worthy of special note, particularly at the present time. It was tolerably well established that no single type of electrically driven snow plow is adequate to meet all classes of storms and service. For suburban or interurban lines subject to heavy drifts in severe storms there seems to be at present little apparatus on the market that can rival a powerful double-truck rotary equipped with from 150 hp to 200 hp in propelling motors, and with about 75 hp in motors geared to drive its fans. Such a plow would weigh about 20 tons, exclusive of its electrical equipment, and it should be liberally supplied with emergency jacks, lanterns, ice chisels, sand, salt and shovels, which, when needed, are wanted badly.

For light storms and general city service some form of nose or radial plow is desirable, and this likewise should be equipped with emergency tools, and should have from 75 hp to 100 hp in driving motors if of the single-truck variety. In all classes of plows the motors should be geared for good acceleration rather than for high-maximum speed, although for suburban service a plow should be capable of getting out of the way of regular cars on clear track, which means a maximum speed of 15 miles to 20 miles per hour in most cases, at least.

The necessity of the personal interest of the operating superintendent in securing enthusiastic, persevering work from the men behind the plows and shovels was strongly emphasized. The company which cares for the physical comfort of its men is far from being a loser in the end, and proper shelter, food and hot drinks have been found to be no mean aids to the snow brigade in its successful campaigns against the storms. The assignment of various sections of the company's territory to the different foremen in the same manner that a fire department chief divides his city among his district captains was also commended.

Another point brought out was the wisdom of cutting down the service by running fewer cars on roads where the power supply is inadequate to operate both regular service and plows. If the plows are to keep the road open for traffic they must in no case fall short of power, and must do effective work in the earlier stages of the storm, being given right of way as far as possible and kept moving.

We regret that more details were not forthcoming at the

meeting in regard to motors, gearing, control of fans, power consumption of fan and propelling motors under various conditions of speed, grade and depth and quality of snow. Such figures, while largely dependent upon the peculiar circumstances which govern the operation of individual roads, are highly suggestive and helpful to managers, superintendents and engineers who have the snow equipment problem to face. Figures on first cost and maintenance would also have been specially welcome in view of the many thousands of dollars which will be paid out by every large road this winter for men and teams. These questions, together with the varying costs of electrically equipping plows, are of great practical interest, and it is to be hoped that in the near future additional data will be published in the interests of electric railway owners and operators.

Considerable space is given in this issue to a description of the third-rail electric railway between Milan and Porto Ceresio, which is interesting not only from the fact that it is the largest interurban electric railway in Europe, and, with one or two possible exceptions, in the world, but also from the fact that the practice in engine design differs radically from that in use in this country. While in this country the Corliss valve with a detachable cut-off mechanism under the control of the governor is almost universally used on all engines of any considerable size in which economy is desired, in Europe, and especially in Germany, the balanced form of poppet valve with two or more openings is used. These valves are usually operated by cams on a weigh-shaft at right angles to the main shaft of the engine, and are rotated by the latter through a pair of bevel or miter gears. The explanation of this practice undoubtedly lies in that on the Continent the engineers have been the pioneers in the use of highly superheated steam, which, as it is probably known to all, is of little value unless the steam is superheated from 75 degs. to 100 degs. F. This, with the pressures now prevalent, from 150 lbs. to 250 lbs. per square inch, means that the temperature of the steam entering the cylinder must be from 440 degs. to 505 degs. From this it is at once evident that expansion and contraction are excessive, making it impossible to use any of the forms of plain slide valve, and while the piston valve may be used if it be made to fit loosely so as to allow for expansion and permit running without lubrication, leakage will be large, and, except at high speed, would discount the gain following the use of superheated steam. As no adequate means has been devised to introduce graphite into the steam, it may be said in general that any form of valve in which one part slides over another should not be used with superheated steam, as at the corresponding temperatures ordinary lubricants fail. Hence poppet valves must be used under these conditions.

Though it would seem from the foregoing that the poppet valve should always be used, there are a number of disadvantages which, combined with more or less prejudice in favor of the Corliss valve, have led the American designer to adhere to that form. Among the disadvantages which have retarded the introduction of the poppet valve into American practice are the increased clearance volume, resulting in a greater loss from that cause, and liability of the valve cracking from the constant shock in those forms in which a releasing mechanism is used, though a carefully designed dash-pot will obviate this. This type of valve also, owing to the small area of the valve seats, is particularly liable to "cutting," causing leakage and necessitating frequent regrinding of the seats. Lastly, the mechanism of the valve gear is of necessity more complicated than the Corliss arrangement.

Collisions on Interurban Roads

Attention has been called several times in recent street railway conventions to the importance of more effective precautions for preventing collisions on high-speed interurban lines. While there are no statistics available as to the causes or number of such collisions over the entire United States, the paper before the New York Street Railway Association last September by C. R. Barnes, engineer of the Railroad Commission of the State of New York, made it plain that these accidents have increased rapidly with the increase of electric railway mileage, and that the larger per cent of them seem to be due to laxity in operating methods and discipline than to any other one cause.

It almost goes without saying at this stage of interurban development that rules somewhat similar to those of steam roads should be adopted as regards tail lights and signals for indicating following cars operating on the same time. The same rules should also apply as regards protecting the rear end of cars stopped unexpectedly between stations.

The despatching system has as its objects the prevention of head-on collisions and the avoidance of delays to all the cars on a single-track road when one or more fall behind schedule time. It is of very little value in preventing rear-end collisions, because the despatching system can never do more than maintain a time interval between trains at stations, and as ordinarily applied does not even insure this, as it leaves the space interval of the trains to the judgment of the individual train crews. Against the giving of wrong orders by the despatcher there is no safeguard beyond the careful selection of the man intrusted with the duty of despatching, and the despatcher is nothing more than human, and hence fallible. The best despatcher is likely at times to make mistakes, but this is one of the inherent weaknesses of the despatching system which cannot be eradicated unless it is by using a block-signal system in addition to despatcher's orders.

Assuming that the orders are given correctly by the despatcher, the next opportunity for mistake is the misunderstanding of orders. The telephone, as a means of transmitting orders, has been condemned as a makeshift by some steam railroad men on this account. On the other hand, certain steam railroads are making an increasing use of the telephone for train despatching in locations where rapidity in the transmission of orders is desirable and the number of trains per hour is large. While the telegraphic train-order system as practiced on steam roads is undoubtedly the most perfect and least liable to error of anything ever devised along that line, we hardly feel that the telephone should be condemned because it has in some cases been used in a slip-shod manner without proper safeguards as to the correct transmission of orders. We do not agree, therefore, with a recent speaker at an electric railway convention, "that the merit of the (telephone despatching) system is summed up in the fact that a train can be handled in ten seconds." Neither do we think that because under certain circumstances this can be done that

the telephone-despatching system is a "dangerous one," or that the safety of any system is directly proportionate with the amount of delay and red tape there is in the transmission of an order and the number of hands that it passes through. Seriously, though, there is room for much improvement in the way train orders are received on very many interurban lines, both the rules regarding the receipt of orders and the way existing rules are enforced. It is true that the telephone opens the door to carelessness in the transmission and receipt of orders, as the telegraph does not, but the use of operators at every switch on an electric interurban road is out of the question, and we are of the opinion that with proper safeguards the telephone-despatching system can be made as safe as the telegraph There is no reason why the wording of a train order cannot be as well understood when received over the telephone by the trainmen as when delivered in the form of a telegram. If it is not, there is certainly something wrong with the rules about receipt of orders or the way they are enforced. The writing down of orders, although taking a few minutes extra time, tends to a clear understanding and also tends to eliminate the sending of ambiguous orders by the despatcher as well. As to whether the writing down of telephone orders as received by motormen or conductors is necessary is a matter upon which there is considerable difference in opinion. A number of steam railroad men now operating interurban lines do not require this; others are of the opinion that it is very necessary. A written order is probably the safest, although, of course, it requires a little more time. With proper order blanks this time need be very short, however.

The despatching system, although necessary on a single-track interurban road of any size, and a tremendous safeguard on any road, has certain inherent weaknesses, as just pointed out, and there is an increasing need on certain interurban lines for block-signal systems, which will add to the security of single-track roads by furnishing an additional check on the despatching system. There are also a few cases where double-track interurban lines have need for block-signal systems for keeping a definite space interval between trains going in the same direction. In the consideration of block-signal systems for single-track roads it has usually been assumed that several successive cars must be allowed to follow each other into a block as different sections of the same train. As long as interurban roads are operated under present conditions such practice will probably be necessary, but, of course, the door is left open for rear-end collisions as long as there is not a definite block or space interval maintained between cars going in the same direction. The tendency in the future will probably be toward shortening up the distance between turn-outs or meeting points, so that cars can be run at more frequent intervals without necessitating two cars in a block between turn-outs at once. Such improvements will be made as traffic increases, not only on the ground of safety, but of expediency, because it will permit greater traffic movement, less delay of trains and the carrying of a greater number of passengers. Of course, it is possible that in the future signal systems will be forthcoming by which signals will be located several points between turn-outs, and so arranged as to maintain a definite space interval between different sections of the same train running in the same direction between two turn-outs. Such a system would give all the security of any block-signal system without the expense of providing turn-outs at frequent intervals.

The block-signal systems employed so far on electric roads can be divided into two general classes, automatically operated and manually operated. Although the automatic signals are admitted to be by all means the most desirable, if reliable ones can be secured, practice so far has been more dependent on manually operated lamp signals. The manually operated lamp signals as frequently used have failed to offer as perfect protection to a car as they could if slightly modified. It is one of the fundamental principles of signal apparatus recognized by the American Railway Association that all failures in the signal apparatus shall be on the side of safety, or, in other words, if the signal apparatus fails, it shall give a danger rather than a clear indication. In steam-railroad practice no small part of the ingenuity of signal engineers is spent in designing apparatus which will never stick in a clear position, and so will never indicate safety when there may be danger. The simple lamp signals so frequently used by electric roads for indicating the presence of a car in a block, and operated by hand switches at each end of the block, are often arranged so that the closing of a lamp circuit gives a danger signal. No signal apparatus should be dependent upon the closing of any circuit whatever for a danger indication. It may be permissible to allow the closing of a local circuit to light red lamps for danger indications, but such circuits should not involve the use of any line wire likely to get broken, and, furthermore, it should be expressly understood when such a signal is installed that the absence of a light indicates danger just as fully as if the red light were burning. With the manually operated lamp-signal system, arranged to work according to these principles, the only chance for a head-on collision would be through the failure of the trainmen to protect themselves by throwing the signal to danger upon entering the block, or direct disobedience of the signal. There is probably an increasing tendency toward the use of semaphores, which indicates danger or safety by their position, rather than to depend upon lamps alone. From an operating man's standpoint the semaphore is desirable. It has been frequently maintained that incandescent lamps are very likely to be burned out, but the same thing might be said with even greater emphasis in regard to magnets placed in block-signal apparatus on an electric road, and such magnets are necessary to operate a semaphore.

The staff system has been frequently mentioned of late and discussed in our columns. The original simple staff system had nothing electrical about it, and consisted simply of a staff, which gave the right of way between passing points to the train which has possession of it. A late modification makes use of a staff instrument at each end of the block, with electrical connections between the instruments and with a number of staffs in each instrument. This permits the movement of a number of trains either way. It allows but one train in a block between staff instruments at one time, which, as we have pointed out before, is really the only sure preventive of rear-end collisions, but which is a practice which many interurban roads would have difficulty in adopting without increasing the present number of turnouts. Nevertheless, with so large a per cent of the collisions, rear-end collisions, this increasing of the number of turnouts is certainly a matter worth considering when a road is investing money in improvements.

The Concord & Manchester Branch of the Boston & Maine Railroad

Electrical transportation has shown such remarkable progress, particularly in the last ten years, that the large steam railroads have been forced to give serious consideration to all matters of electrical development. It was at first thought that the steam roads would be threatened by a new and dangerous sort of competition. Up to the present, however, this has proved to be only for local traffic, and it is a question with the leading steam railroad managers whether this loss has not been more than counterbalanced in most cases by the effect of the electric railways as feeders to the main lines. In New England the steam railroad companies adopted a somewhat different course in dealing with the subject of electric lines in their territory than in other parts of the country. The New York, New Haven & Hartford Railroad Company purchased control of the local railway systems at certain strategic points along its route, as at Meriden and Stamford, and has also equipped with electricity some of its branch lines. The Boston & Maine Railroad Company has also entered the electric railway field, and has recently completed the construction of an electric branch between Concord and Manchester. This railway is also notable from the fact that it is said to be the first electric road of the typical sort to be built and operated by a steam railroad company as an integral part of its general system.

THREE-CAR TRAIN

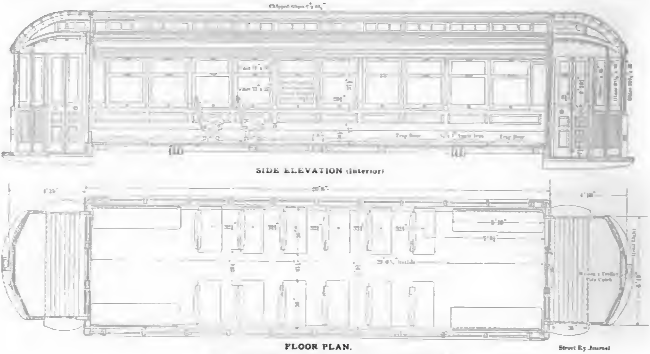
The primary idea of the steam railroad is to give a passenger a "lift" for a longer or shorter distance upon a definitely established line of travel; it is more or less a fixed proposition, the extension of which causes great expenditure of money and energy. The primary idea of the more flexible street railroad, on the other hand, is so to extend its lines as to be able to carry a passenger from his own doorway to practically any destination he may select. The combination of the two ideas is the ideal of modern railway practice, and its most convenient and economical working out must necessitate the operation harmoniously, or else conjointly of steam railroads and street railways in some such way as that undertaken by the Boston & Maine.

The first experiment made by the Boston & Maine was the building and operating of the local system near Portsmouth, N. H., which was supplemental to the steam road, but was operated distinctly as an independent electric railway company. The Concord & Manchester branch, however, is practically a part of the company's steam railroad system, and all the safeguards that are provided for the steam road have been utilized in this electric branch.

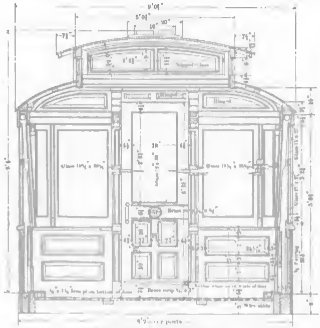
STEEP GRADE AND SHORT RADIUS CURVE NEAR ALLENTOWN

One of the obstacles which has stood in the way of the consolidation of steam roads and electric roads or the

operating of electric roads by steam-railroad managements has been the charter rights of the railroads and the restrictive laws of most States in regard to public highways. In New Hampshire, however, in 1895, an act was passed providing for the organization of street railway companies under the general law, which thus permits existing steam railroads to build branches and extensions in the shape of street railways using electricity as their motive power. The same act allowed street railways to exercise the right of eminent domain in establishing private rights of way, so that now street railway companies can either follow the public highway or their own private rights of way as appears to be most advantageous. Legislation is not yet sufficiently complete to enable an absolute union between steam railroads and existing street railways, but this particular difficulty has been overthrown in part in the case of the Concord Street Railway, operating in the city of Concord and connecting with the electric branch, by having the same officers, the stock being held by Boston & Maine officials as individuals. It is the expectation, moreover, that this difficulty will be removed by legislation in the near future.



SIDE ELEVATION AND PLAN OF STANDARD CAR

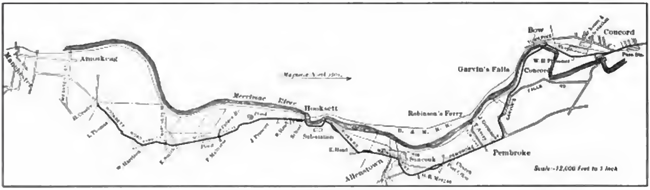


END ELEVATION OF CAR

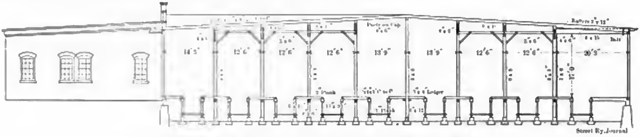
The route of the Concord & Manchester electric branch follows the line of the Merrimac River between these two cities through a picturesque valley sprinkled with typical New England villages and homesteads. The distance between Concord and Manchester by the line of the road is about 16½ miles; the present running time is one hour. It has often been assumed that a roadbed as substantial as that used by steam railroads would cost more than an electric road can afford to pay, but this problem has been solved by the application of steam railroad methods to the

DERAILING SWITCH ON STEAM ROAD AT BOW JUNCTION

street railway field. Instead of the usual method of digging out the highway, putting down ties and rails and throwing in the dirt again, the branch line is ballasted as carefully as if it was intended to be used for standard trains. The highway was dug out to a depth of 2 ft. or 3 ft., as the nature of the grade demanded, and the wornout road material was replaced with clean gravel. This would have been altogether too expensive an undertaking if the usual street railway methods had been employed, but Frank A. Merrill, the assistant chief engineer of the company, laid the roadbed at about one-third the usual expense by the employment of a regular construction train, with dump cars, workmen's cars and steam shovel complete. As some of the grades were as high as 10 per cent, a geared locomotive, such as is used in South American mountain work, was employed. Permission, of course, was secured from the town authorities for the use of a locomotive in the streets, and, although the construction train was possibly an annoyance, its use enabled the railroad to do the work better and quicker, and to the townspeople's permanent advantage. To a considerable extent grades have been avoided. In some places "cuts" and "fills" as heavy as those on the average steam railroad line may be found, and in other places the grade of the whole street was changed at the railroad's expense in order to minimize the wear and tear. The town authorities co-operated in some instances by changing the street lines so that sharp curves would be avoided, and in one case the road was made perfectly straight in this way for a distance of something over a mile. On such curves as could not be eliminated the outer rail has been elevated as in steam-railroad practice.



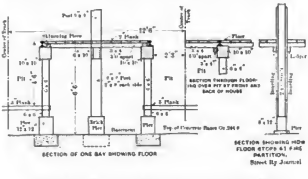
MAP OF CONCORD & MANCHESTER BRANCH



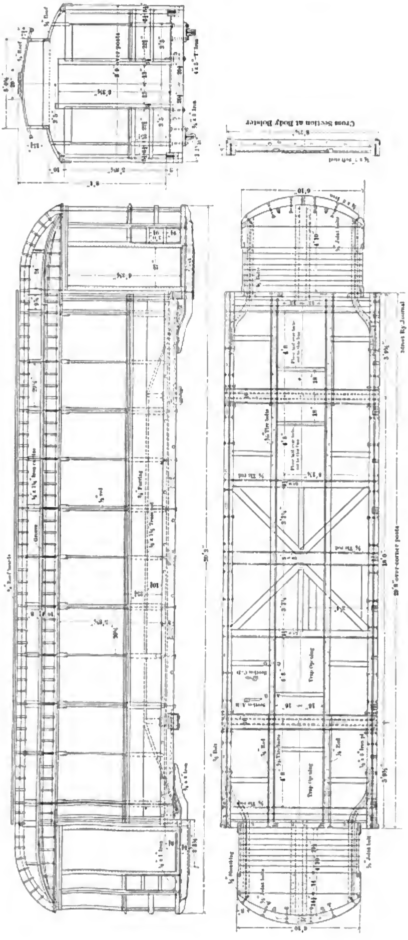
CROSS SECTION OF CAR HOUSE AND SUB-STATION AT CONCORD

In a private right of way near Concord the electric branch parallels for a mile or more the Hooksett branch of the Boston & Maine, and this direct comparison of the two roadbeds shows that there is little to choose between them. At the Suncook River there is a cut and fill, each of considerable depth, and a trestle bridge over the river, and except for the trolley wire the construction would be easily taken for that of a first-class steam railroad. Wherever streams are of sufficient size standard masonry culvert work has been put in and 150 tons of cast-iron pipes have been used for the smaller culverts. At Bow Station, named from the sharp curve of the Merrimac as it leaves Concord and plunges over Garvin's Falls, the river itself

ROTARIES AND SWITCHBOARD, HOOKSETT SUB-STATION



METHOD OF PIT CONSTRUCTION IN CAR HOUSE



SIDE AND END ELEVATION AND PLAN OF STANDARD CAR FRAMING

is crossed on the existing railroad bridge, but all danger of accident is avoided by an interlocking-signal system with derailing switches. In another instance near Concord the highway bridge has been paralleled by a new bridge used exclusively by the street railway, which not only gives greater safety, but less liability to delay, than if the highway bridge were used.

At the present time the line has 16.27 miles of single track and 0.32 of a mile sidings. The maximum grade is 10 per cent and 250 ft. long. There is one curve with a radius of 100 ft. Seventy-two and seventy-six-pound rails are used, and ties 7 ft. long with 5-in. face and 5 ins. thick. Protected double-0000 rail bonds are employed. The highest point on the line is at the corner of Pembroke Street and Broadway, 446 ft. above sea level. The lowest point is at Hooksett, 198 ft. above sea level. The total rise of a car on a round trip from Concord to Manchester and return is 1796 ft., or nearly one-third of a mile. About 80,000 cu. yds. of gravel were used as ballasting, and 80,000 cu. yds. of earth and more than 6000 cu. yds. of solid rock were excavated. Gravel ballast is used to a depth of from 18 ins. to 30 ins.

Section houses are being constructed along the line of the road, and the work of maintaining the roadbed is kept up during the whole year, as upon steam railroads. This is contrary to the usual practice of electric roads, since the roadbed is frequently neglected until it is in need of renewal over almost its whole length. By the practice of keeping section gangs constantly at work it is expected that the roadbed will always be in the best possible condition, and greater comfort will be secured for its passengers. The road is divided into three sections, with a foreman and gang to each section.

The trolley wire used is a 000 grooved copper wire. It is suspended in flexible brackets by means of Anderson LS straight-line hangers and General Electric mechanical ears. For curves Johns' milled ears are used, while the pull-offs are of the Anderson LS type. Especial attention has been given to guying the poles with heavy iron-wire stays wherever there has been danger of the trolley wire being deflected from the center of the line, as, for instance, on hillsides and curves. On heavy curves a double set of poles has been put up. All the electrical work was under the direction of F. D. Hall, chief electrician of the Boston & Maine Railroad.

The road takes its power from the Manchester Traction, Light & Power Company, and also from the Concord Street Railway. The former company has an available 10,000 hp, part of which is transmitted to the sub-station at Hooksett at a pressure of 10,000 volts, three-phase alternating current. At this station it is passed through General Electric transformers and rotary converters and transformed to 550-volt direct current. Aluminum feeder cables equal to 500,000 circ. mils copper cable are used Railroad, and were built in the shops at Concord. They are heavier than ordinary street railway cars of the same length, are 39 ft. 5 ins. long, and are 8 ft. 8 ins. wider. This width makes it possible to have a center aisle of convenient width with two comfortable seats on each side. The weight of each car is 40,000 lbs. They are finished inside in mahogany, and are equipped with large windows so constructed that the whole sash drops into a pocket, leaving the sides open and securing all the advantages of

MASONRY CULVERT, JOINT STEAM AND STREET RAILWAY BRIDGE, ROCK CUT AND LONG GRADE, SHOWING WHISTLING POST AT SIDE OF TRACK

for direct-current distribution. The Concord Street Railway power plant consists of four General Electric dynamos belted to Rollins engines, and has a total capacity of 600 hp. From this station a large aluminum feeder equal to 500,000 circ. mils. copper cable is strung nearly the entire length of the line, and is also tapped onto a large 264-cell storage battery at the Concord sub-station, for equalizing the load.

The cars used on this branch were designed by J. T. Chamberlayne, master car builder of the Boston & Maine

an open car without its disadvantages. Each car has an air whistle, and whistling posts, such as are used to caution locomotive engineers, are found at every street crossing and at other points where the necessity exists. At such points two long and two short blasts are given just as on steam railroads.

The cars, which are eight in number, are mounted on Laconia B3 trucks and are equipped with General Electric multiple-unit control, also with General Electric No. 67 motors, four motors to each car, or about 160 hp alto-

gether. They have electric magnet circuit breakers and Christensen automatic air brakes. Single-motor cars are generally used, but during heavy traffic trains are run with ducing the voltage below 500 volts. The wheel used was supplied by the Laconia Company, and has a 33-in. diameter, 3-in. tread and ⅞-in. x 1-in. flange.

SOUTHERN END OF BOW RAILROAD BRIDGE, USED BY STEAM AND ELECTRIC TRAINS, SHOWING SEMAPHORES AND DERAILING SWITCHES

two and three cars, operated by one motorman, with a conductor for each car. The trolley wheel is form 11, Union standard, which is somewhat larger and heavier than the ordinary trolley wheel, and when operated as in trains the trolley of each car is used against the trolley wire. It has been found by experiment that a train of three cars can start on a 4 per cent grade at the terminus of a line 9 miles from the nearest sub-station without reducing

ELECTRIC ROAD PARALLEL TO STEAM TRACKS

As already stated, the Concord & Manchester electric branch is run entirely on steam-railroad principles with the exception that motors are substituted for steam engines. Printed time-tables are used showing the leaving time at the principal stopping points. Motormen and conductors are obliged to carry watches of standard makes and have them regulated by the official watch inspector, and are compelled by heavy penalties to live up to the running schedule. At the central car house is a train despatcher and at every siding is a telephone. If a car is delayed more than two minutes at the siding the rules require the conductor to call up the despatcher to receive instructions. From steam railroad practice also the joint responsibility of motorman and conductor, as in the case of locomotive engineer and train conductor, has been adopted, and the conductor does not leave the telephone post until he has repeated his instructions to the motorman, so that in case of doubt the instructions may be verified by the latter.

Extra cars are run as sections of the regular car run. Superintendent H. A. Albin, a graduate of the Massachusetts Institute of Technology, who has had charge of this line since its inception, has adopted a device for indicating extra cars, which consists of target signals by day and lanterns by night, both carried on the hood,

corresponding to the colored lights and colored flags carried on the pilot of locomotives to denote following sections. A green light or target on a car means that the line is clear to the next crossing point, while a red target or red light shows that a car is following, and the motorman cannot leave the siding until a car appears with a green target or green light. The absence of signals denotes danger. If for any reason a car be delayed beyond a reasonable limit it loses its regular run and becomes a section of the following car.

This branch road is also unique as a street railway because it has a fully equipped passenger agency in charge of the resident assistant general passenger agent of the Boston & Maine Railroad at Concord, F. E. Brown. One of Mr. Brown's innovations is the use of coupons corresponding to railroad tickets. For example, four fares are

TRANSFORMERS AT SUB-STATION AT HOOKSETT

taken up during the progress of the car over the line. Instead of taking up these four times, necessitating four times of making change with the passenger, the whole amount is collected and a coupon for each interval to be traversed is given. The conductor, after selling the ticket, has only to collect a coupon at each of the four stages of the journey, and it is therefore possible to keep a complete check upon the business and furnish the road with all the statistics required, besides avoiding disagreements as to whether or not a passenger has paid. The fares are registered on a New Haven double register.

An effort has been made to inspire among the employees the same spirit of loyalty that is so often found among men on the steam railroad. Pains are taken in selecting good men and every inducement is given for faithful and permanent service. The Brown system of discipline is used, by which a record is kept of every man. Infractions of rules are recorded by a system of graded marks, and when a man falls below a certain percentage he simply loses his place, but meanwhile he has the right to see his own record at any time, and may claim a hearing on any marking. The record is taken into consideration at the time of the annual examination, which includes tests for color blindness and physical condition, as in the case of steam railroads. Motormen and conductors receive $2 per day as wages.

The superintendent of this street railway system reports to the general superintendent of the Boston & Maine Railroad Company, just as the superintendent of any other division does. The passenger agent's department does the same class of work that is done for a steam railroad, and takes the same care of its patrons. Altogether, although the Concord experiment is young, the officers of the Boston & Maine are convinced that it demonstrates the fact that steam railroads and street railways may work in harmony to their mutual benefit and to the great enhancement of public convenience and comfort.

Rehearing Asked for Chicago Union Traction Transfer Cases

The Chicago Union Traction Company and the Chicago Consolidated Traction Company have asked for a rehearing of their transfer case before the Supreme Court of Illinois. This is the case which has attracted so much attention recently, the decision of the court making obligatory the giving of universal transfers. The companies maintain that they are entitled to a rehearing, because a number of the points that were made by the court were not mentioned in any brief or oral argument, and were of vital significance to the companies. It is also averred that the court has expressed opinions in vital matters which were not issues in the case before it. Some of the points on which the companies relied with much confidence, it is claimed, were overlooked entirely by the court, and that part of the argument seems to have escaped perusal; and, further, that the court has a clearly erroneous conception of the power of the city of Chicago to pass the ordinance which was the basis of the suits. The court held that this power is found in a clause of the cities' and villages' act, which, after conferring upon a city the power to tax, regulate and fix the compensation of hackmen, grants the same power over "all other" individuals or companies pursuing like occupations. The Supreme Court has proceeded upon the theory that all doubts as to whether street-car companies are included in the expression "all others," are to be resolved in favor of the city. The attorneys for the companies maintained that all authorities show conclusively that any reasonable doubt is to be resolved against the existence of any municipal power that may be the subject of discussion.

Railway agents of Salt Lake, who held a meeting in that city recently to consider the question of competition between electric railways and steam railroads, concluded that competition is not the same in all localities. According to the findings, in some localities the competition has been beneficial by building up suburban traffic to a point never reached before. Much of this patronage, it seems, is obtained by steam roads, while in other instances railroads affected by electric traffic have closed way stations, making it possible to give better express service for long distances than was possible before the electric competition.

The Electric Railway in Sydney

The city of Sydney, in New South Wales, boasts of having the largest and most complete electric railway system in Australia. The enterprise is owned and controlled by the government, three commissioners appointed by the Premier for a term of seven years being in direct charge of this department of public service. The work of organization and construction has occupied five years, and the plans of the government provide for still further extension and improvement in the service.

A description of the initial plant for this system was printed in the STREET RAILWAY JOURNAL in October, 1897, but since that time important changes and modifications of the original plans have been made, and the present equipment is, of course, along entirely different lines from those first contemplated. The first electric line in Sydney was installed about 1890, and comprised a short steam line between Randwick and Waverly, which could not be made to yield a profit until it had been converted into an electric road. This experiment was, however, soon discontinued, and the electrical apparatus removed to North Sydney and erected at the terminus of the cable system for an extension to Middle Harbor. The next development was the extension of the Ocean Street cable line as far as Rose Bay, the new part being operated by electricity.

CIRCULAR QUAY AT SYDNEY, SHOWING TROLLEY LINE

This line skirts the shores of Sydney Harbor, and has many steep grades and sharp curves. A view of the circular quay, showing the trolley lines in operation at the present time, is presented on this page.

CENTER POLE CONSTRUCTION ON GEORGE STREET, SYDNEY, BEFORE CHURCH OF ENGLAND CATHEDRAL AND TOWN HALL

From these modest beginnings developed the present city and suburban system for Sydney, which includes 145 miles of track and 527 cars. In the center of the city along George and Harris Streets, center-pole construction with double-bracket arms and cast-iron ornamental bases set in concrete is used. A view of the line passing the Church of England Cathedral and the public buildings shows this form of construction. In all other parts of the city span-wire construction, using both wood and Mannesmann steel poles, has been adopted. Grooved girder rails weighing about 85 lbs per yard are laid on concrete foundation with a wood block roadbed. Both Brown plastic and Washburn & Moen solid crown bonds are used, and copper cables are laid between these tracks and are bonded to alternate rails. These cables are laid against the inner rails of their respective tracks, and the two tracks are cross-connected every 60 yards.

Two types of car have been adopted, both of which are illustrated herewith. One of them was built by the Brill Company, while the other was furnished by the Clyde Engineering Company, of Granville, Australia. Both

Peckham and Brill trucks are employed. Christensen air brakes have also been adopted.

A great deal of attention has been given the problem of collecting fares and arranging rates that would prove satisfactory to the community served and sufficient to support the system. The plan adopted is similar to that commonly used in European cities, and consists in dividing the city into sections. A fare of a penny (2 cents) is collected for each section traveled over. Different colored tickets are issued by the conductor for the several sections, and it is optional with the passenger whether he will pay for one section at a time or for the entire distance he wishes to go at once. Each ticket is numbered, and inspectors are likely to enter a car and examine each passenger's ticket at any time, thus reducing the chance of dishonesty to a minimum.

Power for the operation of this system is furnished by the Ultimo power house, which has lately been enlarged and extended, the original installation having been made in 1898. The old electrical equipment consisted of direct-current generators, but when the new lines were built and the steam roads converted to electricity it was decided to build an addition to the old station and install a three-phase 25-cycle 6600-volt system, with rotary sub-stations. The original plant occupied a building close to the tracks of the government railways and only a short distance from the shores of Darling Harbor, from which a supply of water for condensing purposes was obtained. It is a brick and steel structure, arranged with the offices in front and the engine and boiler rooms behind the offices. Fourteen multi-tubular 300-hp hand-fired boilers, 16 ft. long and 7 ft. in diameter, with seventy-two tubes 4 ins. in diameter, furnished steam for four engine-dynamos. The machines were General Electric direct-current, compound-wound railway generators directly connected to cross-compound horizontal engines built by the E. P. Allis Company, of Milwaukee. The engine cylinders were 26 ins. and 48 ins. in diameter for high and low pressure, with a 48-in. stroke, and their speed 100 r. p. m. Provision has now been made for an additional equipment of three 1500-kw generators with the necessary engines, boilers and auxiliary apparatus, in the extension to the Ultimo power house. The principal features of the completed plant are illustrated in the accompanying views and diagrams. The introduction of alternating-current generators, of course, necessitated the designing of a new system of distribution. Five sub-stations have been built; one each at Newtown, Randwick, Waverly, Hunter Street and North Sydney. In each of these sub-stations, with the exception of that at Randwick, there have been installed two 450-kw rotary converters, six 175-kw air-blast transformers, and two 500 amp.-hour storage batteries, each provided with a 50-kw booster set for charging purposes. Randwick sub-station contains only one rotary converter and one storage battery.

AMERICAN CARS ON SYDNEY TRAMWAY

COMBINATION CAR MADE IN AUSTRALIA

The new building, known as the Ultimo power house extension, was designed by J. G. White & Co. The boiler room is 176 ft. long by 84 ft. wide, and occupies two floors. Two steel coal bunkers, capable of holding 2500 tons of coal, occupy the space directly under the roof. Two chimneys have been built, each 224 ft. high, and are covered with cast-iron caps each weighing 6 tons, and made up of twenty segments. A brick party wall separates the engine room, which is 96 ft. wide, from the boiler room. Foundations have been built for six units, which will permit doubling the capacity of the present alternating-current plant.

The sub-station buildings are brick structures with brownstone trimmings and red tiled roofs. They are divided longitudinally into two parts— one for the rotary converters and the other for the storage batteries, a double interlocking door preventing the fumes from the latter room penetrating the former.

The battery room is 50 ft. long by 40 ft. wide, two stories high. The floor up-stairs is covered with sheet lead, with the seams burnt together, while the first floor is of cement.

The rotaries occupy a room in each station 50 ft. long by 30 ft. wide, one story high, with a monitor at the top. The floor is of cement, and is tiled around each rotary for a

distance of about 2 ft., thus giving a very finished appearance to the machinery.

POWER HOUSE EQUIPMENT

Thirty-two boilers, made by the Babcock & Wilcox

ULTIMO POWER HOUSE EXTENSION BEFORE BOILER ROOM WAS ENCLOSED

Company, are set in batteries of two each, eight batteries on the lower floor and eight on the upper floor. Each the reception of Babcock & Wilcox patent chain-grate stokers. Coal is fed from the overhead coal bunkers by means of iron chutes and feeds over the whole width of the grate, the thickness of the coal layer being regulated by means of the vertically sliding arrangement of fire doors. The stokers are operated by means of shafting and eccentrics. The John A. Mead system of noisless coal and ash conveyors is in use. The apparatus is operated by an electric motor, and includes a crusher operated by a second motor, and twenty center-dumping ash cars.

Three Worthington feed-water pumps are provided, each having two high-pressure steam cylinders 9 ins. in diameter, and two low-pressure steam cylinders 14 ins. in diameter; four single-acting outside-packed plungers 7½ ins. in diameter, all of 10-in. stroke. Each pump is guaranteed to deliver 240 gals. per minute when running at a piston speed of 52 ft. per minute on each side. The two feed-water heaters are each provided with 1500 sq. ft. of heating surface, and are arranged so that the exhaust steam from the boiler feed, circulating and air pumps will be carried through the heaters.

The steam piping was furnished by the Best Manufacturing Company, of Pittsburgh, and extra heavy piping and fittings were used. Ample provision was made for expansion by using wrought-iron bends.

The three main engines were built by the Allis-Chalmers Company. They are vertical, cross-compound condensing machines of the Reynolds-Corliss type, with high-pressure cylinders 32 ins. in diameter, and low-pressure cylinders 64 ins. in diameter, 60-in. stroke, and operating

CROSS SECTION THROUGH ENGINE AND BOILER ROOM OF ULTIMO EXTENSION POWER HOUSE

boiler is rated at 450 hp, has 2852 sq. ft. heating surface, and was built to operate under a steam pressure of 160 lbs. per square inch. The front of each boiler is arranged for at 75 r.p.m. with 150 lbs. steam pressure. The steam from the boilers is led directly into a Reynolds separator placed in the basement, flowing from there into the high-

pressure cylinder, and thence through a receiver and reheater into the low-pressure cylinder. A small motor operated by the switchboard attendant is provided for controlling the speed of the engine within 2 per cent.

Two 150-hp horizontal tandem compound engines made by the Harrisburg Foundry and Machine Works, oper-

OLD ENGINE ROOM AT ULTIMO POWER HOUSE

ating at 270 r. p. m., and each direct-connected to a six-pole 100-kw 125-volt compound-wound generator, are located between the main engines and the high-tension switchboard gallery. These engines are equipped with an automatic self-lubricating device whereby the bearings on the engine frame, crank-pin, cross-head pin and guides will be lubricated from a reservoir of pure oil, which constantly seeks its level, in the engine base beneath the crank-pin. The crank delivers the oil from this reservoir in a continuous supply to the crank-pin, from which it is thrown off by centrifugal force into a pocket provided in the inside of the oil hood, and from this pocket flows through tubes to the crank-shaft bearing, and thence back to the reservoir.

VIEW OF LOWER BOILER ROOM

Each main engine is provided with a Worthington surface condenser which, together with its air pump, is located in the engine basement close to its respective engine foundation. Each condenser has a total of 3600 sq. ft. of cooling surface. Adjacent to the condenser is located a Worthington vertical compound beam air-pump having its steam cylinders of 9-in. and 16-in. diameter, and its air buckets of 20-in. diameter, with a common stroke of 12 ins. The circulating pumps in the boiler room are of the Worthington horizontal compound outside-packed plunger type. The water used for condensing purposes is pumped from Darling Harbor, and the piping is so arranged that any circulating pump can supply any condenser with cooling water. The two condensers for the exciter engines are similar to those for the main engines, except that they are smaller and are provided with combined air and circulating pumps attached to the same steam cylinder. A gravity oiling system is provided for the main engines.

A General Electric 1500-kw 6600-volt three-phase generator, running at 75 r. p. m., is directly connected to each of the main engines. The armatures are stationary,

ONE OF THE NEW GENERATING SETS IN THE ULTIMO EXTENSION POWER HOUSE

while the field poles are attached directly to the periphery of the engine fly-wheel. The fly-wheel hub and spider is a casting in two parts, and the hub is fastened to the shaft by means of six long bolts through the hub and tightened in place while hot. The rim is made up of eight cast-steel segments, four of which are equal to the circumference of the wheel, the other four being placed beside the first four, but arranged to break joints. Forty field poles, which at seventy-five revolutions will give a frequency of 25 cycles, are bolted to the outer face of the engine fly-wheel rim, the bolts passing right through the rim of the wheel. Exciting current is led by means of two cables fastened to one of the spider arms, from the collector ring on the shaft to the field winding. The stationary armature is divided into four parts for convenience of shipping, and are bolted together when assembled, giving an internal diameter of 280 ins. The coils are rectangular, wound on forms and placed in the slots when the armature is assembled.

A raised gallery across the dynamo room, between the old and the new portions of the station, provides an excellent location for the switchboard. There is space on this board for controlling three exciters, two of which are now

installed, six three-phase generators, three of which are at present installed, and five sub-station feeders, all of which are now installed. These feeder panels were placed at the end of the board so that extensions could be provided for without disturbing the rest of the switchboard. There is also an exciter summation and a generator summation panel. The instruments and low-voltage controlling apparatus are mounted on blue Vermont marble panels, while the high-tension parts, consisting of switches, bus-bars and transformers, are placed some distance behind the operating board. Each generator and feeder is controlled by three oil switches connected to a common shaft, which is operated by a lever from the front of the operating board by means of rods and bell cranks. Each oil switch is placed in a separate brick compartment. Arcs which may be accidentally formed in one compartment, cannot be communicated to the others. Generator switches are provided with reverse-current relays which light up a red lamp on the front of the board should any reversal of current take place, but do not trip the switch, as this is not thought advisable. Feeder switches are provided with overload relays, which, in addition to tripping the switch, should the current rise above a predetermined amount, also light up a red lamp in the front of the board, thus drawing the attendant's attention to this switch. Each generator panel is provided with a recording and an indicating wattmeter, a main ammeter and voltmeter, and a field ammeter. Each feeder panel is provided with a recording wattmeter and three ammeters, one for each phase. The generator summation panel is provided with one recording wattmeter, three ammeters and three voltmeters, thus showing the grounding or unbalancing of any phase. Two indicating wattmeters determine the instantaneous power factor. Ammeters, voltmeters and indicating wattmeters are of the horizontal, edgewise type with black enamel finish, while the recording wattmeters are of the round pattern, balanced induction type. Exciters are provided with astatic ammeters and voltmeters, while the exciter summation panel is provided with a Thomson recording wattmeter. Both the exciter and generator field rheostats are placed in the basement and controlled by means of a long shaft with gearing.

WAVERLY SUB-STATION

HIGH TENSION AND EXCITER BOARD AT ULTIMO POWER HOUSE

LAYING HIGH TENSION CABLES IN SYDNEY

A duplicate set of three conductor cables connects the sub-stations with the switchboard at the Ultimo power house. The cables are placed in two troughs and surrounded by an insulating material. One of the troughs in which the high-tension and 600-volt feeder cables are laid is about 8 ins. deep by 11½ ins. wide, while that intended for the return cables is 5 ins. deep by 6 ins. wide. The cables are laid in trenches 3 ft. below the street surface, and are supported by bridges of wood and surrounded by a compound composed of Stockholm tar, resin and sand, the trough being then covered with an iron bark plank held in place by three layers of common brick. Each phase of the three conductor cable is composed of nineteen No. 16 B. W. G. wires (equivalent to about No. 4-0 B. & S.) stranded together and insulated with 7-32-in. paper, the entire three conductor cable being covered first with 6-32-in. paper, then with lead, and outside of all with impregnated jute. The section of the cable running to the North Sydney sub-stations is submerged under the waters

of the harbor, and this cable is armored in addition to the ordinary covering with two layers of No. 11 S. W. G. steel wire, and outside of this with a covering of impregnated jute. Wirt alternating-current short-gap lightning arresters are provided, both at the Ultimo and sub-station ends of each duplicate feeder, for taking care of any electric surgings which may be set up in the feeders due to sudden heavy changes of load or short circuits.

SUB-STATION APPARATUS

The sub-stations are laid out on a general plan and the equipment is similar in all of them. They are provided

ROTARY CONVERTER ROOM IN WAVERLY SUB-STATION

with two six-pole 450-kw rotary converters running at 500 r. p. m. They are provided with four-pole 40-hp induction starting motors. The 6000-volt currents, upon entering the sub-station, pass the high-tension switchboard, and are conducted to two sets of three 175-kw delta-connected air-blast transformers, where the voltage is transformed from 6000 to 375 for use in the rotary converters.

BATTERY ROOM, WAVERLY SUB-STATION

These transformers are cooled by a blower set consisting of a 1-hp induction motor direct connected to a steel-pressure blower. The high-tension switchboard consists of two blue Vermont marble panels, on each of which are mounted a horizontal edgewise voltmeter graduated to read to 8000 volts, and the switch handles. The switches are of the oil type, and are placed in brick compartments, located some distance behind the marble panels. These switches are arranged to trip on an overload by means of relays, a red lamp placed in the front of the marble panel indicating when the switch is open. The 600-volt switchboard is of the ordinary railway type, built of blue Vermont marble, and provided with astatic instruments, circuit breakers, etc. In each battery room is located a storage battery consisting of 280 cells. Each cell contains ten negative and nine positive plates, and is made of wood lined on the inside with sheet lead. The cells are mounted on a wooden platform built up of three 11-inch hardwood timbers placed on edge and floored over. This platform is insulated from the floor by glass blocks, and each cell is insulated from the wooden platform by porcelain insulators, four under each cell. The guaranteed capacity of each battery is 500 amp.-hours. The charge and discharge of the battery is regulated by means of a differentially wound 50-kw booster directly connected to a 100-hp multipolar motor running at 900 r. p. m.

Meeting of the New England Street Railway Club

The New England Street Railway Club held a largely-attended meeting in Wesleyan Hall, 36 Bromfield Street, Boston, on Tuesday evening, Nov. 25. President Farrington was in the chair, and introduced, as the principal speaker of the evening, John P. Conway, of the Old Colony Street Railway Company, of Quincy, Mass., the subject being "Snow Equipment and Organization for Properly Handling Snowstorms—Rotary vs. Shear Plows." This paper has already been published.

In the discussion which followed the reading of the paper, Mr. Rood, of the Worcester Consolidated Street Railway Company, stated that his company had used a rotary snow plow with great success in the outlying districts between Worcester and Clinton. Drifts from 6 ft. to 10 ft. high were cleaned out with little trouble, and lines were kept open without difficulty. Mr. Skane, of Brockton, said that his company had obtained satisfactory results with both rotary and shear plows. With the former they used two W. P.-50 motors to drive the fans on the rotary, and Westinghouse 37-hp motors to drive the plow itself. He had found no trouble with loose paving stones. Mr. Goss, of the Milford & Uxbridge, said that his road uses an eight-wheeled rotary with two small fans on each end, and that winter before last it handled drifts which shear plows could not touch. It was then stated that a nose plow only crushes and presses heavy drifts of snow into a more compact mass, whereas the rotary plow throws slices of snow off to one side and gradually eats its way through.

W. E. Wilder, of Worcester, then presented a paper on the equipment side of the work of snow fighting. He said that it was hardly correct to speak of "rotary vs. shear plows," as there is really no comparison between the two. The shear plow is adapted to handling the lighter snow and the rotary the heavy drifts. It is surprising how little regard has been paid to the steam road experience of the last sixty years, which has cost so much in lives, money and time. Suburban and interurban practice should follow the steam road as far as possible if the lines are to be kept open satisfactorily. No obstruction should be allowed above the head of the rail for a distance of at least 30 ins. on each side. If there is not power enough in the power house to properly run the plows power should be obtained from any source possible. The best way to fight snow is to have enough plows, properly equipped and capable of handling the heaviest storms. Four-wheeled plows are out of the question for either suburban or interurban roads. Mr. Wilder said that he thought an equipment of four 38-hp motors too light for the heavy eight-wheeled plows now in service. Nothing under four 50-hp motors should be put in. When one considers the steam railway plows, driven at from 20 miles to 40 miles per hour by several locomotives, each ranging from 1000 hp to 1500 hp, and weighing from 75 tons to 150 tons, the comparison between the 20-ton electrically-driven plow becomes decidedly marked.

Rapid acceleration is a desirable feature and greatly augments the efficiency of the plow on the electric road.

The wedge-nosed plow has not been much improved since horse-car days. If the resistance of the snow exceeds the weight of the plow, the outfit becomes easily derailed, and it has long ago been discarded by steam roads. Its short wheel base of 12 ft. to 14 ft., compared with its over-all length of from 40 ft. to 44 ft., produces a leverage which easily derails the plow. Rotary plows are especially adapted to sharp cuts and bad places where huge drifts abound. Snow from 1 ft. to 2 ft. deep can be cleaned out at a speed of from 8 miles to 10 miles per hour by a rotary plow, and when 6 ft. to 8 ft. deep, at a speed of from 1 mile to 2 miles per hour. A rotary plow is very handy in raising blockades and

digging out stalled trains. Usually the schedule has gone to pieces when the rotary plow has been called in. Motors that drive the fans are generally speeded too high. The rotary plow quickly does the work of an army of shovelers, and saves much expense and loss by its use under conditions of heavy storm.

The Russell plow is an example of a square or shovel plow, which has been used with great success on steam roads. No records of accidents have yet been made by it. This plow moves snow in the line of least resistance, and cannot be derailed, as every pound of snow on the plow adds so much to the plow's weight, and consequently to the tractive effort. Mr. Wilder then spoke of a plow which he designed last winter for the Worcester Consolidated Street Railway Company, which was very successful. It has plows mounted on each of its two trucks, and is of the radial type, the trucks accommodating themselves to sharp curves easily. A jack can be put on at any point of the plow. There is no leverage, as the forward wheels are but 5 ft. 6 ins. from the very front of the plow, which is 8 ft. wide, with wings extended, and 20 ft. from center to center of trucks. It is 37 ft. 6 ins. over all, and its diggers will remove 3 ins. of solid snow from the rails. A stream of dry sand can be turned in front of the wheels, and no salt is required. It has sheltered double-glass windows, and in operation last winter ran 150 miles at an average speed of 8 miles per hour without being once stalled or derailed.

F. G. Henderson, of Newton, emphasized the importance of a suitable house on the plow for the proper care of the men's comfort, and urged the necessity of the superintendents' getting out with the men in the field and showing a live interest in the work. He suggested a very deep nosed plow, and stated that he had himself laid out the idea of one of the earliest nose plows built in the East, and had watched the development of plows with much interest. Colonel Parker, of the Lexington & Boston, said that his road was largely troubled with snow, which would drift in over stone walls on country roads. He has a plow of the rotary type, being a Peckham double-truck plow, equipped with four General Electric 67 (38 hp) motors, with low-speed gearing for driving the car, and with two General Electric 67 motors, geared for passenger car speeds for driving the fans. Last winter there was but one opportunity to use this plow, but on the Lexington & Woburn line Superintendent Greene has gone through a drift 10 ft. deep and 1000 ft. long in two hours, the plow moving steadily all the time. He figured that it would have cost at least $500 for shoveling if the road had not had the plow. On country lines which drift badly a rotary plow seems almost a necessity. A double-truck plow rides very much steadier and does its work far better than does a single-truck equipment. In ordinary storms a single-truck nose plow is highly satisfactory. The Lexington & Boston also have a large double-truck plow, equipped with four General Electric 57-motors, but this is not required to be used except in the heaviest storms. Colonel Parker added that both of his rotary plows were equipped with air brakes.

President Farrington then emphasized the need of confidence being felt by the man who is operating the plow. He said he had repeatedly seen men run into a drift and turn the power off the moment they struck the snow for fear of being derailed. He said that a man should keep the power on in practically every case, whether the plow was derailed or not, and should stick by his machine, even if it was derailed. He had found it much easier to put a derailed single-truck plow back on the track, and urged the necessity of loading down the plow as much as possible to give it adhesive weight, recommending the carrying of a liberal supply of salt and sand.

The paper by William Pestell, on "Car House Labor-Saving Services," was postponed.

The New York Central After the Electrics Again

A writ of certiorari, granted by Justice Nash, of Rochester, on the application of the attorneys of the New York Central & Hudson River Railroad, has been served on the State Railroad Commissioners.di recting them to certify to their proceedings in granting to the Rochester, Syracuse and Eastern Railroad Company a certificate to construct and operate a line between Rochester and Syracuse.

When the certificate was granted the Central opposed the application. The commissioners stipulated that the trolley line must be built on private property, except where it ran through cities, towns, and villages, its total length being 81.6 miles. In its application for the writ of certiorari, the New York Central Company argues that its line runs through all of the towns concerned between Rochester and Syracuse, by a route six-tenths of a mile shorter than the electric railway. It points out that the West Shore road also runs through most of those places, and that a third railroad connects Rochester and Syracuse by way of Auburn.

The Central points out that it has expended a large amount of money on its road and stations, and that the construction of the proposed electric railway would divert its business and seriously diminish its revenue. The writ is returnable within twenty days.

Efficient Discipline*

BY THOMAS E. MITTEN

Railroad service requires men who are steady and reliable in habits. Efficient discipline demands that they be well-trained and prompt in obedience to orders. In addition to a carefully prepared book of rules, it is essential that there be a well-defined policy covering the method by which discipline is to be maintained, the underlying principles of which must be thoroughly understood by those to whom its enforcement is entrusted. All matters of discipline should be under the general direction of a chief operating head, with whom subordinate officials should be in close touch and accord, and to whom all employees should have the right of appeal.

Much depends upon the selection of new men, and in order that the employment shall be sufficiently attractive to interest the better class of wage earners, a fair wage, at least equal to that paid for a like class of men in other lines of work, should be assured to applicants as soon after they have entered the service as is practicable. The acceptance or rejection of applicants should be entrusted only to those who, from their experience have become good judges of human nature, and are thoroughly conversant with the requirements of the position for which application is made.

The habits and history of each applicant should be carefully inquired into, his physical condition determined, and a conclusion as to his fitness for the service arrived at, independent of any outside influence.

Instruction should be given to new appointees only by the most competent men in each branch of the service, who should believe in and be fully familiar with the policy of the management. It should be thorough and systematic in character and subject to careful review before the final acceptance of applicant is decided upon.

Men who are undesirable do at times secure employment even after the most careful scrutiny of their history and personat appearance, and being on good behavior during instruction, are passed as satisfactory, but prove later to be an actual detriment to the service. Such men should not be allowed the latitude and consideration given to old employees, but removed by prompt discharge as soon as their unfitness is assured.

Other men, during the early stages of their employment, make mistakes which are due largely to an insufficient understanding of what is required of them; such errors are best corrected by subjecting the offender to further instruction, the logical conclusion being that under these circumstances punishment administered educationally will ultimately correct the man of his shortcomings or prove him unfit for the service.

Men employed for a sufficient length of time to have become thoroughly familiar with the dut.es which they are required to perform, have, as a rule, acquired a certain pride in their knowledge and skill, and also in the fact of their extended service. Punishment of any character inflicted upon such men almost invariably humiliates to such an extent as to leave in their minds a feeling of resentment. More can be accomplished, generally speaking, by a plain, straightforward talk, such as will appeal to their manliness.

A book record should be kept covering the history of each employee during the period of his employment, in which proper entry should be made regarding all matters which have a bearing upon the efficiency of the service rendered.

When accused of shortcomings men should be notified by written communication, setting forth their offense in detail, to which they should be permitted to make a written reply, as by so doing they avoid the necessity of being called to the office with consequent loss of time and wage. If the reply is unsatisfactory they should be so informed, and, unless they then appear at the office and make a satisfactory explanation, an entry, covering the facts in the matter, should be duly made on the record.

For repeated infraction of rules, or in case of serious accident, the party at fault should be given a hearing before the officer by whom discipline is administered, who in rendering decision should take into consideration the gravity of the offense with which the man is then charged, the length of time in service and previous

* Paper read at the meeting of the New York Railroad Club, Nov. 21, 1902.

record. In case of a man's discharge being necessary the record will show that he has practically discharged himself, having been given every opportunity to mend his ways before being dismissed. As every effort is made to reclaim erring employees before their services are dispensed with consistency demands that when once discharged they be never again re-employed.

Under this method the number of discharges are reduced to the minimum consistent with the maintenance of good discipline. Employees are made to feel that after having served a company sufficiently long to have become identified with its practice they become a part of its system, and are not to be divorced therefrom unless absolutely necessary for the good of the whole. It should be impressed upon them that their employment is of a fixed and permanent character, promotion being open to all, dependent solely upon the faithful performance of duty and fitness for increased responsibility.

The right of appeal to the chief operating head is considered to be of the utmost importance, in that it insures to each employee a review of his case before an unpredjudiced judge, who should possess the absolute confidence of his men. Without such a court of appeal employees, who feel that they have been dealt with unjustly, having no means of redress, are in some instances almost forced into forming associations for their own protection.

Those entrusted with the enforcement of discipline are also, by this method, made to be more careful in their rulings, and where in any doubt will be found to submit almost invariably the question to the chief operating head for decision before taking definite action, realizing that by so doing they avoid the possibility of being overruled.

Subordinate officials should, wherever possible, be selected from the ranks, preference being given to those who have served as instructors. They should be calm and considerate in their treatment of men, and consistent in the enforcement of rules.

Discipline sometimes becomes lax and inefficient owing to superannuated employees being retained in the service, who from no lack of willingness, but entirely owing to their infirmities, are unable properly to perform their duties. A most satisfactory solution of this question seems to have been found by some of the larger companies, who have set aside a fund for the pensioning of such employees as become incapacitated after long years of faithful service; this not only permits the retirement of those who have outlived their usefulness, but also serves to instill in the minds of all employees a feeling of security and confidence.

Suspension from duty and from pay, which was at one time the generally recognized punishment administered for minor offenses, is rapidly falling into disuse, having proven mischievous in its effects, not only by its leaving the man so punished in a disgruntled state of mind, but in addition often resulting in his family being subjected to severe hardship by the loss of revenue incident thereto.

Arbitrarily discharging employees guilty of violating certain specified rules, without reference to their previous record, was at one time considered absolutely necessary in order to prevent the increase of certain classes of accidents. While the fear of discharge seemed in some instances to make men more careful, very good men were at times necessarily sacrificed to maintain this principle, the result as a whole being found generally unsatisfactory, as the feeling became prevalent that as the best and most careful of men were liable to accident on occasion no man could be absolutely sure of retaining his position.

Within the last few years over fifty-seven railroads have abandoned the methods of punishment formerly used, and are now relying almost entirely upon the Brown system of discipline by record, either in its entirety or in some modified form, it having become apparent that as the requirements of the service grow more exacting, making necessary the employment of a higher degree of intelligence, men with minds capable of such training are not to be controlled by the arbitrary methods formerly used, but that they respond more readily to moral suasion and appeals to the better side of their natures.

The Trolley in the Eternal City

The trolley system is being extended in Rome, and this modern vehicle now traverses many of the ancient highways formerly trodden by the army of the Senate and people of Rome. The seven hills of the city have created considerable difficulty in the way of electric railway construction. This has been especially true of the Quirinal hill, which formed a serious barrier between the old part and the new parts of the city. This difficulty has been finally overcome by constructing a tunnel under the Quirinal, upon which is the royal palace. The eastern end of this tunnel commences near the art museum on the Via Nazionale, and emerges at a point near the Place d'Espagne near the Piazza Collona and the Corso.

Electrical Testing Laboratory

The lamp testing bureau, which was conducted for several years under the auspices of the Association of Edison Illuminating Companies, has, during the last year, extended its field of operations in response to a general demand for a similar organization covering other branches of electrical work. It will be remembered that the bureau was established to meet the requirements of the Edison operating companies for a testing laboratory which would determine the efficiency and life of incandescent lamps and furnish them other data for securing uniformity in practice. During the last seven years this bureau has inspected upwards of 25,000,000 incandescent lamps, and has measured the candle power and life of over 125,000 sample lamps. The work of the bureau has attracted a great deal of attention outside of the field in which its operations have, up to the present time, been confined, and the advantages of having a similar organization equipped for general electrical testing purposes has been recognized, especially by street railway companies, which cannot afford the expense of organizing, equipping and supporting such a department of their own. The lamp testing bureau has been induced to offer its facilities for making electrical tests for purchasers and users of electrical material, supplies and apparatus, so that they may be able to know the properties and values of the goods which they use. It has accordingly fitted up three large floors at 14 Jay Street, New York, as a general electrical and photometrical testing laboratory, and is prepared to test electric lamps, electricity meters, electrical instruments and apparatus, and to provide incandescent lamps accurately calibrated as secondary standards of candle powers, amperes and watts, and Clark cells as standards of e. m. f. A specialty will be made of the calibration of instruments against authoriative standards as well as performance tests of electricity meters. It is also equipped for making extensive tests to determine the accuracy of indicating and recording instruments for railway power stations, and of the complete equipment of electric railway systems. Several electric railways have already taken up the matter of testing their station instruments, their transmission system and the lighting of their cars. This last feature is particularly important on large roads and in the principal cities.

As already mentioned the lamp testing bureau has fitted up three floors, 90 ft. x 23 ft., at 14 Jay Street, for work of this character, and the equipment has been selected entirely with the view of affording facilities for carrying on work of this kind. It is not intended for original investigation, but for commercial testing, covering a very wide range, and at the same time maintaining a very high standard of accuracy. One floor is fitted up as a general electrical laboratory, with portable instruments as well as instruments of precision, including an accurately-adjusted Wheatstone bridge of the Anthony pattern, wound with manganin wire; a Thomson double bridge by Wolff, of Berlin, for the measurement of low resistances and of the conductivity of specimens of wire; potentiometers by Leeds & Co., of Philadelphia, and by Wolff, with a complete outfit of standard cells and with the requisite chemicals and apparatus for the preparation of standard cells; a complete set of manganin resistances by Wolff, running from 0.0001 ohm to 100,000 ohms, which are used as standards of resistance, and, in connection with the potentiometer, for the accurate measurement of direct currents up to 2000 amps.; the platinum dishes and sensitive balance required to make standardizations by the silver voltameter. For alternating-current measurements, besides a very complete set of portable and semi-portable voltmeters, ammeters and wattmeters, there is a Rowland electrodynamometer, with shunt box, by which a great variety of alternating current work can be done, including much that is entirely outside of the range of the ordinary instruments. Standard condensers, keys, secohmmeters are at hand for cable testing, determining coefficients of induction, capacity, etc. Alternating-current instruments are checked or standardized by reference to standardized direct-current instruments, using reactanceless transfer instruments. The standard photometer, which is equipped for making all kinds of photometric measurements, is also on this floor. The accessory apparatus for correcting measurements made with the Hefner amylacetate lamp and the 10-cp pentane lamp, taking account of atmospheric conditions, is also at hand.

On another floor 300 cells of accumulator are arranged in several batteries and used for testing purposes; also a small converter, which can be driven by storage battery current to furnish alternating current for making instrument checks, and vibration-free meter boards, with the necessary arrangement for making accurate tests, and complete laboratory investigations on recording electricity supply meters, using current from storage batteries. Facilities are also provided for testing heavier apparatus.

The equipment also includes a motor-dynamo, which supplies current to lamps on life test, working photometers for life-test measurements, and the racks on which lamps on life test are set up to burn. These racks are at present capable of holding and supplying 1100 incandescent lamps. The various pressures required are supplied to these lamps from a special sectional transformer, the e. m. f. of which is controlled by an attendant constantly on duty. Any integral voltage can be steadily maintained between 100 volts and 150 volts. The finer adjustments of voltage on individual lamps are made by placing suitable resistances in series with them.

Owing to the growth of this business and the expansion of the field it has been found desirable to transfer the management of the bureau to an incorporated company, and provide additional facilities as occasion required. The president of the company is J. W. Lieb, Jr., of the New York Edison Company, and the manager, Wilson S. Howell, who has been in charge of the testing work of the Edison association since its inception. The bureau testing officer is Dr. Clayton H. Sharp, a graduate of Hamilton College, New York, and of Cornell University. Dr. Sharp has also studied in the University of Leipsic, where he undertook special work in physics. He was for a number of years instructor in physics and applied electrictity at Cornell University. Dr. Sharp is assisted by a corps of experts in every department of electrical testing work. Dr. A. E. Kennelly, of Harvard University, is associated with the bureau in the capacity of consulting engineer.

Double-Acting Two-Cycle Gas Engine

The accompanying cuts illustrate the principal features of a new double-acting two-cycle gas engine, designed by Ernst Koerting, and manufactured by the De La Vergne Refrigerating Machine Company, of New York. It will be noticed that the crank end and the head end of the power cylinder are similar to the corresponding parts of a double-acting steam engine, and that the admission valves are located in the valve boxes, which are bolted to the cylinder heads. Exhaust valves are not required, as the products of combustion escape through slots or ports in the middle of the cylinder leading to the exhaust pipe. These slots are covered by the motor piston itself, which is made very long, and is backed at each end by self-closing spring rings. Two double-acting auxiliary pumps are employed for supplying the combustible mixture, one furnishing gas and the other air, and both proportioned so that their combined action insures a proper mixture. The gas and air are compressed to about 9 lbs. per square inch. The compression spaces of the pumps are divided so that the crank ends of the pumps discharge into the crank end of the power cylinder, and the head ends of the pumps into the head end of the power cylinder.

By reference to Fig. 1 it will be seen that the piston is at the outer dead point, and the exhaust ports exposed toward the head end of the engine. In operation, as soon as the piston begins to uncover the exhaust ports the pressure of the residual products of combustion in the cylinder drops rapidly to that of the atmosphere, enabling the inlet valve to be opened and admitting a fresh charge from the pumps. Air only is supplied at first to separate the burnt gases from the succeeding mixture, and afterwards gas and air are admitted in proper proportions. As soon as the exhaust ports are again covered by the receding piston the air and gas pump pistons reach the dead point, and the supply of the combustible mixture is interrupted. The next step is the closing of the inlet valve when the charge is compressed in the cylinder, and ignition takes place at the dead point of the stroke. The ignited charge exerts its driving power and expands with the

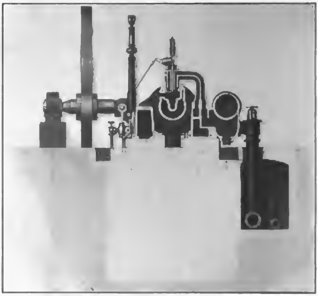


FIG. 2.—SECTIONAL VIEW

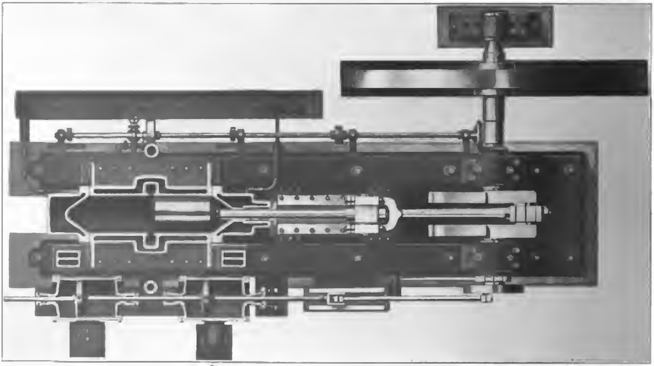


FIG. 1.—PLAN OF TWO-CYCLE GAS ENGINE

next movement of the main piston. Just before arriving at the other dead point the piston uncovers the exhaust ports and the consumed charge is then blown out. The same operation takes place on the opposite end of the piston. The separating layer of air between the hot consumed gases and the fresh charge is insured through a special feature of the gas pump, which is built so that no gas is delivered until after a certain point in its compression stroke is reached. The valve gear in this pump is so arranged that the maximum capacity will not exceed 50 per cent to 60 per cent of the total displacement. The amount of gas thus furnished corresponds to the maximum power of the engine. When the load on the engine is reduced the gas pump begins to furnish gas as a correspondingly later period, thus discharging a diminished quantity of gas into the working cylinder. This is accomplished either by the valve gear of the pump and controlled by the governor, or by a by-pass located between each pump end and respective compression channel which leads to the inlet valve on the main cylinder. The throttling device in this stuffing boxes in the cylinder heads are surrounded by water, and the cylinder walls are also cooled except at the middle, where the exhaust slots are located.

The cylinder is equipped with relief valves, which serve also as safety valves. Hand-hold plates are provided for cleaning the exhaust ports. Experience has shown, however, that the inside of the cylinder remains very clean It was found that even after long-continuous running the exhaust ports especially remained perfectly clean, which is the result of the violent discharge of the burnt gases occurring alternately from right and left. In engines where the gases are always blown out in the same direction, scale or crusts of oil are liable to form, which become intensely hot, and may eventually cause premature ignition. Formation of the oil crusts is further effectively prevented by the cool piston sliding over the bridges that separate the exhaust ports, thus keeping the temperature of these so low that the adhering lubricating oil does not vaporize.

The engines are built in sizes ranging from 400 hp to 2000 hp,

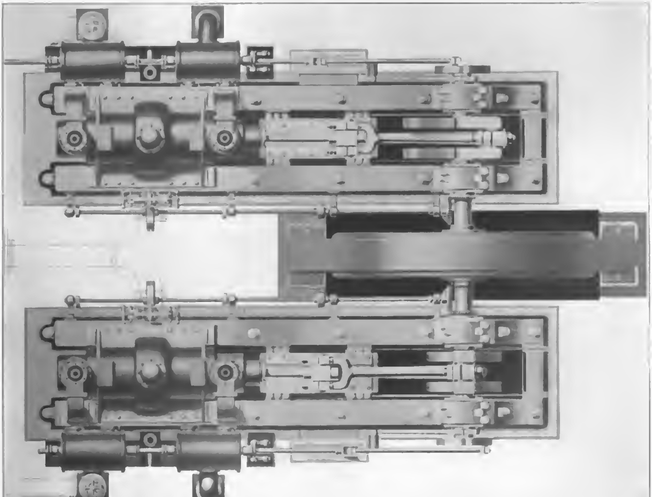


FIG. 3.—LARGE DIRECT-CONNECTED GAS ENGINE AND ALTERNATOR

by pass is also under the control of the governor. The engine, therefore, operates with a variable amount of mixture, and the air first sent into the power cylinder stays near the middle while the combustible mixture remains at the head of the cylinder, near the inlet valves and igniters. Two spark coils at the ends of the power cylinder are operated by a separate shaft driven by spur gearing from the cam shaft, and the regulation is such that the time of ignition can be changed during the running of the engine to suit whatever kind of gas is being used. Moreover, the point of ignition may be set so that it will take place only after the piston has passed the dead point. The engine may be started very slowly without pre-ignition. The engine is started with compressed air; those to which a blowing cylinder is attached requiring less than 150 lbs. pressure and those without such cylinders 90 lbs. to 120 lbs. per square inch. This does not exceed the amount of compression under which the engine runs. The power cylinder and piston are cooled by circulating water, the and are adapted for all classes of power plants. Fig. 3 shows twin Koerting engines directly connected to an alternating-current generator. The revolving field in such machines can be utilized for a fly-wheel.

"The Suburban Railroad and Its Effect on Municipal and Urbana Life," was the subject of a paper read a few evenings ago before the Cleveland Council of Sociology, by W. F. Carr, a prominent attorney of Cleveland. He declared that he believed in lower fare, but said that the earnings of the street railway companies had been greatly exaggerated. He mentioned no names, but incidentally he criticised the politicians who have been making political capital out of the street railway situation. "Let us treat the matter as a business proposition; take the street railway problem out of politics." A plea was made by Mr. Clark for the general handling of all freight by electric railway.

High-Speed Cars for the Wilkesbarre & Hazelton Third-Rail Road

Six combination passenger and baggage cars recently built by

END VIEW OF HIGH-SPEED CAR

LARGE COMBINATION CAR FOR THIRD-RAIL ROAD

the J. G. Brill Company, of Philadelphia, for the Wilkesbarre & Hazelton Railway Company, represent eminently the high standard to which interurban car building has been brought; and in plan, construction and equipment are highly significant and suggestive of the trend of this rapidly developing form of service. The cars have been built in conformity to conditions closely approximating those of steam roads. The line extends through a populous district between the cities of Wilkesbarre and Hazelton, a distance of 40 miles. Outside of the cities T-rails are used and the current will be collected from a third rail. A speed of over 60 miles per hour will be regularly attained between stations, notwithstanding frequent heavy grades, one of which is 3 per cent for 2 miles.

INTERIOR OF PASSENGER COMPARTMENT

The general dimension of the cars are: Length over end panels, 43 ft.; length over platforms, 51 ft.; width over outside sheathing, 9 ft. 6 ins.; height from bottom of sill over roof, 9 ft. 8½ ins.; inside length of passenger compartment, 29 ft. 11 ins.; inside length of baggage compartment, 11 ft. 11½ ins. The side sills are 5¼ ins. x 8⅛ ins., reinforced for the overhang at baggage compartment end of car by ½-in. x 8-in. plates; intermediate sills, 4½ ins. x 7¼ ins. The center sills are double, with ½-in. plates sandwiched between, size over all, 6 ins. x 8¾ ins. The intermediate and center extend from bumper to bumper. Body trusses of 1¼-in. diameter, and double trussed needle beams are amply able to counteract deflection from the unusually heavy electrical apparatus. The flooring is double, the lower being laid transversely and the interspace, 5¼ ins. filled with mineral wool to deaden sound. The double side posts, 5¼ ins. thick, have ½-in. rod running through. The corner posts are 5½ ins. thick. Ten ⅜-in. x 1½-in. steel car lines are sandwiched between extra heavy wooden car lines.

Double sliding doors are provided at the passenger end of the cars, and single sliding door at baggage end. Each side of baggage compartment has a 42-in. sliding door. The sliding door in the partition is panelled, not glazed. The vestibule side doors are hinged to the vestibule post next the car body. These doors, when closed, are locked by the close-fitting of the trap door covering the three risers. Swinging doors leading to trailers have half-drop sash. The motorman's cab in vestibule has sliding door to platform and drop sash in side and front windows. The cab is provided with a hinged set. The upper sashes of the car windows are stationary and are of decorated plate-glass. The lower sashes raise.

The interiors of the cars are finished in solid mahogany, with pilasters handsomely carved and panels richly inlaid. The headlinings are of three-ply curly birch in natural color and decorated in silver. The passenger compartment is seated for thirty-eight. The cane seats are 40 ins. long, and have high reversible backs and mahogany arm rests. Four double seats in the baggage compartment are arranged to drop against the walls. A saloon of standard character and fittings occupies a corner of the passenger

compartment against the partition. The trimmings throughout, and basket racks, are of solid bronze. The cars are furnished with "Dedenda" gongs, automatic air sand-boxes, M. C. B. couplers and two-stem spring buffers. The cow-catchers at either end are so placed as not to interfere with coupling. Their construction is unusually powerful, as will be seen in the illustrations.

The trucks are Brill No. 27-E; wheel-base, 6 ft. 6 ins.; 36-in. steel-tired wheel; diameter of axles, 6 ins.; at gear seat 7½ ins.; at wheel seat, 7 ins.; journals, 4¼ ins. x 8 ins.; length of truck frames, 11 ft. 3 ins.; weight of each truck without motors, 13,000 lbs. The transoms are secured to the solid forged side frames in a manner which insures squareness and enormous vertical strength, namely, double-corner brackets, 1 in. thick, and forged from a single billet, are heavily bolted to frames and inside of angle-irons transoms; single-corner brackets of the same character are bolted to frames and outside of transoms.

An extremely interesting part of the equipment is the brake system, said to be the most complete ever furnished to any form of rolling stock. No less than four braking appliances are used. The outside brakes are operated by two methods: Westinghouse automatic air, and a vertical hand wheel in the motorman's cab. The inside brakes also have two systems of control: Westinghouse magnetic, and a vertical wheel in the vestibule. The cars are arranged for running in both directions, are adapted for use either singly or in trains, and are equipped for head-end train control. The total weight of a fully equipped car is 84,000 lbs.

Snow Melter

In many cities the street railway companies in winter are not allowed to pile up the snow which they remove from their tracks on the rest of the streets, but have to remove it to dumps. This often is very expensive, and considerable attention has been given to the subject of snow melters. Several of these have been tried on the New York city streets, and one of them is illustrated herewith.

This melter, which is placed on the market by the General Supply Company, of New York, uses a hot-air blast, which is brought into direct contact with the snow to be melted. The melter itself consists of a double-end furnace of large grate area, surmounted by a horizontal water jacket of crescent-shaped cross section, with two inverted L-shaped flues. The dimensions of the melter are those of an ordinary truck. It is mounted on four wheels, and may be easily moved from place to place by a team of horses.

The water jacket forms the bottom of an iron frame or box, into which snow may be shoveled direct from the street, or into which a load of snow may be directly dumped. The furnace burns coke and is large enough to hold a cart-load at a time; it makes no smoke and very little ash. All the steam generated in the water packet is expelled through steam jet nozzles into the flues, producing a strong forced draft. The outlets of the flues are so directed that all the intensely heated products of combustion, together with all the steam from the boiler, are forced into the melting enclosure under the snow, and thus all the heat of combustion of the fuel is utilized.

The snow, as it is thrown into the melting enclosure, is struck by a blast of heated gases from the flues and is melted as fast as a gang of laborers can shovel. When the snow is melted the water resulting therefrom runs down the sides of the boiler into a trough which extends around the base of the machine, and from there it is piped away into the nearest gutter or sewer.

MELTING SNOW ALONG TROLLEY ROADS

The melter has repeatedly melted 70 yds. of snow per hour, and with a good fire has run over 80 yds. On one occasion, after a snowfall of 8 ins., it melted the snow from an entire block in 37 minutes. This was at the rate of over 100 yds. to the hour. The amount of snow melted depends upon the skill of the fireman, as the more fuel there is burned the more snow there will be melted, there being no escape for the heat except to melt the snow if the melting inclsure is kept filled.

The average density of new-fallen snow, according to the standard of the United States Weather Bureau, is one-tenth that of water. In other words, 1 cu. ft. of new-fallen snow weighs about 6½ lbs., or 1 cu. yd. weighs about 175 lbs. This new-fallen snow is usually loose and soft. As soon as it is trodden upon or shoveled into heaps or into carts, the volume is greatly reduced, and the weight per cubic yard is correspondingly increased. In actual practice it has been found that a cubic yard of handled snow weighs from 500 lbs. to 800 lbs. Running at 50 yds. per hour, therefore, the snow melter will melt about 25,000 lbs. to 40,000 lbs. of snow per hour. Theoretically, 1 lb. of coke will melt 103 lbs. of snow at the temperature of 32° F.; hence, to melt 40,000 lbs. of snow about 400 lbs. of coke per hour would be required, provided there was no loss of energy whatsoever. In actual practice it has been found that the snow melter, running as above, burns about 500 lbs. to 600 lbs. of coke per hour. At this rate the efficiency of the machine is from 66 2-3 per cent to 80 per cent of the total energy expended. Assuming the cost of coke to be $5.00 per ton, the cost of running the machine per hour would be from $1.00 to $1.50 for fuel. As the machine melts 50 yds. of snow per hour, the fuel cost per yard would be from 2 cents to 3 cents, plus the cost of horses, driver and fireman, or, perhaps, 2 cents per yard, making a total of less than 6 cents per cubic yard.

New Type of Trolley Wheel

The New Haven Car Register Company, which some time ago signalled its departure from the field of fare registers only by bringing out a number of other devices, has recently put on the market a new trolley wheel. A view of this wheel and diagram showing the shape of the groove are published herewith. The

NEW TROLLEY WHEEL

SHAPE OF GROOVE

wheel itself is made out of a special compound for which a long life is claimed, but the special feature of the wheel is the bearing. The hole for the shaft is first drilled and then rifled, and into the interstices thus left a special lubricating graphite compound is forced under hydraulic pressure. The result is that the wheel has an automatic lubrication, in fact the manufacturers insist that the bearing is not to be oiled. A number of these wheels have already been put in service, and are reported to be giving very high records as regards mileage.

The International Traction Company, of Buffalo, is operating special cars for smokers in Buffalo. They are small open cars, run as trailers, and have proved very popular.

High-Voltage Transmission Insulators

The accompanying illustration shows a high-voltage transmission glass insulator manufactured by the Brookfield Glass Company, of New York. This company has been very successful in the manufacture of glass insulators for high-voltage work, and the one

HIGH-VOLTAGE GLASS INSULATOR

illustrated was constructed for a transmission line carrying 45,000 volts. The diameter of the insulator is 7½ ins.; its height is 5½ ins., and the distance measured around the insulator from the cable to the pin is about 12 ins. The groove for the cable is 1¼ ins. in diameter, and the weight of the insulator is 4½ lbs.

New Trolley Wheel and Harp

A new trolley wheel and harp, embodying novel improvements, are herewith illustrated. Fig. 1 shows the device from above; Fig. 2 is a side view; Fig. 3 a longitudinal section, and Fig. 4 a section taken in the transverse and in direction of the axle.

These improvements relate to the harp, wheel, axle and its bearings. The wheel, *A*, is a composite wheel, consisting of the grooved central conductor, *B*, made of an alloy of best mixture for being revolved by tractive force from a line wire without liability of rapid reduction of the metal. This grooved conductor is liable to become worn, and is therefore arranged to be removed readily and replaced, the movable part being inserted between the iron clamping-plates, *C C*. It is electrically connected with the same. This composite wheel is mounted on a hardened steel axle, *D*, and is removably secured in its hub, so that it may freely revolve with the wheel when the latter is revolved by the action of the line wire, *W*. The holding of this axle with wheel, *A*, is effected by spline, *a*, rigidly secured to the wall of the axle and fitting in the seat, *c*, provided in the hubs of the clamping-plates, *C*, as seen in Figs. 3 and 4. This axle contains a central chamber, *E*, which serves as

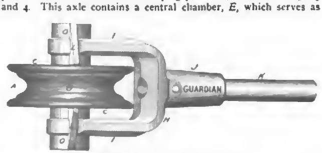


FIG. 1.—TROLLEY WHEEL AND HARP

a reservoir for a lubricant and feeds the latter to the outer surfaces of the journals, *e e*, of this axle, through the ports, *f*, shown in Fig. 4. The outer ends of this central reservoir, *E*, are temporarily closed when filled, by disks, *g*, of heavy paper board, for preventing the escape of the lubricant by way of the ends of the axle. The journals, *e e*, of this axle project laterally from the clamping-plates, so as to give to the wheel an extensive axle-base and ample area for best electric connection with the bearings carried by the harp.

The harp, *H*, is provided with branches, *I I*, which are horizontal in relation to the stem, *J*, which receives the arm, *K*, of the trolley pole. In this form of construction of the harp, the inclination of stem, *J*, operates to guard the wheel from entanglement with span wires and adjuncts thereto, should it accidentally jump from the line wire, while at the same time the horizontal upper edges of the branches, *I*, operate to cast the transverse span wires

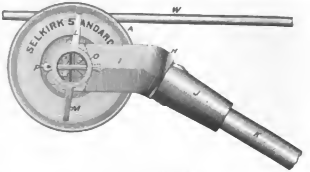


FIG. 2.—SIDE VIEW

upward towards the crown of the wheel for free passage rearward of the same. This harp is also provided with upper fenders, *L*, and lower fenders, *M*. These fenders operate to prevent the line wire and the switch plates from engaging with any portion of the harp when the wheel has escaped from the line wire.

The journal ends of the axle, *D*, have their bearings in bush form pieces, *N*, which are held in the eyes, *O*, of the harp, by cotter-pins, *P*, holding with the wall of the eyes and also with one of the transverse grooves provided in the end wall of these bush form bearings, *N*. These pieces, *N*, may be rotated in either di-

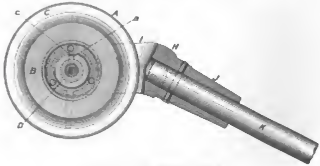


FIG. 3.—SECTIONAL VIEW

rection, and also be withdrawn from eyes, *O*, by means of a suitable screw-threaded hole in the end closing walls of those pieces.

This harp and wheel are manufactured by the Railway Appliance Company, of Albany, N. Y. The trial services of these wheels, for three months under supervision of Alexander Selkirk, the general manager of the company, and inventor of the improvements, have convinced those who witnessed their performance that this wheel is adapted for city and long-distance and high-speed service.

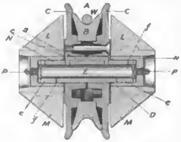


FIG. 4.—TRANSVERSE SECTION

Wheels with central conductors of 3⅛-in. diameter of groove bottom, after running continuously for four weeks, and covering 3300 miles, show a wear of the groove bottom of less than 1-16 of an inch all around, while others in service forty days, running 4800 miles, show a reduction of only one-eighth diameter of the groove bottom. In this wheel the diameter of the groove bottom is 3⅛ ins., requiring less than 6500 revolutions per mile, while at the end of the service the diameter of the groove bottom is only 2 ins., requiring 10,000 revolutions per mile run. These service trials of this wheel show that the central conductor, *B*, will run over 18,000 miles before being worn out and required to be replaced by a new piece.

These trial records also showed that the balance of these wheels were perfect from first to last, with their centers of revolution coincident at all times with the centers of their axles, so that with good lubrication of the journals of the latter, drag of the line

wire on the wheels was only nominal, and not such as would wear the wire. It was also found that with proper pressure of the wheels to the wire the contact evidently was constant, as vibrations from these wheels could not be felt by the conductors through the trolley rope. The wheels ran silently and without sparking, and not a fuse was blown out on any car during the trial.

The Railway Appliance Company proposes to furnish on order with each assembled harp and wheel, an extra central conductor, *B*, axle, *D*, and bush bearings, *N*, (one pair) for replacing the similar original parts when worn out, so that those extra pieces may be in readiness for replacing the worn parts when removed. A lubricant charger, axle remover and wheel holder are also furnished for convenience for removing and replacing the wheel and axle and charging the latter with lubricating substance.

Pneumatic Painting Machine

The substitution of spraying machines for the paint brush constituted one of the most important savings in the economy of labor which has been effected by the use of machinery. Many thousands of these machines are in use in the United States for painting or whitewashing large surfaces. The purposes to which they are largely put in railway service are the interior and exterior painting of power stations and repair shops and the painting of cattle guards, freight cars and structural work of all kinds. The average labor cost of brush work is said to be from 12 cents to 15 cents per 1000 ft., while the cost with a machine is not over 1 cent for coating the same surface.

Painting machines do not work on the principle of squirting the paint against the object to be covered, for paint is expensive, and such a method would be wasteful. The machines discharge the liquid through a hose and special nozzle, in the form of a kind of misty spray, which gives a uniform and even coat and which will go into cracks and crevices in a way which is impossible with a brush.

PNEUMATIC PAINTING MACHINE

The accompanying engraving shows the Hook pneumatic painting machine, manufactured by F. E. Hook, of Hudson, Mich. The paint or whitewash is forced through the hose by pneumatic pressure, which is provided by a brake lever, as shown in the illustration, and which is arranged so that after pumping for a short time the pressure is sufficient to emit a spray for at least ten minutes without further operation of the pump. The valves are located at one side instead of directly under the pump, so that the liquid passes through the valve chamber into the receptacle without coming into contact with the plunger of the pump. The receptacle is made of 8-in. steel boiler tube, with heavy reinforced heads, and the complete machine is mounted on a substantial platform. Ceilings of the ordinary height can be reached by means of an extension head accompanying the machine, and without moving from the floor. The pump is so arranged that the paint or whitewash is kept in agitation before being sprayed, and is thus thoroughly mixed. Mr. Hook manufactures paint for use with the machine, but nearly any of the mineral or lead oxide oil paints can be used in it.

The American Car Company

The American Car Company, of St. Louis, has elected permanent officers. The business and good will of the old company, it will be recalled, were purchased some weeks ago by J. G. Brill & Co., of Philadelphia, and local parties. It was reincorporated at an increased capitalization under the name of the American Car & Truck Company, but the old name has been readopted. It was partly on account of this change that the permanent officers were not announced before, although they were chosen about two weeks ago. The officers are as follows: John A. Brill, president; L. E. Curwen, vice-president; James Rawle, treasurer; H. A. Morseman, assistant to the president and purchasing agent; John R. Williams, secretary and assistant treasurer; George H. Tontrop, sales agent; W. J. Mackle, superintendent. Messrs. Brill, Curwen and Rawle are of Philadelphia and officers of the firm of J. G. Brill & Co., while the other officers are of St. Louis. Mr. Morsman was formerly agent for the Pacific Express Company at St. Louis. Mr. Williams was formerly secretary and treasurer of the American Brake Company, and Messrs. Tontrup and Mackle were connected with the old American Car Company. Improvements ordered by the new company are being made at the plant, which is to be practically doubled as to capacity and placed in thorough condition. A new lighting and heating plant is being installed, and 200 workmen are now employed at the works.

Wireless Clusters for Car Lighting

Wireless clusters are desirable in any class of electric wiring, but they are especially so in car work, where the tangle necessary to wire an old-style cluster fixture is to be avoided. The Benjamin wireless clusters, which are among the best known of this class, have the electrical connections as solid pieces of the fixtures. As soon as connection is made to the binding screws the cluster is ready for operation, as there are no wires save the two leads. These clusters consist primarily of an insulating base of porcelain, two one-piece contact plates attached thereto (each serving like terminals of all lamps in the cluster, and each provided with a binding screw), and a removable casing of brass or aluminum, supported and insulated by porcelain rings or bushings of special design. In eliminating wires in the cluster body by combining the necessary elements of the sockets upon one base the cost of installation is considerably reduced, and a neat, strong, durable and well-insulated cluster results. In the series clusters the contact plates are made in sections, each section, except the two carrying the binding screws, serving two adjacent lamps, so as to connect them in series. The car cluster of two lamps shown herewith is especially designed for car work and low ceilings, where opal reflectors are preferred. The reflector is firmly held between rubber rings, which protect it from the vibration of the car These clusters are made by the Benjamin Manufacturing Company, of Chicago.

CEILING CLUSTER FOR STEM

WIRELESS CAR CLUSTER WITH REFLECTOR

Litigation Over Subway Rights

An effort is being made by counsel for the Underground Railroad Company of the city of New York and the Rapid Transit Railroad Company, to secure an early hearing by the Supreme Court of the United States of the suit against the city of New York, the Rapid Transit Commissioners and the Rapid Transit Subway Construction Company. The suit was brought in the Federal Court for the Southern District of New York on July 5, 1901, by the plaintiff companies to restrain the building of the New York subway, under

claim of violation of prior rights granted by the State to those companies for its construction. The bill was dismissed from the District Court owing to lack of jurisdiction, but the question was certified to the Supreme Court in connection with the appeal taken from the decision by the lower court. The complainants aver that the case also involves the question whether the act authorizing the construction of the subway is not in contravention of the Constitution of the United States, and whether or not the act is void because it increased the debt of the city of New York beyond the limit permitted by the State Constitution. Counsel urges as reason for an early determination of the suit that the case would not in its regular order be reached and decided before the early part of 1904, whereas the defendants have announced in public prints that the operation of the underground railway will be begun during the year 1903.

Cooling Railway Motors

C. O. Mailloux and W. C. Gotshall, of New York, have obtained two patents on systems of cooling electric railway motors by means of compressed air, which, it is believed, will greatly modify the limitations that are at present encountered in electric railway practice. It is pointed out that the size and capacity of the motor is restricted by the track gage, and that the number of motors per car cannot exceed one for each axle, which gives a four-motor equipment for the ordinary double-truck car. The size of each motor depends upon the space available on the trucks, and this in turn depends upon the diameter of the wheels and on the length of the wheel base. The power limit of each motor depends upon its ability to commutate satisfactorily when carrying heavy currents, and to dissipate the heat due to motor losses and to keep its temperature below permissible limits.

In high-speed rapid transit work, especially in operating heavy trains with frequent stops and at a high-schedule speed, it has been found necessary greatly to increase the size and weight of motors, not only because of the commutation requirement, but largely on account of the temperature requirement. The high speed and the acceleration requirements tend to increase the heating of the motor, and for this reason they must be operated at a lower output than would be allowable under more favorable conditions. In some cases it has been found impossible to attain and to maintain a desired schedule speed, merely because the attempt to do so involved the running of motors at a mean rate, which caused their temperature to exceed the permissible limits. Under the circumstances it is very desirable to employ artificial means of cooling the motor, so that the heat due to copper and core losses may be more rapidly dissipated, and at the same time the output of the motor increased.

It is to meet these requirements that the system proposed by Messrs. Mailloux and Gotshall has been worked out. The motor cooling system may be supplied with compressed air from the same source as that which serves the air-brake system, or from an independent source. The air is conveyed through suitable pipes, having flexible couplings leading into the motor case, the air being distributed inside the motor frame between the field coils by means of perforated pipes. Three methods are suggested for controlling the supply of air to the motor. The first is by hand control, in which the exhaust vents of the present air-brake system are made to return the air through an exhaust pipe in such a manner that the air from the air-brake cylinders, instead of being exhausted into the outer air when the brakes are released, is sent through the cooling pipes into the motor cases. The second method consists in the use of automatic devices, whereby air is periodically allowed to flow for a determinate period of time from the air storage cylinders into the cooling pipes. The third method consists in the use of thermo-static devices, whereby air will be allowed to flow from the air storage tanks into the cooling pipes whenever a certain limiting temperature is reached.

It is claimed that the introduction of such means of artificial cooling will enable the size and the consequent cost of a motor equipment required for a given high-speed service to be materially reduced, and that in cases where a given motor equipment has reached its limitations, owing to excessive heating, the motor output may be materially increased, so as to enable the rate of acceleration and the number of accelerations in a given time to be both increased, thereby enabling a much higher schedule speed to be attained than would be possible without such means of artificial cooling. The use of artificial means of motor cooling would also permit the introduction of methods of electric braking in many cases where such methods would not now be permissible, owing to the fact that the motors are already overworked, and that the attempt to use the motors as generators in braking would heat them beyond proper temperature limits.

Chicago Union Traction Finances

Financial affairs of the Chicago Union Traction Company have been a fruitful subject of discussion the past week. The company was taxed into a deficit last year, and even higher taxes are threatened for this year. The increase in wages of conductors and motormen decided upon by the recent arbitration will cause an additional drain on the company's income. The giving of universal transfers as recently required may cut into the gross receipts, but it is too early to determine that.

General Counsel W. W. Gurley appeared before the capital stock committee of the State Board of Equalization last week at Springfield, Ill., and entered a strong protest against the way his corporation has been taxed recently.

Last year the board placed a valuation of $40,000,000 on the stock and bonds of the Union Traction. Judge Grosscup cut this to $23,000,000. Mr. Gurley said his client would be satisfied with a valuation of $23,000,000 this year, but to go above that figure would be robbery and an outrage, and the company, if the $40,000,000 assessment is made, would have to cease to exist.

"The idea that the public sales of common stock at 15 and preferred at 35 should form an estimate of the value of shares of stock is not just," said he. The uncertainty of franchise renewals renders the value of stock and bonds very precarious.

"Every one knows that the franchises will never be renewed, except upon terms much more onerous than those now enjoyed by the company, and some of the terms that will be demanded are just and right. The most conservative estimate shows that it will require from $10,000,000 to $15,000,000 to equip our property in the manner that will be demanded by the public, and in addition to this the city will undoubtedly demand some compensation for the franchise.

"With this staring us in the face, where in the world are we going to get the money if these taxing bodies continue to impose these unreasonable burdens upon us.

"I am not here," continued Mr. Gurley, "pleading for mercy. I am here for simple justice. As a matter of fact the owners of the Union Traction Company made a bad bargain when they took in these leased lines, and last year our deficit, after paying operating expenses, maintenance, and fixed charges was $247,000, not including the back taxes of $143,000 which we were compelled to pay."

The assessment of $40,000,000 placed by the board last year against the stock of the Union Traction Company and its subsidiary lines, would, the attorney repeated, ultimately drive it out of business if persisted in, he contending it was twice the real value of the property, judged from its carrying capacity.

James H. Eckles, treasurer of the Union Traction Company, in commenting on Mr. Gurley's remarks in one of the Chicago papers, says:

"What he means is that if the exorbitant taxation to which the Union Traction Company is now subjected is continued there can be but one issue in time. What he said of the Union Traction Company could be applied to other public utility and private corporations which are suffering from this unreasonable taxation. No matter how strong they are, they must succumb to it in the end. This is particularly true, however, of the traction company, because it appears to have been especially singled out as a victim of taxation.

"The assessing boards have been unreasonable with it, and Mr. Gurley simply pointed out a naked truth when he said that this course followed for some time would bring disaster."

"Where Mr. Gurley said, 'The end of the traction company is almost here, and you can touch it,' did he mean that any dissolution of the company is now contemplated?" Mr. Eckels was asked.

"Not at all," was the reply. "There is no such thing contemplated. He simply meant that such exorbitant taxes as those to which the company has been subjected recently would wreck even the strongest concern."

Casting Foundry for St. Louis Car Company

The St. Louis Malleable Casting Company, capitalized at $325,000, has been incorporated by interests identified with the St. Louis Car Company, of St. Louis, Mo., to build an immense casting foundry adjoining the works of the latter company at North Broadway. The new plant will cover about 5½ acres of ground, and will employ between 300 men and 400 men. This further development of the immense plant of the St. Louis Company shows strikingly the increased demand for the products of the company.

NEWS OF THE WEEK

Relief for Brooklyn Bridge Crush

It is understood that the American Bridge Company, which has been awarded the contract for installing four additional loops at the Manhattan terminus of the Brooklyn Bridge, so as to relieve the congestion of traffic at that point, will begin work at once. The plan will necessitate the removal of a large part of the mezzanine floor of the bridge and the cutting away of some of the stairways. All this work, however, is to be done at the expense of the Brooklyn Rapid Transit Company, and the traffic across the structure will not be interrupted while the alterations are going on. The new loops will be inside of those on which the cars run now, and there will be a distance of about 40 ft. between them. This will give additional standing room while persons are waiting for cars, and while no more cars can be run across the structure, there can be more at the terminal, and this will relieve the crush which is now caused by the crowds having to wait for the car desired.

Louisville Railway Company to Extend Lines

The Louisville Railway Company, now that the improvements in its city lines are practically completed, plans to build an extensive system of suburban lines to extend to Jeffersontown, Fishersville, West Point, Shepardsville, Worthington and Huber's. In fact, the system of lines that it is proposed to build will give Jefferson County a complete interurban system, with Louisville as a center. The first of the projected lines will extend from Louisville to Jeffersontown, a distance of 13 miles, and its construction will be begun at once. It is expected that this line will be completed by July 1. The plans of the company for building the other lines are very indefinite at this time, but preliminaries can be arranged this winter, and next year it is probable that a number of lines will be under construction. About two years ago Louisville became a mecca for electric railway promoters, but the only line that resulted from the agitation at that time is the Louisville, Anchorage & Pewee Valley Railway, which has for several months been operating successfully a line between Louisville and Anchorage, extending into the Pewee Valley.

Four-Track Line at Los Angeles

The Huntington syndicate, which, in the lines it now operates from Los Angeles to suburban points, under the name of the Los Angeles Railway and the Pacific Electric Railway, has a system of suburban electric lines that many of the large cities in the East might well be proud of, has in contemplation the construction of additional lines that, though they will not reach the total mileage of some of the systems extending from the large cities, will, in one respect, be particularly novel. The unusual feature is to be found in a belt line which the syndicate plans to build from Los Angeles to Whittier, Riverside, Redlands, San Bernardino, Ontario and Pomona, then to Los Angeles. This is not only the most extensive of the projected lines, but it will have four tracks. Two of these tracks will be used exclusively for passenger traffic and two will be used exclusively for freight traffic. From this line a branch will be constructed east of Whittier, and be extended to Fullerton, Anaheim and Santa Ana. This branch will be a double-track line, and, like the Long Beach and Alhambra lines, will act as a feeder to the system. It is understood, moreover, that a proposition is being considered for extending the Santa Ana line to San Diego, and that the construction of a line to Ventura and Santa Barbara is in contemplation. Mr. Huntington and his associates are, in the construction of this line, acting as the advance guard of the four-track electric railway. But the expectations of the projectors will probably be fully realized, as the line will extend through an agricultural district which, for the abundance and diversity of its products, is unsurpassed.

Whole Town Depended on the Power House

The recent destruction by fire of the power house of the Helena Light & Traction Company, of Helena, Mont., illustrates a condition in which many other cities of the size of Helena would probably find themselves if, for any reason, the entire power equipment of the local traction company should become disabled. As a result of the fire at the plant of the Helena company street car service was at a standstill for a week; factories were compelled to shut down, mines, mills and smelters were temporarily abandoned; newspapers were seriously hampered in their publication, as both typsetting machines and presses were run by motors. The streets were without lights, and extra precautions had to be taken to protect the public from molestation at the hands of thugs and highway robbers. Even the play at the opera house had to be postponed. Old lanterns were resurrected by citizens who wished to come down town at night, while small boys inserted candles in punctured tin cans for the purpose of providing a light. One or two business houses illuminated their entrances with Jack o'Lanterns, using pumpkins, cut in the usual manner, portraying the features of a face. An effort was made on the first day after the fire to operate the cars with horses, but the cars were found too heavy for this.

Pennsylvania Tunnel Hearing

The railroad committee of the Board of Aldermen of New York gave a public hearing on Wednesday, Nov. 21, in the matter of the Pennsylvania Railroad tunnel. The Chamber of Commerce, Merchants' Association and Realty League were among the organizations represented to urge the granting of the franchise. Several members of the Central Federated Union attended for the ostensible purpose of pleading for the inclusion of the labor clause in the contract. Abram S. Hewitt was to have been the spokesman for the Chamber of Commerce, but as he was unable to attend J. Harsen Rhoades and Gustav H. Schwab were delegated by President Jesup. Before the hearing Alderman Sullivan, representing the opposition, submitted the minority report, which objected to the granting of the franchise because the railroad company would be permitted to transport freight through the tunnel under the terms of the grant, it is claimed, and that the sum to be paid the city is insufficient. S. C. Mead, of the Merchants' Association, made a lengthy address, dwelling upon the benefit which would accrue to the city by the construction of the tunnel. The Merchants' Association committee also entered an earnest protest against the provision for an eight-hour day for laborers engaging in constructing the tunnel. Another public hearing is to be given this month.

Long Trolley Trip in Massachusetts

A novel trip was taken on Saturday, Nov. 22, by a party of street railway officials in the parlor car Concord, of the Concord, Maynard & Hudson Street Railway Company, of Concord, Mass. Starting at Maynard the car was run to Woonsocket, R. I., going over eight systems and covering 130 miles of line. With the exception of about 20 miles the entire length of Massachusetts was traversed. After leaving the lines of the Concord, Maynard & Hudson Company the car traversed the lines of the following companies: Marlboro Street Railway, Worcester Consolidated, Westboro & Hopkinton, South Middlesex, Milford & Uxbridge, Milford, Attleboro & Woonsocket and the Woonsocket Street Railway. The route extended from Maynard to Hudson, to Marlboro, to Northboro, to Westboro, to Hopkinton, to South Framingham, to Milford, to Hopedale, to Milford, thence to Woonsocket and return. The start was made from Maynard, at 7:30 a. m., and Milford was reached at 12 m. Lunch was served at Milford, the journey being begun again at 1:40 p. m. Woonsocket was reached at 3 p. m., and the return trip was begun at 3:20 p. m. Returning, Maynard was reached at 9.40 p. m. The trip was conducted under the personal supervision of John W. Ogden, superintendent of the Concord, Maynard & Hudson

Street Railway. In the party that enjoyed the hospitality of the Concord, Maynard & Hudson Street Railway were the following, all of whom hold official positions: Walter R. Dame, Henry Tower, Julius Loewe, Charles W. Shippee, William S. Reed, E. A. Onthank, Charles H. Persons, George F. Marshall, E. W. Goss, Wendell Williams, Andrew F. Mars, Edward F. Blodgett, Harry C. Garfield, Arthur M. Bridgeman, E. K. Ray, A. D. Thayer, John W. Ogden, George R. Damon, H. M. Young, D. H. Leahy, Albion R. Clapp, Carroll Z. Parker, James F. Ray, Adams Franklin Brown, J. Allen Rice, Abbot A. Jenkins, Marcus M. Wood, F. S. Ogden, E. S. Channell.

Another Court Decision in Ohio

The Supreme Court of Ohio has handed down an important decision in the case of the Hamilton, Glendale & Cincinnati Traction Company vs. O. V. Parrish. In this case Parrish sought to restrain the company from entering the heart of Hamilton, claiming that consents of certain property owners had been secured by purchase, and that, therefore, the action of the city in granting a franchise was illegal. The Common Pleas Court granted a perpetual injunction, and ordered the company to tear out its tracks in the city. The company appealed to the Circuit Court, which affirmed the finding of the lower court. The case was carried to the Supreme Court, which has reversed the decision of the lower courts, and the company will now be permitted to build into the city. The series of suits were among the important incidents in the long fight between the Pomeroy-Mandelbaum and the Widener-Elkins syndicates for control of the situation between Cincinnati and Hamilton. This fight was settled a short time ago by the "community of interests" effected by the two syndicates. However, the decision is an important one to electric railway promoters, since it decides that consents of property owners to a franchise may be purchased if necessary. The syllabus of the decision follows:

1. The consents of owners of lots abutting on a street, to the construction and operation of a street railroad on such street, are not property rights that can be appropriated under the power of eminent domain.

2. Such consents are not property rights, but rights in their nature personal to each owner of an abutting lot.

3. Such personal rights were bestowed by the General Assembly on owners of abutting lots, as a check upon the power of municipal authorities to authorize street railroads to be constructed and operated against the wishes of the owners of lots on such street.

4. The owners of abutting lots are free to give or withhold such consent, upon such terms as to them severally may seem proper, and there is no public policy in this State against giving such consent for a valuable consideration moving from the street railroad company to such lot owner.

Judgment reversed and judgment for plaintiff in error.

Chief Justice Burket formulated the opinion and it was concurred in by Judges Spear, Davis, Shauck, Price and Crew.

Report of the Twentieth Annual Meeting of the Street Railway Association of the State of New York

The New York State Street Railway Association is not only the largest of the State associations, but shares the honor with only one other, that of the Pennsylvania Street Railway Association, of publishing the proceedings of its annual conventions. These publications, in the case of the New York Association, extend back nearly two decades, and contain information in regard to operating practice and the technique of street railroading which is of the highest value. The present volume, it is needless to say, is no exception to this rule. Secretary Robinson is to be congratulated on the promptness of the publication of the report, as well as upon its attractive typographical appearance.

The Report of the Accountants' Convention

The "Report of the Sixth Annual Convention of the Street Railway Accountants' Association of America" has just come to hand, and contains 184 pages. Mr. Brockway, the energetic and efficient secretary of the association, deserves a great deal of credit for the appearance of this latest addition to the volumes containing the proceedings of the association as well as the promptness with which it has been issued. Typographically the volume makes an excellent impression, and a number of slight improvements have been introduced this year, such as printing the names of the speakers in capital letters, which make the subject matter more easily read. The volume has as a frontispiece a fine portrait of the retiring president of the association, Mr. Mackay.

The proceedings this year were unusually interesting and valuable, and their permanent record, in the form of the printed report, is one worthy of the association.

Failure of Schenectady Boycott

The boycott on the Schenectady Railway Company proved such a dismal failure that in spite of assurances of aid from the Albany labor organizations it was deemed expedient formally to rescind the action of the Trades Assembly. The order to boycott the street railway lines was never observed in Schenectady, and the folly of attempting to wage war upon the Albany railway company because of the operation of Schenectady cars over its lines was apparent even to the agitators.

The action of the Trades Assembly, however, in declaring a boycott has aroused the merchants of Schenectady, and a citizens' association has been formed to protect the city from similar experiences in the future. The association is to be non-partisan and non-political; its fundamental doctrine is freedom—political, social and industrial. It will stand for law and for an orderly respect for law. All proper aid and support will be accorded to sufferers from lawlessness of whatever nature. The objects of the association, as set forth in the constitution, are "to enable those citizens who are interested in the prosperity of Schenectady to act effectively together to a common end, the promotion of the welfare of the city; to aid in developing the material resources of the city by providing conditions that will attract and protect industries, and to support any movement calculated to encourage a good administration of municipal affairs or to prevent any improper use of public franchises to develop, sustain and make effective the best public opinion of the city."

"Noise" Suit at Boston

The full bench of the Supreme Court, last week, heard arguments in the test case of Edward F. Baker against the Boston Elevated Railway Company, which is an action to recover compensation for damages arising from the construction, maintenance, operation and location of the company's elevated system. As stated in the STREET RAILWAY JOURNAL for Nov. 29, the case is narrowed down to the question how far, if at all, the company is to be held liable to property owners along the line of the elevated system for the noise from operation.

The petitioner contended that the statute intends that damage should be awarded for the noise from operation; that "damage from operation," which means from "systematic working," is broad enough to include damages from the noise of operation; that the building of a railroad or an elevated railway in a highway without legislative authority would be a nuisance, and, while the Legislature has power to legalize a nuisance without providing compensation to the injured party, still it can do so only to a very limited extent. The Legislature has no power to legalize a nuisance such as this, which practically ruins or confiscates the property of individuals, without providing that compensation be paid to the property owners. No previous railroad or street railway statute in the State provided damages for property owners whose property was injured by the operation of the system. The fact that the Elevated Railway Act does is entitled to great weight, particularly in view of the constant running of trains in places where the real estate is of immense value and in the heart of the city, while the noise from steam railroads is but occasional.

It is further contended that the damage from noise is a direct special damage, which is a fact found by the Superior Court, and not consequential or remote, for which compensation cannot be had. That the damage in question is in its character and extent such a nuisance as amounts to a taking of property within the constitution for which damages must be awarded.

It is further claimed that the rule of damage applicable to this case is this: Take the fair market value of the abutting real estate before the same was affected by the location, construction, maintenance or operation of the defendant's elevated railway or any apprehension of it. Take the fair market value of his estate after the location and construction and the regular running of trains, subtract the latter from the former, and the difference is clearly the actual damage which the abutter has suffered by such construction and operation unless other causes have increased the depreciation or diminished the same.

The respondent says, in substance, that the statute gives property owners only a right to compensation for direct damage to real estate, and makes the following additional contentions:

That the freedom from noises is not a property right, but a personal right.

That the damage from noise is consequential or indirect, being for the depreciation caused by the noise of passing trains.

That the personal annoyance to the plaintiff and others by the operation of the trains, while ordinarily it would be a nuisance, still the elevated railway acts have legalized it to meet public necessities, and there is no legal precedent in this State for holding such indirect damage recoverable under an eminent domain statute where no real property was taken.

That the statute means that the defendant shall pay all legal damage, which, as adjudicated by the decisions of the courts, excludes remote or consequential damages from smell, noise or soot arising from the operation of the public franchise granted by the Legislature, as in cases where a grant of rights to build and operate a canal, a railroad or an elevated railway.

That if part of the plaintiff's land is taken by the defendant he is entitled to the value of the land taken, and as regards noise only the difference between the depreciation in the value of his property which would have been caused by the noise if it existed just beyond its confines and the depreciation which is caused by the noise in its present location.

That, in estimating the damage caused by noise, the rule of law should be this: First, estimate the depreciation in the value of the plaintiff's property which would be caused by the noise if it existed just beyond the property confines; second, estimate the depreciation which is caused by the noise in its present location. The plaintiff is entitled to the difference between the two, and no more.

That the damage from noise is not in its character and extent such a nuisance as amounts to a taking of property within the meaning of the constitution for which compensation should be provided.

Comments on the Chicago Situation

Apropos of the recent vote of the Chicago City Council, which effectively threw cold water on Mayor Harrison's "wait-for-municipal-ownership" policy in regard to the renewal of street railway franchises The Record-Herald of that city states the case briefly and to the point as follows:

It is gratifying to observe that the City Council is not inclined to delay the settlement of the street car franchise problems pending the campaign for municipal ownership legislation.

All the public demands is that any negotiations entered into now shall preserve all rights which the city may avail itself of when the enabling legislation is enacted.

The obstructive attitude of the Mayor in regard to the transportation and tunnel lowering propositions is inexplicable except as accounted for by politics.

Alderman Bennett, chairman of the Council committee on transportation, is quoted by a daily newspaper as favoring early action in the franchise question, declaring that better terms can be obtained now than have ever been secured by any municipality. He is reported as saying further:

The people have declared for municipal ownership as a general proposition; but it is a question as to the best way of securing such ownership. Talk of municipal ownership at this time is childish.

Suppose we started in now to force municipal ownership. We would have to have legislation. Then we would have to condemn the properties of the traction companies, proceedings which would string out for years and be of uncertain termination.

Suppose we secured a municipal ownership enabling act from the next legislature. We would have to get a constitutional amendment to secure bonds to purchase the properties. It would take more than two years to get such an amendment.

Then suppose we went before the people with a $70,000,000 bond issue proposition, for instance. How would the people vote on such a thing?

The traction companies would grant things to-day that they would not grant years ago. The time is ripe for a settlement that would be most advantageous to the municipality. There is no use building air castles and wasting time on impossible things. The question must be met with common sense and on business lines.

All the traction franchises do not expire next year. The franchises of 6 per cent of the traction companies do not expire until after next July. Some do not expire until 1915.

I believe the people should have municipal ownership eventually. But talk of such at this time is foolish. The Mayor, in his last message to the Council, said that the Council should lay a sure foundation for municipal ownership. That is what we propose doing.

While I do not assume to speak for the committee I emphatically favor a municipal ownership clause which will give the people the right to take over the lines at the end of a specified period. How can municipal ownership be secured in an easier way?

I believe we can get the best service in the world from the companies. I believe we can secure liberal compensation It is to the city's interest to secure these and other things, and secure them at once.

Boston Elevated Annual Report

The annual report of the Boston Elevated Railway Company for the fiscal year ended Sept. 30, 1902, has been filed with the Railroad Commissioners. The statement follows:

	1902-01	1901-00
Gross receipts	$11,321,030	$10,792,993
Operating expenses	7,862,571	7,336,597
Earnings from operation	$3,458,458	$3,456,395
Receipts from other sources	....	76,503
Gross income, net	$3,458,458	$3,532,898
Fixed charges	2,836,560	2,896,359
Net earnings	$621,899	$636,539
Dividends	600,000	575,000
Surplus	$21,898	$61,539
Total surplus Sept. 30	483,733	463,509

Details of earnings from operation:

	1902-01	1901-00
Receipts passengers carried	$11,060,385	$10,562,533
Receipts mail carried	28,109	21,600

Traffic statistics:

	1902-01	1901-00
Number passengers carried	222,484,811	213,107,660
Number passengers carried 1 mile	617,315	590,979
Number car miles run	45,772,836	43,631,384
Average number employed	7,166	7,729
Total people killed in year	11	38
Total people wounded	2,095	1,806

Details of operating expenses:

	1902-01	1901-00
Extension and addition to rail	$326,351	$1,736,342
New electric construction	....	187,909
Subway construction and improvements	25,207	92,269
Total addition to property account	1,949,545	4,778,203
Rental of subway	219,026	213,205

The following is the balance sheet as of Sept. 30:

ASSETS	1902	1901
Total cost of railway owned	$4,739,276	$4,412,925
Equipment	1,307,813	874,447
Cost land and buildings	4,679,548	3,514,928
Subway construction and equipment	158,269	133,061
Cash and current assets	3,788,397	1,818,123
Miscellaneous assets	3,461,168	4,733,088
Total	$18,134,470	$15,486,574

LIABILITIES	1902	1901
Capital stock	$10,000,000	$10,000,000
Subscriptions	2,346,586	....
Current liabilities	1,346,568	1,313,246
Total accrued liabilities	2,362,843	2,386,556
Sinking and special fund	1,558,016	1,323,262
Profit and loss surplus	483,733	463,509
Total	$18,134,470	$15,486,574

Number of stockholders, 2187; number of stockholders in Massachusetts, 1851; amount of stock held in Massachusetts, $7,792,400.

Franchise Tax Appeal in New York

Argument in the appeal from the decision of Referee Robert Earl declaring constitutional the franchise tax law, passed by the Legislature of New York in 1898, was begun in the Appellate Division of the Supreme Court, Third Department, Dec. 2. Forty-seven corporations, among the largest in New York city, are parties to the controversy, but the arguments are being made on behalf of the appeals by companies whose railroad cases cover all of the points of law and fact involved in the entire controversy. Judge Earl's decision, as referee, was confirmed by Supreme Court Justice D. Cady Herrick on July 15 last. It found that the special tax law violated neither the State nor the Federal Constitutions, that the State Board of Tax Commissioners is not required, in determining the value of a special franchise, to separate the value of the tangible from the value of the intangible property constituting the franchises, and that the rate of taxation on special franchises should correspond with the rate applied in determining the value of other species of real estate in the same tax district. The amount involved aggregates $12,000,000, assessed against the corporations of the State and paid by them under protest.

PERSONAL MENTION

MR. HENRY R. NEWCOMB, chairman of the bankers' committee of the Everett-Moore syndicate, has recently returned from Europe.

MR HENRY G. FOREMAN has been elected chairman of the board of directors of the Chicago Union Traction Company, vice Mr. Jesse Spalding.

MR J. H. VAN BRUNT has recently been appointed general manager of the St. Joseph Railway, Light, Heat & Power Company, of St. Joseph, Mo.

MR. HENRY JAMES CROWLEY, of Lansdowne, Pa., general manager of the American Railways Company, and Miss Serena Virginia Ford, of Glenolden, Pa., were married at Sharon Hill, Pa., on Nov. 26.

MR. C. W. SIMONSON, of Dayton, has been appointed general passenger agent of the Columbus, Delaware & Marion Railway, of Columbus, Ohio. Mr Simonson formerly held a similar position with the Dayton, Springfield & Urbana Railway.

MR. A. E. DOMVILLE, who has been connected with the St. Thomas Car Wheel Works, of St. Thomas, Ont., for eighteen years, has accepted the position of general manager of the New York Car Wheel Works, with headquarters at Buffalo.

MR. A. H. WARREN, assistant treasurer of the Houghton County Street Railway Company, of Hancock, Mich., has been appointed superintendent of the company, which place he has filled temporarily for several weeks. Mr. J. W. Payne has been appointed assistant treasurer of the company to succeed Mr. Warren.

MR. GARDNER F. WELLS has retired as general manager of the Brockton & Plymouth Street Railway Company, of Brockton, Mass., to become connected with the Terre Haute Electric Company, of Terre Haute, Ind. Mr. A. J. Bemiss will be appointed to succeed Mr. Wells at Brockton. Both companies are controlled by Stone & Webster.

MR. RICHARD EMORY, general manager of the Columbus, London & Springfield Railway, of Columbus, Ohio, has been made vice-president and a director of the Central Market Street Railway, of Columbus, vice Mr. John G. Webb, resigned. Dr. J. B. Hartman was re-elected president of the company, and Mr. Emory was made general manager.

MR. FRANK H. BROWN, who, for the last ten years, has been connected with the Worcester Consolidated Street Railway Company, of Worcester, Mass., as conductor and inspector, has been appointed superintendent of the Plainfield Division of the Elizabeth, Plainfield & Central Jersey Railway Company, of Elizabeth, N. J., of which Mr. John W. Akarman is general manager.

CONSTRUCTION NOTES

HARTFORD, CONN. Surveys for the proposed electric railway between Hartford and Middletown are being made. The Hartford & Middletown Railway Company holds a charter for an electric railway link from the terminus of the Hartford Street Railway Company's system in Wethersfield, to Cromwell.

WILMINGTON, DEL. The Delaware Suburban Railway Company, which plans to build an electric railway from Wilmington to Elkton, Md., a distance of 19 miles, will let the contract for materials at once. The company will do its own construction work. The plan is to use three-phase transmission at 600 volts. The officers of the company are: George E. Schelegwich, president; John W. Schmidt, vice-president; H. R. Fothergill, secretary, manager, superintendent, purchasing agent, engineer and electrician; W. W. Hess, treasurer.

CHICAGO, ILL. The ordinance of the Chicago, Milwaukee Avenue & Inland Lakes Traction Company that has been before the County Commissioners has been withdrawn.

QUINCY, ILL. A committee of capitalists met a committee of the Quincy & Western Illinois Electric Railroad Nov. 21 and decided to subscribe $250,000 toward the capital stock of the company. The project, by this action, seems assured. The road is to run east to Beardstown and another branch north to Niota.

EAST ST. LOUIS, ILL. There is a probability that the fight between the East St. Louis & Suburban Electric Railway Company and the Interstate Transit Company for the patronage of the people who ride across the Eads Bridge may lead to another electric railway being constructed between Belleville and East St. Louis. Charles E. Thomas, secretary of the Interstate Transit Company, and George Postel, of Mascoutah, have had introduced in the Mascoutah City Council an ordinance granting them or their assigns a franchise for the construction and operation of an electric railway on several designated streets of the town. Mascoutah is about 30 miles from the Eads Bridge, but the connection between the Eads Bridge fight and the Mascoutah ordinance is not hard to trace. The East St. Louis & Suburban Company operates a line between Belleville and East St. Louis. By running cars across the bridge the company has almost entirely cut off the patronage of the automobile line, because people are not unloaded at the bridge approach, which is the automobile terminal, as they were before. The Interstate Transit Company, to get even, plans to build a competing line, carrying passengers for a lower fare and unloading them where they can be carried across the bridge in automobiles. All this is made plain by the provision of the Mascoutah ordinance that the fare from Mascoutah to Belleville is to be 10 cents, and from Belleville to East St. Louis 10 cents. The present fare between Belleville and East St. Louis is 20 cents. If the ordinance is passed and accepted, a bond of $10,000 must be given to insure the construction of the line within eighteen months. The right of way for the line between Mascoutah and Belleville, Mr. Thomas says, has been partially assured. Negotiations are said to have been opened with the Southern Railway Company for its old right of way for a part of the line between Belleville and East St. Louis. If the line should be built it is said that a summer hotel will be erected on the bluffs.

EVANSVILLE, IND. The County Commissioners of this county have granted a franchise for a right of way to the Evansville, Booneville & Rockport Electric Railway, on condition that certain alterations be made in the specifications. The right of way has already been secured through Warrick and Spencer Counties. The company has recently been granted a franchise in Booneville.

TERRE HAUTE, IND. The County Commissioners have given a franchise to the Terre Haute Electric Company for an interurban line on the Lafayette Road from the north city limits to the boundary line of Park County. The road as surveyed runs through part of Park County to reach Clinton, in Vermillion County. No remuneration was asked for the grant.

LEBANON, IND. Townsend, Reed & Company, of Indianapolis, who are building an electric line from Indianapolis to Frankfort by way of this city, have begun laying rails. After the line is completed to Frankfort it will be extended to Lafayette and a spur built from Lebanon to Crawfordsville.

COLUMBUS, IND.—The Indiana Central Electric Railway Company is completing arrangements for building an electric railway to connect with the Indianapolis, Greenwood & Franklin Electric Railway in this city, to Seymour, Brownstown, French Lick and West Baden. An assessment of the stock has been ordered.

ELWOOD, IND. The new extension of the Union Traction Company's line from Elwood to Tipton has been completed and placed in operation.

CEDAR RAPIDS, IA.—A syndicate of local capitalists headed by Orville M. Truman, of the Truman Finance Company, of Chicago, has organized a company, with headquarters at Cedar Rapids, for the purpose of introducing the hydro-carbon motors made by the Chicago Motor Vehicle Company, and also for the purpose of building interurban lines in Iowa. In the spring the company will commence the construction of an electric railway from Cedar Rapids in a northeasterly direction through Linn and Cedar Counties to Dyersville, a distance of about 40 miles.

SIOUX CITY, IA.—Improvements of the Sioux City Traction Company which will cost more than half a million dollars will be started before Jan. 1. A new car house will be constructed on the property between the present car house and the power house. This property is at present occupied by a frame building used for office purposes. This building will be dismantled and new offices will be provided on the second floor of the projected car house. The power house will be considerably enlarged. The capacity of the car shops will be doubled, and the force of this department will be worked to the limit. New cars will be built at the company's shops as fast as possible, but it is likely that some new rolling stock will have to be purchased from one of the large car works.

DES MOINES, IA. The Interurban Railway Company has decided to extend from Collax to Newton the line which it is now constructing from Des Moines to Collax. The line will be completed to Colfax this month, but the extension from Collax to Newton will not be constructed until the spring. The object of the construction of the extension is to make connection with the Iowa Central Railway at Newton, thus giving that company connection with Des Moines. The Iowa Central is the only large railway system in Iowa which does not have direct communication with Des Moines. This line extends from Watertown and Minneapolis, Minn., on the north to Albia, Ia., on the south, and Peoria, Ill., on the east. The extension will parallel the Rock Island Railroad from Collax to Newton.

LOUISVILLE, KY. It is said that the Louisville, Anchorage & Pewee Valley Electric Railroad is contemplating erecting elevated tracks in this city. An effort will probably be made to get a right of way into the city.

BALTIMORE, MD. Press reports say that the Chesapeake Beach Railroad, which runs from Washington to Chesapeake Bay, will shortly be converted into an electric railway. The road is now in the hands of David H. Moffatt, of Denver, President Otto Mears and Charles W. Popper, the vice-president having retired from the management. Mr. Moffatt recently attached the company's real estate for a debt of $25,000. On the outskirts of Washington the road connects with the electric railway system, and the plan now under consideration will provide for running the trains from the Beach clear into the heart of Washington. The excursion business is to be developed for the benefit of visitors to the National Capital.

WESTFIELD, MASS. The Westfield Valley Electric Railway Association was an organization founded to do pioneer work toward the building of an electric railway through the towns of the Westfield Valley. Its mission was to agitate, not to undertake, the construction of street railway lines. Out of it, however, has grown an organization known as the Western Massachusetts Street Railway Company, which has secured franchises, and promises to commence construction next spring.

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Union Opposition to Trolley Mail Cars

When it was proposed several years ago to employ street cars for carrying mail objection was raised by labor unions as soon as it was found that interference with the operation of these cars would be punished by the Federal Government. It is undoubtedly because of this experience that the present movement to have mail boxes attached to trolley cars is so vigorously opposed. Prominent labor unionists complain, according to a press despatch, "that the use of the street cars as regular mail carriers will mean that striking employees of the street railway companies will not be able to obstruct the free movement of the cars without laying themselves open to punishment for interfering with the United States mails," and a member of the American Federation of Labor is quoted as saying: "We shall oppose any proposition that looks to furnishing the protection of Federal Courts and troops to the operation of a private enterprise employing a large number of workingmen, under the guise of protecting the mails." This is not the attitude of honest men engaged in legitimate occupation and employing lawful means for their own protection. It is the logical position of the lawbreaker, the rioter and the striker who would use intimidation and force in gaining their ends, and even resort to bloodshed, violence and the destruction of property. The fact that the law is opposed on the grounds stated by representatives of labor unions is a very good reason for strictly enforcing such statutes as may apply to those who obstruct the operation of cars. The attitude that the radical labor leaders have taken toward encouraging the nullification and open violation of existing laws should be met with firmness. We do not believe that these men faithfully represent the great body of American workmen, but in any event they must be taught a wholesome respect for authority.

Electrical Power for Railroads

The current number of the "North American Review" contains an interesting article by Cornelius Vanderbilt on the future of electricity as a motive power on steam railroads. As might be expected the author does not foresee any great future for electrical power on trunk lines. The principal reason upon which Mr. Vanderbilt bases his argument is that the transportation of freight is, after all, the controlling factor in the situation, as it is from this item that most of the revenue of the usual trunk line comes. According to Mr. Vanderbilt the advocates of electric power have not yet demonstrated that freight traffic can be cared for at a less rate per "ton-mile" with electricity than with steam, consequently the former does not possess much chance of adoption until a saving in this department of railroad operation can be demonstrated. If passenger traffic only is considered, Mr. Vanderbilt admits that the question assumes a different aspect, and that after a certain density of traffic is reached the fuel cost may be so reduced and the facilities afforded in the way of speed and frequency of trains so increased as to warrant the introduction of electricity.

We will not stop to inquire now whether this density of traffic does not exist on many portions of trunk lines in the neighborhood of large cities. We believe that it does, and that a good electric suburban service on some of the railroads which center in New York or Chicago would show results which would surprise steam railroad managers. These results might, perhaps, not be so much in the direction of reduced operating expenses per "car mile" as in an enormous increase in net earnings due to higher speed, better train service and the many other advantages accompanying the use of electric traction, and we look for an early demonstration of this fact through the proposed electric suburban service on the New York Central Railroad, with which Mr. Vanderbilt's family has been prominently identified for so long. We prefer, however, to call attention to one point in connection with this subject, the importance of which steam railroad managers do not yet seem to realize fully, and that is the effect of frequency of train service on gross earnings, even in the item of freight. The unit "ton-mile," as given by Mr. Vanderbilt, and as generally

employed on steam railroads, is irrespective of the time taken to transport that ton from the shipper to the consignee. We are not yet prepared to state whether the freight earnings from a frequent train service would show the same percentage of increase as that experienced in the case of electric passenger service, but that there would be an enormous advantage to all concerned if the railroads could handle freight economically in short train loads can hardly be denied. The experience of the express companies that shippers will frequently pay three or four times the regular freight rates simply to insure quick transportation and delivery indicates that the element of time is often as essential in ordinary business affairs as in the C. G. S. system. It not only saves the insurance and interest on the investment of articles in transit, but what is more important will frequently create a traffic in perishable goods and also save the retailer from the necessity of keeping a large reserve stock of standard goods, with attendant warehouse expenses, trans-shipment charges, etc. Experience with the electric freight business in Ohio has demonstrated, without possibility of doubt, that frequency of freight train service increases the amount of business and creates new lines, for the same reasons that have been shown to exist in the case of the transportation of passengers. We do not mean by this that the steam locomotive is yet doomed to the scrap heap, or that a half-hourly express service would necessarily be profitable on a trans-continental line. But in many cases it will pay, and if it is not installed by the steam railroad companies at the points where it will be profitable it will be by the competing electric railways.

Local Transportation and the Central's Terminal Plan

An interesting feature of the terminal plan of the New York Central & Hudson River Railroad Company, which has an important bearing upon the subject of improving the transportation facilities of New York and its suburbs, is the provision that has been made for connection with the Rapid Transit subway system at Forty-Second Street. An examination of the plans shows that of the new tracks which the company proposes to lay under the roadways of Park Avenue the outer one on each side will be gradually depressed from a point near Fiftieth Street below the grade of the other tracks, and, running under the Grand Central Station, will connect with the express tracks of the subway company. It has been assumed heretofore that it was intended to give the Central's suburban passengers the benefit of easy transfer to and from the underground rapid transit trains, but the proposed arrangement will enable the company at any time to make an actual traffic connection. In order to carry out such a plan provision must be made for the sale of suburban tickets at subway stations, but only at express stations, which will be few. Some modification would also be required in the Central's rolling stock, as the large and heavy cars of the type now in use on steam roads cannot run through the subways. Schedules would also have to be adjusted so as not to interfere with the natural operation of the subway system, and doubtless there would be other complications, but details may be worked out after the essential condition of track depression along Park Avenue has been secured. Such a plan may not be adopted for some time to come, if, indeed, it is ever found needful or desirable, but it is evident that the railway companies and the Rapid Transit Commissioners are looking ahead, and that whatever plans are approved to-day must contain ample provision for the city's future.

Traction

There are times when the trend of engineering practice along certain lines has a general shaking up by the introduction of some new principle. The whole tendency of modern practice in electric traction has been to distribute electric motors over a large number of axles in order to get traction for accelerating purposes. If the experiments with magnetic devices for increasing the traction between rails and car wheels, which are noted elsewhere, are as successful as present appearances would indicate, it is likely to make much difference in the electric locomotive practice of the future as well as in the braking possibilities of the present. An increase of 350 per cent in the tractive effort of a 15-ton electric motor car, with an expenditure of only 2½ hp in electrical energy, is something to make electrical engineers rub their eyes and wonder why the matter was not worked out before. To be sure, the field was a very unpromising one, and we are informed that at the beginning of the experiments the amount of wire and electrical energy required to produce anything like a satisfactory increase in traction between wheels and rails was something enormous, the results being correspondingly discouraging.

The success of the present arrangement is explained by the utilization of certain principles of the magnetic circuit, which are not commonly considered in connection with the design of magnetic devices, together with some better-known and thoroughly established principles used in dynamo design. That a short magnetic circuit is necessary to maximum efficiency has long been recognized. It is not, however, so generally known that the reduction of the cross section of a magnet at its point of bearing on the armature which it attracts greatly increases the tractive effort. For example, in the experiment on this magnetic traction apparatus it was found that the pull required to lift a car wheel from a rail, with the coil energized, was much greater with the ordinary car wheel than with a wheel which had a flat surface planed upon it, if this flat portion rested upon the rail. To this principle is undoubtedly due much of the success of the apparatus under discussion; otherwise, the small area of contact of a car wheel upon the rail would prohibit its success.

Taken altogether it is a matter of much interest, both in its bearing on electric railway engineering problems and on the design of magnetic apparatus.

Labor Unions in Politics

The recent collapse of the street railway strike in New Orleans made it necessary for the labor leaders in that city to take effective measures toward revivifying the movement, and they have decided that the quickest way to do this is by getting the workingmen involved in a political controversy. The local conditions lend themselves very readily to this plan, and consequently it has been determined that the labor unions of the city shall go into politics. Hereafter the members are expected to cast their ballots, not necessarily in accordance with their own views, but to meet the wishes of the leaders. The excuse for this action is found in the late difficulties, the car men holding that they would have won a signal victory had not Governor Heard and Mayor Capdevielle taken the side of the company. Under the new regimen, it is confidently asserted, no one having political ambition will dare run counter to the demands of the politico-labor bosses. The key to the political situation in Louisiana is the poll tax. No one can vote in the next State and city elections, which occur in 1904, unless he pays the poll tax for 1902 before Jan. 1. In order to vote the entire strength, the Street Car Men's Union has offered to pay out of its treasury all the poll taxes of its members, 1500 in number. The other unions have followed its example, and it now looks as if every union man in New Orleans will have his poll tax paid for him, and thus be entitled to the ballot. On the other hand there is no one to pay the poll taxes for the non-union voters, and unless they do so themselves they will be disfranchised. Less than 11,000 citizens have so far fitted themselves for the franchise, of which nearly half are union men. The Street Car Men's Union has adopted resolutions calling upon all members to take part in politics, in all primaries and elections.

* * * * *

The New Orleans organization would do well to take a leaf from the experience book of its co-worker in the field at Richmond, Va. The union in the latter city is an educational force; it has undertaken a series of meetings for the instruction of the members in their duties toward their employers, the public and the union, and judging from recent reports of their meetings there is a conservative element in the organization sufficiently strong to defeat any such measures as those now advocated at New Or-

leans. One speaker declared: "I have no sympathy with the people who tell us we ought to start a new party and revolutionize the politics of our city. Politics has no place in our labor meetings. Labor organizations must foster a feeling among their members such as is found among the Odd Fellows." A second speaker, who had been an employee of the company about eleven years, said: "If we don't treat ourselves, our union, our employers and the public right, we can't expect them to treat us right. Give the company what belongs to it, treat the passengers courteously, and the company won't want to see our union broken up, and no one can break it up." Again: "Let us have confidence in our officers and our employers, and stick to and uphold them, and we will be more successful." The secret of the success of the Richmond union lies in the fact that its officers and members have not been blindly lead by designing and interested politicians.

* * * * *

There is one feature of the plan proposed at New Orleans that must be viewed with indignation and alarm by self-respecting workingmen, whatever their condition or affiliation, namely, the idea of disposing of the union vote in bulk. We do not believe that these self-styled leaders can deliver the goods, but aside from the resentment and humiliation an intelligent voter must feel at such an outrageous attempt to disfranchise him, as is practically proposed in New Orleans, there is grave danger to the community and the labor organizations, too, through the opportunity which this power places in the hands of unscrupulous men, that it will have a demoralizing influence and result in wholesale corruption in municipal politics. These conditions present a problem which merits serious consideration, and as similar symptoms have been discovered in other quarters it might be well for those who are now philandering with reform to turn their attention to this matter.

The No-Seat-No-Fare Campaign

We learn that a concatenation of presumably well-meaning ladies has been formed in this city with the avowed object of taking up this venerable hue and cry. Heretofore similar kickers have taken it out in talk, and perhaps such will be the real issue of the present movement, but the promulgators have started out with the threat to purchase control of one of the transportation companies and then run the system according to their own sweet will, provided matters are not remedied soon. If this should not bring the offenders to terms, or should otherwise prove impracticable for any reason, the *soi disant* reformers propose to appeal to the legislature or other powers that be. To do the crusaders justice they have modified the original howl somewhat, and suggest half fare for those who stand. Just what half fare is to mean they do not deign to state, and we are quite in the dark as to whether they may contemplate 3 cents or 2 cents; whether they expect Uncle Sam to coin a 2½-cent piece, or desire the conductors to carry cutting pliers to facilitate making change. As in most campaigns of self-appointed reformers this has as its basis a single pile of justice driven in a slough of nonsense. The average man or woman knows nothing, and cares less, about the difficulties of traffic management on a great street railway system. He has a touch of dyspepsia and straightway tackles the first grievance that he can find with an energy that should be put to better use. If he has to hang to a strap for a few blocks he curses the street railway company; if a shower comes in summer he howls for closed cars to be supplied then and there, and if there is a warm day about Christmas he demands open ones—always howls for the thing which is evidently not at hand.

* * * * *

The complaint of inadequate seating accommodations is one which has at its basis the undoubted fact that the patron of a street car line frequently has to stand during the rush hours for part of his journey. This has as its cause the desire of everybody to hurry over the same line at the same time. A record by hours of the number of passengers carried by the surface lines in any large city would show some very surprising figures. One gets a vivid idea of the facts by inspecting the load curve of a power station during the peak, but even this gives but a faint idea of the real rush, since there is a large and somewhat variable substratum of load which cannot be charged to any increment of passengers carried. In actual practice the street railway companies do make strenuous efforts to rush on all available cars to meet the daily jam, but the more cars there are the more people simultaneously desire to ride, and there finally comes a point when the available facilities are exhausted. They might, of course, be still further increased, but it will usually be found to be the case that any effective increase would do more harm than good by increasing the congestion. It is small comfort to get a seat if thereby one gets into a blockade and loses time. There is a practical maximum for the mere number of cars that can be effectively worked over a given line in the heart of a city, and there is no doubt that a mass of cars sufficient to give every passenger a seat during the busiest part of the day would prove utterly unmanageable and woefully inconvenient. We should like to see it tried just once, on Broadway for example. Unless we are greatly mistaken the result would be a mob of enraged citizens, all late at dinner, and breathing out threatenings and slaughter against the soulless corporation that ran those cars. It is again the old story of everybody trying to occupy the same space at the same time. The secret of rapid transit is so to distribute the traffic as to prevent its convergence at a single time and place. This is the direction toward which the newly-formed "Car Passenger Rights Association" in New York, and other similar bodies in other cities might more profitably direct their attention. Let them exercise their utmost endeavors to induce their male relatives to travel to and from their places of business before or after the "rush hours," during which time it is safe to say that they would stand a much greater chance of obtaining the seats for which they seem so anxious. This plan, however, would hardly suit the average American, who is constitutionally in such a hurry that he guides his progress through space more by impulse than by judgment. If he is on his way to reach a destination he jumps on the first conveyance which will take him there, whether he is actually in a hurry or not, and if it is a crowded street car, will inveigh against the company audibly or inwardly for the entire journey. On his arrival he will sit down and write to the "Daily Scold," denouncing the management and demanding full municipal management, although one-tenth of the time taken in writing the letter, if devoted to waiting on the street corner for an empty car, would have insured a seat.

* * * * *

The fundamental difficulty in preventing over-crowding in street cars lies less in the difficulty of providing sufficient cars than in the reasonable control of those who use them. The Continental system of refusing passage after all the seats are taken would irritate the average denizen of our cities more than standing occasionally, although after getting used to it he might calm down a trifle. In many cities in this country the plan is rigorously enforced as regards the open cars, and with pretty satisfactory results. It is, of course, the duty of every street car company to make reasonable provision for the traffic that may properly be expected, and if then a sudden crowd overwhelms a particular car or group of cars, it must either be taken on so long as standing room lasts or refused entrance. But the proposition to charge standing passengers no fare or half fare is nothing less than ridiculous, and moreover it would lead to the most obnoxious kind of crowding, for it would promptly be taken as a convenient method of getting rides at half price. We could wish no more fitting punishment for the particular aggregation of ladies who have raised the present wail than to travel under compulsion in cars run on their own approved plan, with the half-fare contingent walking over their pedal extremities. The only plan which would ensure seats for all is the Continental practice, and we shudder to think of the language that would be used by those left by the wayside.

The Brooklyn Rapid Transit Employees' Benefit Association—Some Interesting Features Concerning Its Organization and Methods of Work

The social betterment of the employees and the establishment of more friendly trustful relations with the officers of all large enterprises is now receiving from the managements more marked attention than ever before. Movements with this end in view,

BILLIARD ROOM IN CROSSTOWN DEPOT

wherever they have been undertaken, have invariably aroused the interest and sympathy of the more intelligent classes of the men, and in many cases have had their active support. Where the co-operation of the men has not been secured the cause has usually been that they did not fully understand the objects and aims of the work, or were not in accord with the methods to be employed. To be successful any work of this kind must proceed upon the principle of co-operation with the men. They must be made to feel that they are a factor of equal importance with the management in the development and carrying out of the plans which are eventually to become of mutual advantage to both.

President Greatsinger is one of those who believes thoroughly in a closer and more cordial relationship between the officers and the employees, and that the best results can be obtained for both when there exists between them a spirit of mutual confidence and trust. It is now generally recognized that one of the great problems of railway management is for the manager to gain and hold the respect, confidence and loyalty of his men. That President Greatsinger possesses in an eminent degree those kindly qualities of heart and that sunny cheerfulness of disposition which enable him successfully to do this was clearly shown by his cordial friendly relations with his employees, of low and high degree, on the road over which he presided for many years before coming to Brooklyn. Having worked his own way from the lower ranks his employees know that he is no stranger to hardships and long hours of toil and that they will always find in him a patient and sympathetic listener to the stories of their crosses and trials, and that he will take an active interest in smoothing over the rough places in their daily lives. When he assumed the management of the Brooklyn Rapid Transit Company he found the conditions ripe for carrying into effect plans similar to those he had successfully adopted in the West. To understand the situation properly the reader is reminded that not very long ago the roads now comprising the Brooklyn system were operated under separate managements, whose interests were not identical. At one time there was a distinct feeling of antagonism between the employees of the competing companies, such as would naturally result from the long continued strife between conflicting interests. At the time of consolidation there was no community of interest among the men belonging to the constituent companies. In fact, they looked upon one another as aliens, and it required considerable time and no small amount of tact to cement them together in friendly and brotherly relations. One of the first means adopted to bring them together was the organization of base-ball teams from different parts of the system, and the playing of match games, of which the officers of the road were always interested spectators. For several years the officers or some of the directors personally contributed the money to equip the base-ball teams. Three of the directors each gave a pool-table, and one of the directors contributed a piano for the equipment of local club rooms at the different depots. The company installs and maintains these local club rooms wherever possible, and furnishes light, heat, water, etc. At several of them the company installed first-class bowling alleys, which, with the billiard and pool-tables and shuffle-boards, seem to attract the chief interest of the men. The photographs shown herewith are typical views of the local club room at the "Crosstown" depot in the Greenpoint section, at the corner of Manhattan Avenue and Box Street, on the second floor of the car house. This depot has about 700 men, and at times the large club room, 35 ft. x 120 ft., and the bowling alley adjoining, are crowded to the full capacity. This club room has four pool-tables, one double shuffleboard, a piano, a gramophone, horizontal bars, punching bags, chest weights, dumb bells, Indian clubs, etc., and the reading table is filled with the popular magazines and papers and several of the technical railroad journals. The penny charges exacted for the use of the pool tables, shuffleboard and bowling alleys are sufficient to pay for attendance of porters, pin boys, etc., and in some cases to provide for the maintenance and repairs of the equipment.

Soon after assuming the management of the Brooklyn system

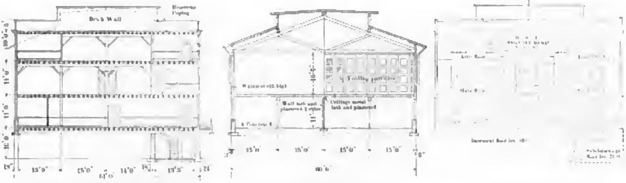
BOWLING ALLEY IN CROSSTOWN DEPOT

President Greatsinger took an active part in carrying into effect plans, which had for some time been under consideration, for the organization of an association of the employees. As a preliminary step he secured the services of J. M. Dudley to act as secretary and devote his entire time to the association work. Mr. Dudley is himself a railroad man, having been a brakeman and conductor on the Chesapeake & Ohio Railroad, and, like his chief

is in sympathy with the aims and aspirations of the workers among the rank and file. Many years ago he became associated with the work of the Young Men's Christian Association among railroad men, and just previous to coming to Brooklyn was the secretary of a railroad men's association in Chicago, having among its membership representatives from several of the largest railroad systems entering the city. The wisdom of securing Mr. Dudley's services has been demonstrated by the ability he has displayed in infusing the men with a fraternal feeling toward one another and toward the officers of the company, and by the happy faculty which he possesses of encouraging, by precept and example, a more wholesome robust manhood. Gradually and naturally, and as rapidly as the conditions seem ripe for it, the methods which the Young Men's Christian Association has so successfully applied elsewhere among railroad men will be inaugurated in Brooklyn. As is well known this work is not bounded by any denominational lines, and in fact it can hardly be called a religious work, but is purely an effort toward the upbuilding of mind and body and the establishment of a higher, cleaner standard of individual character. For such purposes all right-minded men can unite and work together. This feature of the association work on street railways was first inaugurated in Brooklyn, and shortly afterwards in Rochester, N. Y., and the example will undoubtedly not be lost upon other railroads that are studying the social and industrial betterment of their employees.

The association in Brooklyn, which forms the nucleus for the work of the Young Men's Christian Association, is known as the Employees' Benefit Association. It was organized not by the officers and subordinate officers, but by the men themselves, under the advice and guidance of the officers. One of the most important features of Mr. Greatsinger's methods of organization is that in all those combinations of effort by which the men are to be benefited

BROOKLYN RAPID TRANSIT EMPLOYEES' RECREATION ROOM



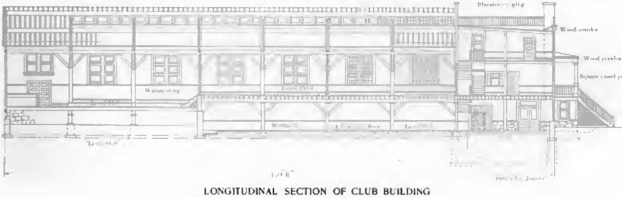
Transverse Section through Employment Bureau looking toward rear.

Transverse Section looking toward rear.

Front Elevation.

ELEVATION AND SECTIONAL DRAWINGS OF NEW CLUB ROOMS

the executive officers of the road take but little active part, and then only in an advisory capacity. He believes that if the men are left to themselves and choose their officers from the operating force with which they are so much more closely connected, a much



LONGITUDINAL SECTION OF CLUB BUILDING

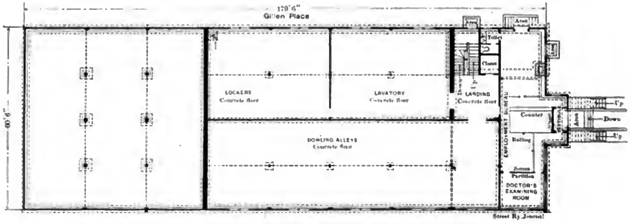
firmer foundation is made upon which to build an association for mutual benefit. He, therefore, holds no office in the benefit association, the president being the general superintendent of the road. The Young Men's Christian Association has no official connection with the benefit association, and it is mentioned in connection with the benefit association because a man, trained in the methods of the Young Men's Christion Association, assisted by others of the same training, will conduct for the men the affairs of the benefit association and apply to its social and educational work the same successful methods which have stood the test of time and experience on the steam railroads. The benefit features are free medical attendance and reduced price of drugs, $1 per day sick benefit, with suitable restrictions, and $150 in case of death. It is evident that in many cases the absence of doctors' bills for minor ailments will more than cover the annual dues of $6 and the initiation fee of $1. Valuable privileges in the handsome central club house about to be erected by the company for the association work goes with the membership. When the association was organized the company contributed $2,000 to its treasury, and agreed always to pay the salary of its secretary. The new central headquarters, which is soon to be built, and which is described herein, will cost upwards of $30,000. The company also proposes to provide and equip local club rooms at those depots and terminals that are now with

out such facilities, at a cost of several thousand more. Those who talk about the soulless nature of corporations will do well to make a note of these facts.

Within six months after the organization of the association it had taken in over 3000 members, and this number will probably be doubled within another year. The association, after paying the organization expenses and the running expenses, including several death benefits and many sick benefits, ended the first six months with a cash balance of about $4,000 in its treasury. The men in organizing happily made special provision for taking in as charter members all of the old superannuated employees who had served the company long and faithfully, and who were beyond the established age limit of fifty years. Partly in consideration of this, and for other reasons, the company guaranteed the financial integrity of the association, and should it be called upon will see that all of the obligations are met. In the April 12, 1902, issue of this paper there appeared a description of the proposed central headquarters, which it was planned to locate at Ridgewood. On account of finding a better location at East New York it has been decided to erect there a separate building in close proximity to the terminals and shops of the surface and elevated lines for the exclusive use of the association, and it is expected that the building will be completed early in the coming spring. It will be of frame construction, except the front walls surrounding the association offices, which will be of brick. It will be three stories in front and two in the rear, with dimensions 60 ft. x 170 ft. It will be seen from the floor plans shown herewith that the first and second floors are devoted to the association work. The employment bureau for the system occupies the front of the basement floor, but is separated entirely from the association rooms. The remainder of the basement floor is devoted to the bowling alleys, the lavatories and the locker room. There are two pairs of (four) alleys, built and equipped in the most modern fashion. The baths and locker room are immediately adjoining the alleys. The baths, as is usual in association work, are mostly showers. The men prefer running water, with the opportunity to vary the temperature as often as desired.

The second floor, as indicated by the plan, contains the secretary's office and lobby, the reception and reading room, the game and billiard room, the gymnasium and the instruction or class room. The game room has four billiard and pool-tables, a shuffleboard and numerous small games, such as checkers, dominoes, chess, etc. The reading room is to be provided with plenty of popular books, papers and periodicals and technical railway journals. It is the intention eventually to have a good circulating library, from which books may be drawn and sent to members regularly in any part of the city. The reception room will have a pianola, contributed by the former president, C. L. Rossiter, who was always much interested in the welfare of the men. The gymnasium is expected to be up to date in every respect. It will be provided with Indian clubs, dumb bells, chest weights, muscle developers, horizontal bars, parallel bars, vaulting horses, spring boards, tumbling mats, jumping bars, trapeze, flying rings, traveling rings, ladders, basketball and handball courts, etc. A competent physical director will conduct classes in physical culture on certain days of each week. It will be noticed that the gymnasium is immediately over the locker room and baths, and communicates with them by means of a stairway, thus giving convenient access for the devotees of physical culture to the shower and tub baths. The instruction or class room is to be one of the most completely equipped of its kind in the country. It is to have two skeleton car equipments, one representing the surface and another the elevated railway equipment. They will have precisely the same kind of apparatus as those in regular service, and all the working parts, including the wiring and the electrical and mechanical details, will be exposed to view, so that the men can have a practical demonstration of the working of the entire apparatus. There will be an instructor to explain the elementary principles to the novices and to give them information concerning actual operation, including the rules and regulations of the road. From time to time lectures will be given to the old as well as the new men, and made interesting and instructive by practical illustrations of the several points covered. Educational work is to be made one of the leading features at these rooms, and the classes will bring the employees into actual contact with the other desirable features of the association. The partitions on the second floor are folding or removable partitions, the idea being to throw all the rooms together, making a seating capacity for over 1000 persons, when needed for large affairs. The association will give a course of vaudeville entertainments and lectures

SECOND FLOOR PLAN



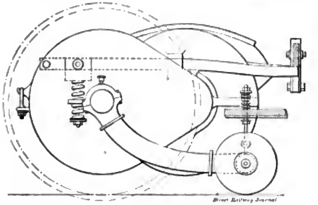
BASEMENT PLAN

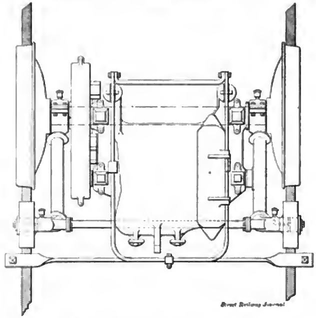
during the year, which will be free to the members. Such occasions may be taken advantage of by the officers of the road when they desire to meet and talk with "the boys."

Up to the present time the association work has shown its great value by bringing the men from the different divisions together and placing them in friendly social intercourse with one another and with the officers of the company. There is manifested now a truly fraternal feeling, where before there was suspicion and distrust. The free semi-weekly excursions for the men and their families, which went to Rockaway Beach by special train service, contributed by President Greatsinger during all of the hot months of last summer, seemed to be one of the valuable agencies for bringing men and officers together, and it was done under the association auspices. A bowling tournament is now being conducted, in which fifteen teams, including one from the general office, are striving for the honor of winning one of the several handsome prizes, costing from $5 to $50, for the individual scores and $200 for the team scores. In all of the efforts of this kind which are making for the mutual good of the employer and the employee, the restraining, refining and uplifting influence of the Young Men's Christian Association workers is quietly and unostentatiously being exercised, and it is safe to say that no individual who comes in contact with that influence will be injured thereby.

Increasing Traction by Magnetism

Some interesting experiments have been made at Seattle, Wash., the last two years on electric railway trucks equipped with devices for increasing, by means of magnetism, the adhesion of the wheel to the rail, or in other words the traction. The results which have been obtained are somewhat remarkable, and may be of far-reaching importance in railroad work. The apparatus has been





PLAN AND SECTION OF AN ELECTRIC TRUCK WITH MAGNETIC ADHESIVE DEVICE

much perfected since the first experiments, and its weight, as well as the amount of energy required to energize it, seem to be well within practical requirements. Furthermore, it obviates the necessity for important modification of existing trucks or motors, which will, of course, be an important consideration with the management of roads already equipped.

Herewith are presented diagrams showing the magnetic equipment of a truck now in Seattle, placed on all four wheels of a double-truck 15-ton car, equipped with two 50-hp motors. On each side of the motor, between the motor casing and the wheel, is a bearing which supports an arm, upon which the magnetizing coil of wire is wound. The other end of the arm carries a wheel without any flange, which rolls along the rail when the device is in operation, and is held ⅝ in. above the rail by springs when the coil is not energized. The object of this arrangement of an idler wheel upon the rail is to give a short magnetic circuit. The lines of force in this case, of course, flow from the arm to the car journal and wheel, from the car wheel to the rail, from the rail to the idler wheel, and hence through the coil-wound arm. Some earlier experiments attempted to dispense with the idler and make simply a magnetic circuit from one car wheel to the other through the rails; but these arrangements required a great deal more electrical energy than the present one. With an expenditure of 2½ hp in electrical energy, to magnetize the four coils, an increase in tractive effort of 350 per cent is obtained, and, what is still more remarkable, the tractive effort does not fall off when the wheels begin to slide or spin, but, on the other hand, increases slightly. This is accounted for by the generation of eddy currents in the wheel and rail when slipping takes place.

This increase in tractive effort being due to magnetic attraction between the wheel and rail is by no means an equivalent of an added weight which would give the same traction. In order to demonstrate this a car was loaded with a weight which would give it a tractive effort 350 per cent greater than the empty car. The current required to propel the car on the level was noted; the current required to propel the empty car under the same conditions without the magnetic adhesion device, and finally the empty car was run with the magnets energized. It was found that the increase in power required to propel the car on the level, with the magnetic device in action, over that needed when the magnets were not energized, was only 23 per cent of the increase required to propel the car loaded with a weight which would give it 350 per cent increase in tractive effort without the aid of the magnetic device. The difference between 23 per cent and 100 per cent, therefore, would represent the difference between the rolling friction of the wheel on the rail with magnets in action, and the bearing and rolling friction caused by an increase in dead weight sufficient to give 350 per cent increase in traction.

In the tests at Seattle, which were made by the division master-mechanic of the Northern Pacific Railroad, it was found necessary to grease the rails and wheels with axle grease in order to bring the slipping point of the wheels down to the limits of the motor capacity when the magnets were energized. The draw-bar pull upon this greased rail before the wheels began to slip was 1500 lbs. It was increased to 5450 lbs. upon the energizing of the magnets.

It will be seen from the drawings of the truck that the device does not take up an unreasonable amount of space on the axle, though, of course, it would be somewhat crowded with larger motor equipments, and in some cases might preferably be mounted on the truck frame rather than on the axle. It is proposed to use this device to increase the traction of steam and electric locomotives as well as electric motor cars. In electric railway operation, as at present carried on, probably the most valuable feature of this improvement is the increased braking power it affords for emergency stops, especially when the rails are slippery and for controlling the car on grades. An increase in tractive effort of 350 per cent is by no means to be despised. According to modern methods, with motors on every axle, there is not as great need for increase in traction during acceleration as there would be if the motive power were concentrated at one point in the train, yet there is a possibility that the use of a magnetic device of this kind will modify the present tendency to distribute motors throughout the train, and will tend to a more extensive use of electric locomotives for certain kinds of service. The electric locomotive, equipped with magnetic traction-increasing apparatus, would have its traction so increased that the necessity for distributing motors throughout a train would not be as great as at present. It greatly increases the possible train weight an electric locomotive can start without increasing the locomotive weight.

This apparatus is now controlled by the Magnetic Equipment Company, of Chicago, and the invention is credited to A. A. Honey, formerly of Tacoma, Wash.

New Repair Shops of the Brooklyn Rapid Transit Company

Some twenty or more years ago an extensive series of plans were made for improving the steam railroad facilities of Long Island, and one of the features of the scheme was an immense terminal station at Thirty-Eighth Street and Second Avenue, Brooklyn. This station was erected by the South Brooklyn Railroad & Terminal Company as the enterprise was called, but was never used, and has remained practically idle for many years. The property was acquired by the Brooklyn Rapid Transit Company a year or more ago, and has been since used as a shed for the storing of cars. Plans have now been perfected, however, for transforming the structure into what will probably be one of the most extensive and convenient repair shops in the country.

INTERIOR OF SHOP

It is expected in the near future to rebuild and equip 240 of the steam coaches at present used on the elevated with motors. These cars are to be considerably changed, in order to conform with the standard elevated equipment used since the introduction of electrical operation on the road. The platforms will be lengthened to 4 ft. $1\frac{1}{8}$ ins. from the present dimensions of 3 ft. 2 ins., necessitating the changing of the hoods, etc. Additional sills will be placed under the car to strengthen the present side sills, and new trucks will, of course, be required. The present shop facilities of the road are entirely inadequate to handling this immense amount of work, and the old station of the South Brooklyn Railroad & Terminal Company was thought of as a solution to the problem. The idea was immediately put to use, and the accompanying half-tone engravings, which are reproduced from photographs recently taken on the ground, show the present general appearance of the building and the state of the work of changing it into a repair shop. The shop is 148 ft. 6 ins. wide, and 513 ft. 4 ins. long. At the Second Avenue end there is a partition about 44 ft. from the end, which encloses what was originally intended as a waiting-room. It will be used as a carpenter shop. At one end of this space, which is two stories high, in the corner of the building, offices have been partitioned off, and along the second story a balcony will extend across the building, from which an inspection of the whole shop can be readily made.

There are eight tracks in the station. The ground is now being broken for a concrete filling, which will be evened off level with the head of the rail, making a hard, smooth floor for the shop. A novelty of the sonstruction is that the roof is supported on trusses that extend entirely across the shop, leaving the interior free from posts. The track on the south side of the building is to be extended so as to run out by a slight grade to Second Avenue. This track will be used for bringing in supplies, etc., and none of the repair work will be done upon it. The next two tracks have a pit running their entire length, and will be used for truck and motor work. Tracks 4, 5 and 6 will be used for the wood work. The last two tracks, 7 and 8, will be used by the painters. Along the north side of the building the station platform, which was one of those originally intended for use by passengers, has been left, but at the south side the floor has been evened off at the same level as the rest of the floor space. At the east end of the building there is to be built at the side of the first track a high platform about 50 ft. long for receiving goods on flat cars. At both sides of the building a platform is to be placed about 8 ft. wide and 8 ft. 8 ins. below the roof. These platforms will be supported by brackets underneath, and their outer edges will be hung from iron rods. The platform on the north side will be used by the wiremen, and that on the south side for the storage of light parts of the equipment. Over the two pit tracks will be two traveling cranes, supported on rails suspended from the roof trusses, as shown in the cross section. These cranes will be provided with two air hoists on transverse travelers. About the floor between the other tracks are suspended platforms upon which the workmen can stand while rebuilding and painting the cars. These platforms are hung from the roof trusses. At the west end of the building a transverse traveling crane, 55 ft. in length, traverses the entire width. This crane will be capable of picking up a complete car body and moving it to any track desired.

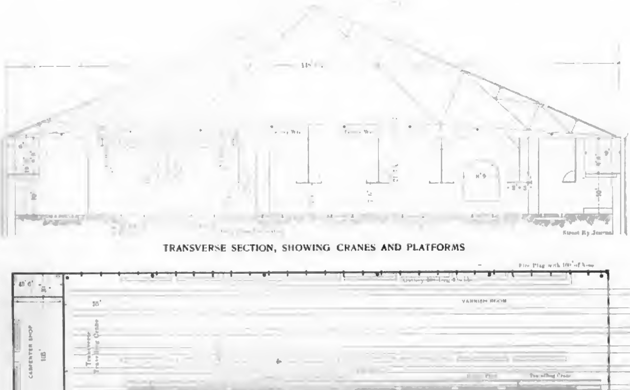
The windows at the north of the building are unobstructed, but at the south the windows in the walls are darkened by buildings built on the adjoining property. In order to give more light, therefore, to this part of the shop openings are being made in the roof, and skylights will be introduced. The central part of the structure is lighted by a monitor running the entire length of the roof. The top of this monitor consists of sections alternately glazed and solid, about half the surface being glazed. The sides of the monitor, which are now only partially glazed, will probably have sash placed in them for the entire length. The shop will be heated by steam, radiators being placed in various parts of the building, while in the pits and under the galleries at the side, steam

GENERAL VIEW OF TERMINAL STATION BEING MADE INTO REPAIR SHOP

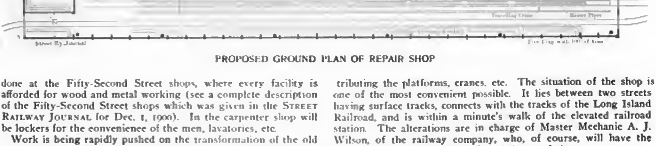
EAST FRONT OF NEW REPAIR SHOP

pipes will be suspended. The boilers for the steam heating system will be in the west end.

The carpenter shop will contain only a few tools, such as a circular saw, a band saw, small forge, drill press, tool grinder, lathe, etc., as the greater part of the work is expected to be ready the cars will be run in for conversion to the new standard. When finished there will be room for forty-two cars on the floor, so distributed that the workmen will not interfere with each other. The plans have not yet been fully decided upon, but the accompanying cuts show the probable changes and method of dis-



TRANSVERSE SECTION, SHOWING CRANES AND PLATFORMS



PROPOSED GROUND PLAN OF REPAIR SHOP

done at the Fifty-Second Street shops, where every facility is afforded for wood and metal working (see a complete description of the Fifty-Second Street shops which was given in the STREET RAILWAY JOURNAL for Dec. 1, 1900). In the carpenter shop will be lockers for the convenience of the men, lavatories, etc.

Work is being rapidly pushed on the transformation of the old station into an up-to-date shop, and as soon as the building is tributing the platforms, cranes, etc. The situation of the shop is one of the most convenient possible. It lies between two streets having surface tracks, connects with the tracks of the Long Island Railroad, and is within a minute's walk of the elevated railroad station. The alterations are in charge of Master Mechanic A. J. Wilson, of the railway company, who, of course, will have the building under his direction after their completion.

The Wheel Capacity for Engine-Driven Alternators

BY H. F. SCHMIDT

The wheel capacity for engine-driven alternators has been the subject of much discussion among the electrical and mechanical fraternities ever since the problem of parallel operation of generators was first met with. This is shown by the paper on this subject by Mr. Schlichter, before the American Society of Mechanical Engineers last week, as well as the extended discussions by Messrs. Keilholtz, Emmett, Steinmetz, Berg, Schlichter and others at the October, 1901, meeting of the American Institute of Electrical Engineers.

One of the first requirements for the successful operation of alternators in parallel is that the engines driving them have as nearly as possible a uniform torque, since alternators are particularly sensitive to the instantaneous changes of angular velocity of the shaft, due to the inertia of the reciprocating parts, angularity of the connecting rod and drop of steam pressure on the piston, due to the expansion of the steam after cut-off.

Of these causes for the variation of the angular velocity the effect of the inertia of the reciprocating parts is the most serious, though not so much so in the first as in the second half of the stroke. In the first half of the stroke the mass of the piston, piston rod and connecting rod must be accelerated, requiring, at high-piston speeds, a force as great as the total pressure of the steam on the piston, while in the second half of the stroke the masses must be brought to rest, giving out the stored energy, resulting in an excessive thrust on the crank-pin and an increased torque. The extent of this effect is directly proportional to the mass of the reciprocating parts and as the square of the number of revolutions per minute. Hence the low-pressure piston will affect the torque most, owing to its weight. This excessive thrust at the end of the stroke can be somewhat counterbalanced by having considerable compression and making the low-pressure piston as light as possible. A change of the position of the cranks from 90 degs. will also tend to give a more uniform torque, though this will lead to difficulties in the steam distribution between the cylinders. Also if the load is not divided equally between the cylinders, the greater part being done by the low-pressure cylinder, the "peak," as shown by the indicator card at the end of the low-pressure stroke, will be much flattened.

For the foregoing reasons there are but two or three impulses obtained in one revolution of a cross-compound engine instead of four, as would be expected, and for similar reasons it has been found that the three-crank triple expansion engines are little better in this respect than the cross compound. Thus, it would seem as though a more even crank effort could be obtained from the cross-compound type, by converting it into a two-crank triple-expansion engine, with the high and intermediate cylinders in tandem, thus more nearly equalizing the weight of the reciprocating parts, and obtaining a greater uniformity of the steam pressure throughout the high-pressure stroke.

Owing to the angularity of the connecting rod the effect of gravity on the piston of vertical engines is not the same on the up as on the down stroke, thus making the torque variable, therefore the horizontal engine has an advantage in this respect.

The result of these various causes for the instantaneous change in the angular velocity is that a massive fly-wheel is required, since if an alternator has p pairs of poles, and the maximum angular displacement of the shaft is Δ, then will the electrical displacement be $a = p\Delta$, hence the greater frequency and the slower the speed of rotation, the smaller the angular displacement of the shaft permissible.

The energy in foot pounds which a fly-wheel of moment of inertia J can store up with a displacement Δ, will be given by

$$\text{energy} = J\int_0^{\Delta}\left(\frac{d^2\theta}{dt^2} + \frac{d^3\theta}{dt^3}\,dt\right)d\theta, \text{ or we have}$$

$$M = \frac{\text{Energy}}{r^2\int_0^{\Delta}\left(\ddot\theta + \dddot\theta\,dt\right)d\theta,}$$ where

M = mass of the fly-wheel, and r is the radius of gration, and θ is the variable angular displacement in circular measure. Therefore, it follows that the greater the unbalancing factor and the smaller the value of Δ, the greater must be the mass of the fly-wheel.

From the nature of the fly-wheel and the duty it performs it is evident that its action is like that of the pendulum—an oscillatory motion—acting on the governor, which if sensitive will be affected by it, often causing cumulative "hunting," with the result that the machines will be thrown out of step. There are several remedies for this trouble, the most effective of which probably is the use of "time delay" dash pots, the invention of H. W. Buck and H. Cooke. Another successful means of preventing this trouble is in changing the weights on the governor, keeping the moment of the weight the same, but changing the moment of inertia by lengthening the lever arm. This gives the governor a different period of oscillation from that of the fly-wheel, causing them to neutralize each other.

While an absolutely uniform torque is desirable a constant speed of rotation is not necessary, for, as has been shown by Mr. Steinmetz, under that condition the division of the load between the machines is indeterminate, consequently a small decrease of speed is desirable with increase in load.

Having discussed the steam engine side of the question there are certain electrical requirements which must be considered, which are more or less contradictory to the facts governing the conditions of uniform rotation of the engine, were it not connected to the alternator. Namely, considered separately, absolutely uniform rotation of the engine could be obtained if we made the fly-wheel of sufficient capacity, but when considered in its relation to the alternator we must consider the synchronizing action which exists between the alternators operating in parallel, and to the rotaries and synchronous motors on the circuits. Considering the form of the waves as sine waves, and if the angle of lag or lead between the machine is B, then will the cross current through the machines be

$$i = C \sin\frac{B}{2}$$

and as the synchronizing force is porportional to this current, that is

$$F = \text{synchronizing force} = K \sin\frac{B}{2}$$

$$\text{and } B = 2\sin^{-1}\frac{F}{K}, \text{ or as } F = J\left(\ddot\theta + \dddot\theta\,dt\right)$$

$$B = 2\sin^{-1}\frac{J\left(\ddot\theta + \dddot\theta\,dt\right)}{K}$$

It follows that an increase in J means an increase in B and i. Therefore too large a fly-wheel is almost as bad as one which is too small. From experience with a large number of representative alternators it has been found that the maximum short-circuited current was about 2.5 times the full-load current, hence the

$$\text{impedance is } Z = \frac{e}{i} = \frac{E}{25}, \text{ whence}$$

$$\text{cross current} = \frac{2\,E\sin\frac{B}{2}}{2\times\frac{E}{2.5}} = 2.5\sin\frac{B}{2}$$

this shows the maximum allowable electrical displacement to be 2.3 if a cross current of 10 per cent of maximum full-load current is to be permitted. The synchronizing torque due to this current may aggravate the unbalanced effect of the engine by as much as 30 per cent, which has been found in some cases.

The unbalancing factor found in average engines may be expected to be about

.15 to .3 for single-crank engines.
.075 to .15 for two-crank compound.

Three-crank compound and triple-expansion engines show about the same unbalancing factor as the cross-compound engines, for reasons already stated.

"Hunting" or "surging" can be greatly reduced by the use of "deadeners" (short-circuited windings on the field coils), but cannot be prevented entirely, for, like the governor, they depend for a change in velocity to make them come into play, therefore a slight angular deviation must exist. When deadeners are to be used armature slots, which are almost closed, will be found advantageous, as they keep the flux density in the pole face more uniform, resulting in a smaller loss from eddy currents.

In considering two or more alternators operating in parallel, driven by steam engines, it has occurred to the writer that if instead of having the alternators rigidly connected to the engines, they were driven through a spring coupling, and the engine fly-wheel were only of moderate weight and the rotating part of the alternator of great weight, then would any momentary change in the angular velocity of the engine shaft be taken up by the spring without changing the angular velocity of the moving part of the alternator to any great extent. It might seem at first as if cumulative oscillation would take place under these circumstances, but if the moments of inertia of the two rotating parts and stiffeners of the springs were properly adjusted, such oscillation could not take place. Also in a plant in which several alternators were running the stiffeners of the various springs would each be resigned differently so as to prevent any resonance. The chief objection is that it cannot be adapted conveniently to engines of large power

The action of these springs would be very similar to self-induction placed between the generators, except that it would not cause any heating of the alternators and permit their carrying a greater load without overheating.

Flywheel Capacity for Engine-Driven Alternators*

BY WALTER I. SLICHTER

The paper is written with the object of showing certain considerations which must be borne in mind when selecting a steam engine to drive an alternating-current generator which is to run in multiple with another generator or which is to generate power for a system in which synchronous apparatus, such as synchronous motors or rotary converters, are to operate.

A detailed analysis of the mechanical action in the engine which is the cause of the trouble is to be found in J. I. Astrom's paper, and the discussion thereon, read before the society last year at Milwaukee.

An alternating-current generator, when direct-connected to a steam engine, is sensitive to certain irregularities in the speed of the engine, which affect no other type of apparatus. This irregularity is in the instantaneous value of the speed, or the variation of the angular velocity during one revolution, as distinguished from the changes in the average speed, due to a change of load or of steam pressure.

During one revolution the force applied to the crank-pin of a steam engine varies considerably, due to the following causes:

Transfer of reciprocating to rotating motion.
Variation in steam pressure on the piston, due to expansion.
Inertia of the reciprocating parts.
Weights of the reciprocating parts
Throw of connecting rod.
Shortness of connecting rod.

Of these the first three are of the greatest magnitude. The first causes the torque to pass through zero twice in each revolution, the second causes the torque to be less in the second half of a stroke or impulse than in the first. The effect of the reciprocating parts is to diminish the torque in the first half of the stroke and increase it in the second half. Therefore, it is opposed to and counteracts the effect of expansion. The inertia effect is of considerable magnitude, and frequently more than balances the effect of expansion. This is particularly the case in high-speed engines and in the low-pressure cylinder of a cross-compound engine, which is necessarily very large and bulky. The effect of the reciprocating parts is the most interesting, as it may be either harmful or beneficial—harmful in producing a peak at the end of the low-pressure stroke, where it overlaps the admission of the high-pressure stroke, thus merging the two impulses; beneficial in lowering the excess energy during admission of the high-pressure stroke.

In a single cylinder double-acting engine there are two impulses per revolution, and in a cross-compound engine there are four impulses. During the first part of the stroke the effort is less than the average, during the second part (equal to about one-half the period of the stroke) it is greater than the average. During the last part of the stroke the effort is less than the average again. This is shown diagrammatically in Fig. 1, Curve 1. Curve F is the varying crank effort or torque in foot-pounds at the center of the shaft. The straight line AG represents the average value or mean effort. The difference between these two at any time represents the excess of deficit torque, or the force acting on the fly-wheel or given by the fly-wheel.

This force F, acting on the mass of the fly-wheel M, gives the wheel an acceleration $a = \frac{F}{M}$, or $a = \frac{F}{I}$, where I is the moment of the fly-wheel.

From a to b in the diagram the acceleration is negative and the speed drops (Curve 2), from b to d the acceleration is positive and the speed rises, the gain in speed from minimum to maximum (b to d), represented by S, being proportional to the area of the figure bcd. The acceleration is negative again from d to e, and the speed drops back to its original value at the end of the impulse to pass through a similar cycle in the next impulse.

While the speed is less than the average during the first half of the impulse (as from a to c, Curve V), any definite point of the revolving masses, as the crank-pin center, will fall behind the position it would maintain if the angular velocity were constant; and at c, where the speed becomes greater than the average again, it will have reached its greatest displacement and will commence to regain its correct position, which it reaches at d, and passes to a displacement ahead of that of constant velocity. The change of position from c to e, represented by $2\ \Delta$, is proportional to the area of the Curve V between c and e.

Thus we find that the displacement angle is proportional to the double integral of the curve of unbalanced effort. This would be a long and tedious operation, but it is the only correct method of obtaining exact values. The method was given in the discussion on Mr. Astrom's paper. The work may be considerably shortened by the use of the integraph (of Coradi, Zurich), an instrument which will graphically integrate each curve in turn. By tracing the curve to be integrated with the pointer, a recording pointer will draw a curve, each ordinate of which is proportional to the area enclosed by the original curve up to that point. Its principal objection is that to get accuracy the original curve must be on a large scale, for the deduced curve is of such a scale that a 1-in. ordinate represents at least 4 sq. ins. of area in the original.

The displacement may be obtained approximately quite easily on the assumption that the curves are more or less regular and symmetrical, resembling sine curves.

In a bipolar alternator the e. m. f. performs a complete cycle for every revolution; in a four-pole machine there are two cycles per revolution; that is, there is a cycle for every pair of poles per

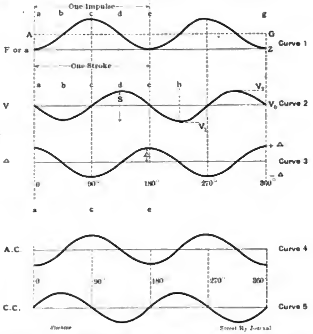


FIG. 1.—TORQUE, SPEED AND DISPLACEMENT OF A SINGLE-CRANK ENGINE

revolution, and if there are p pairs of poles on an alternator one cycle of the crank corresponds to $p \times 360$ degs. in the electrical circuit. The effect produced in the electrical circuit is due to this displacement rather than to the variation in speed.

A displacement of phase in the electrical circuit of 2.5 from mean will cause a cross current of about 10 per cent of full-load current to flow. Therefore we assume $a = 2.5$ as the limiting value of the displacement. This cross current heats the windings of the generators and may cause considerable loss of power in the resistances of the connecting cables.

The value $a = 2.5$ is one which builders of electrical apparatus have more or less generally agreed on as the limit, if satisfactory parallel running of apparatus is expected. If other conditions are favorable, such as low resistance between generators, and few synchronous motors in circuit, the generators will work well in parallel with a considerably greater displacement, but when the conditions become exacting 2.5 is the limit.

A synchronous motor or rotary converter having a constant load tends to run at constant speed and has more or less fly-wheel effect in its rotating member. If now this is connected to an alternator driven by an engine which has an irregular angular velocity, giving a displacement from + 2.5 to — 2.5, there will be a continual give and take of current between the two, which may lead to the phenomenon known as hunting. That is, when the generator is ahead of the motor, the motor tries to catch up and takes power from the generator to do so; then, when the generator is behind in relative position, the motor tries to drag it along, and in so doing gives its power back again.

We have seen that the evil effect in the electrical circuit in-

* Abstract paper presented at the New York meeting (December, 1902) of the American Society of Mechanical Engineers.

creases with p, the number of pairs of poles. Thus it is that high-frequency generators give more trouble than low-frequency generators. In most designs of engines the fly-wheel capacity necessary to carry the engine over a change in load while the governor is operating is sufficient to maintain the angular velocity within reasonable limits, but in cross-compound engines the inertia of the reciprocating parts of the low-pressure cylinder (the cylinder being so large) is usually so great that the crank effort diagram is much distorted. Instead of getting four peaks per revolution we get two or three, and each of these peaks lasts longer, the period of high speed lasts longer and the displacement is greater.

There is also an aggrevating action in the electrical generator itself, as pointed out by H. E. Longwell in a paper before the Engine Builders' Association last May. This is what may be called the synchronizing force, or torque, of the generator. As mentioned before, each generator, as well as each motor and rotary of the system, tends to keep in step with the rest of the system—that is, resists any displacement. If some external force causes a displacement, there occurs in the generator a torque proportional to the displacement, tending to bring the revolving part back to the mean position.

If the displacement is backward, as at c of Curve 3, Fig. 1, there will be a torque trying to pull the revolving part forward into step (as in Curve 4, Fig. 1), which torque, it will be noticed, is greatest where the displacement is greatest, and where the engine effort is greatest; thus the synchronizing torque of the generator is in step with the unbalanced effort of the engine and additive thereto.

Two generators connected in multiple will share the load between them at any instant in proportion to the angular displacement between them. If the displacement is not very great, the variation in load or, in other words, the synchronizing force in each is proportional to the sine of one-half the angle between them—that is, is proportional to the cross current. Thus we find that at 2.5 degs. displacement there is a torque equal to 10 per cent of full-load torque tending to pull the alternator into step, and this torque occurs simultaneously with the excess effort of the engine, and increases that excess and the unbalancing factor.

In the case of the 800-kw set, the curves of which are given here as an example, we find a displacement of 3.4 degs., due to unbalanced engine effort alone, and this displacement causes a synchronizing torque in the alternator varying up to 15 per cent of full-load torque as a maximum. This increases the unbalancing factor 30 per cent, and would increase the displacement about the same amount. But this is an old plant and an unusually severe case (sixty cycles). This shows that it does not necessarily follow that alternators of large synchronizing power will run in parallel better than those of small synchronizing power, but rather the reverse, though there are reasons why the other extreme is not desirable either.

It might be interesting here to note that in a continuous current machine this torque is proportional to the speed instead of the displacement. When the speed is high the torque is negative, and when the speed is low it is positive, or additive to the engine effort. This is shown in Curve 5 of Fig. 1. The effect of this torque is merely to distort the curve of engine effort, as it is displaced 90 degs. therefrom. It is interesting to note that this torque is just opposite in effect to that of the reciprocating parts at any given time.

From a number of engines I have analyzed, and from data collected from some German and French technical publications and different American engine builders, it may be considered reasonable to expect an unbalancing factor of:

.15 — .30 in a single-crank double-acting engine,
.075 — .15 in a two-crank engine.

But in the two-crank engine, as mentioned before, the distorted curve of effort usually gives only two displacements per revolution instead of the four we would expect; therefore we may say that the "apparent" unbalancing factor is .15 — .30. A three-crank engine has about the same apparent unbalancing factor as a two-crank.

A vertical engine gives a little more unbalancing than a horizontal, due to the dead weight of the moving parts, for which we should make some allowance.

To determine a weight of fly-wheel which would limit the displacement to a value approximately equal to 2.5, I have derived a formula based on the foregoing unbalancing factors with a reasonable increase to allow for overloads. While not always giving the most desirable fly-wheel capacity, since it would be impossible to take into account all the irregularities of some engines, yet it gives a value suited to the various conditions, such as frequency of alternator, style of engine, etc., such that if the engine is reasonably good we will get the results desired. If this weight of fly-wheel does not give satisfactory results it would be much better (for the electrical circuit) to make such changes in the engine itself as to give a better crank effort diagram than to increase the weight of fly-wheel, for a fly-wheel may easily give trouble by being too heavy.

As changes in the engine I might suggest:

First, as best though most difficult, changing the angle between the two cranks.

Second, changing the proportion of load taken by the different cylinders, and make the low pressure take more load.

Third, introduce compression at the end of the stroke to take up inertia, particularly in low-pressure cylinder.

The formula is:

$$Wr^2 = \frac{KW \times C \times 10^9}{S^4},$$

where
W = effective weight of wheel,
KW = rating of generator,
S = speed of engine in R. P. M.,
r = radius of gyration,
C = a constant as follows:

	Horizontal Single Crank	Vertical Cross Compound	Horizontal Cross Compound
25 cycles...........	315	275	250
40 "	505	440	400
50 "	630	550	500
60 "	755	660	600
125 "	1575	1380	1250

In some cases it is necessary to use a larger fly-wheel than this to carry the load during the short time it takes for the governor to operate. In railway power stations the load varies so greatly and so suddenly that an immense fly-wheel has to be adopted to meet these changes and the angular displacement has to be ignored. But so far as hunting and parallel operation are concerned, too great a weight of fly-wheel is almost as undesirable as too little, for a large inertia in the circuit means that much power must be expended in bringing any oscillating mass back into synchronism. Therefore, where a very heavy fly-wheel is not necessary for definite reasons, it is desirable to keep the weight down, and the weight necessary to limit the displacement to 2.5 degs. will be found a reasonable medium value.

In many cases where hunting has occurred, due to a pulsating prime mover or other cause, it may be held in check and practically suppressed by connecting a dashpot to the governor mechanism. This dashpot should have the characteristics that it is not sensitive to sudden changes in load or speed, but that any prolonged change will cause it to move. This has been used successfully in practice to a considerable extent.

To determine by test the variation in speed of an engine is a very delicate and complicated experiment, and there have been many ways tried and suggested, but with very little success. At the meeting of the French Société Internationale des Electriciens last winter this subject was discussed, and many methods described. The most successful was that of E. W. Mix, in which a bevel-gear wheel is driven from the engine shaft by some very positive method—as gearing, or a bicycle wheel pressed against the engine fly-wheel. This gear wheel drives in opposite directions two other bevel gears on concentric shafts at right angles to the shaft of the first gear. The outer hollow shaft of these two concentric shafts drives a light aluminum disc. The other gear wheel is connected to a shaft consisting of a long elastic steel wire, and this drives a disc with a heavy fly-wheel rim. These two discs are placed side by side. One being light and connected by a rigid shaft, follows all the irregularities of the prime mover; the other, having considerable inertia and being driven by an elastic connection, revolves at practically constant angular velocity. There are slits in both discs, and by an arrangement of a light and mirror the relative displacement of the slits causes a beam of light to be deflected.

If an alternator becomes very much displaced in phase it may absorb power electrically and drag the engine along. If now the governor does not meet the condition properly, there may be no steam admitted to the cylinder; then at the end of the stroke the vacuum in the cylinder may be sufficient to draw water from the condenser, which may cause damage. Electrical damping devices are used in many cases to overcome these irregularities. They consist of short-circuited windings on the poles of the alternator. When the alternator oscillates ahead of or behind its correct speed, currents are generated in these devices which tend to oppose these oscillations. This is quite effective if the oscillations are rapid or of a short period, but, of course, it wastes power just in proportion as its effectiveness increases, being nothing more than a friction brake.

To give an idea of the fly-wheel capacity required to meet the requirements advocated, and show that, contrary to the general opinion among mechanical engineers and engine builders, a very heavy wheel is not necessary, I append a table giving a comparison of the weights calculated by the above formula and those actually installed by the engine builders:

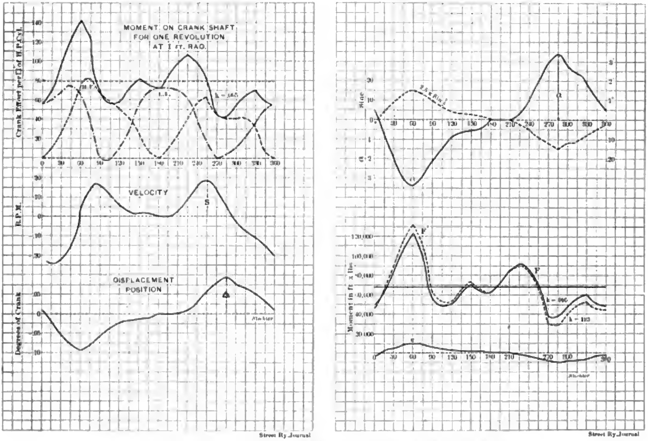
	Installed	Calculated
Altoona	13,000	11,000
Cleveland	41,000	75,000
Glasgow	148,000	164,000
Hanover	40,000	53,000
Baltimore	73,000	45,000
Metropolitan	240,000	193,000
Washington	15,100	17,500
Philadelphia	70,000	107,000
Omaha	24,000	18,000
Santa Catalina	34,000	21,000
Tornavento	72,000	44,000
Santiago	17,000	13,300
Milwaukee	50,000	40,000

seventy-two poles; hence the displacement in the electrical circuit is $36 \times .95 = 3.4$ degs.

In Fig. 3, Curve 1, is shown *a*, the displacement, and the broken line shows the variation in synchronizing force. In the lower part of the figure we have in full lines the crank effort diagram, and curve *e* is the synchronizing torque of the alternator in foot pounds. Adding these two together, we get the resultant unbalancing torque, which, as mentioned before, gives an unbalancing factor of .123, or 30 per cent greater than that due to the engine alone. In these diagrams the high-pressure cylinder takes 47.5 per cent of the load and the low-pressure cylinder 52.5 per cent.

Smoke Consumption

Among the topical discussions at the New York meeting of the American Society of Mechanical Engineers last week the contribution by Professor F. R. Hutton, on the subject of smoke consumption, will prove particularly interesting at this time.



FIGS. 2 AND 3.—CURVES OF HORIZONTAL CROSS-COMPOUND ENGINE

I have given attached the curves of a horizontal cross-compound engine, cylinders 24 ins. and 48 ins., by 48-in. stroke, which is direct-connected to a 60-cycle alternator of 800 kw, at 100 r. p. m. There were several of these in the station, and there was considerable trouble from "hunting." It was finally necessary to put short-circuit windings on the poles, and a dash-pot governor on the engine, since which time the plant has run satisfactorily. The plant was laid out several years ago.

The irregular shape of the curve of combined high and low-pressure crank efforts will be noticed. There are practically only two impulses per revolution. The maximum unbalancing factor is .095, is negative, occurs during the (high pressure) return stroke, and lasts for 126 degs., or over a third of a revolution; this is the cause of the poor characteristics of the engine. If dead weight were added to the high-pressure piston the diagram would be improved, or if the angle between the cranks were less.

By integrating this curve of crank effort we get the velocity curve as shown, and by integrating this in turn we get the curve of displacement of the crank center, which shows very clearly the "two-impulse" effect of the engine.

The maximum displacement is .095 deg. The generator has

Professor Hutton described a recent visit to an important plant just outside of Syracuse, where his attention was directed to the appearance against the sky of two columns of "products of combustion," a photograph of which he displayed. The stacks are of about equal height, one of brick and the other of steel. The brick one takes the products of combustion from 3500-hp Babcock & Wilcox boilers, which are fired by hand. The steel stack to the right of the brick stack is discharging the smoke from 3600 hp of the same type of boilers, operated with mechanical stoking. The coal used is the ordinary run of mine from the Clearfield district, of the usual soft-coal type, and the rates of combustion, as far as have been observed, average 18 lbs. per square foot grate per hour for the hand-fired battery, and about the same for the stoker. It is, of course difficult in a photograph to secure the profound impression which is made upon the eye even with a background of a gray sky, but in the picture shown the superiority of mechanical firing is very evident. The author says, too, that it happens quite often that the mechanically-fired boilers show less volume of smoke than at the time chosen in the photograph, but that the picture covered average conditions as nearly as could be represented.

The New Subway in Boston

The passage of the Washington Street Subway Bill on Tuesday of this week by the referendum vote of the citizens of Boston adds the final signature of public approval to this noteworthy piece of legislation, and marks the beginning of a vigorous prescution of the enterprise. Boston is to be congratulated that the general welfare of its citizens has been again intelligently conserved, and that the ill-advised interference of various irresponsible labor unions has been declared intolerable by the majority of the voters of the city. We have frequently commented in these columns upon the essential features of the act, and consider an extended summary unnecessary.

Briefly, the act provides for a subway to be built by the Boston Transit Commission for the city of Boston, under its principal business thoroughfare, extending from the vicinity of the junction of Broadway and Washington Streets, northerly beneath the most congested section of the city to the vicinity of Adams Square, Haymarket Square or Causeway Street. Two tracks are to be provided for elevated trains and two for surface cars, and suitable connection is to be made with the existing Tremont Street subway, the East Boston tunnel and the present elevated structure. The subway is leased to the Boston Elevated Railway Company for twenty-five years, at an annual rental of 4½ per cent of its net cost of construction. Bonds designated "Boston Tunnel and Subway Loan" are to be sold by the city of Boston for the purpose of defraying the cost of construction, and the entire income of the subway to the city is to be paid into a sinking fund which will ultimately extinguish the bonds. The term of office of the Transit Commission is extended to July 1, 1906.

The beginning of operation of the new subway will witness the withdrawal of the elevated trains, which have been operated in the Tremont Street subway since the new service began in June, 1901, and the return of the surface cars to its through tracks. There can be no doubt that the latter subway is far more suited to the operation of single cars of the surface type than to large elevated trains. It contains a grade as steep as 8 per cent, and curves of as low as 90-foot radius are frequent in its interior. Considerable alteration was required to adapt it to the use of elevated trains, and it is greatly to be hoped that the new subway will benefit from the experience obtained under Tremont Street. While it must be borne in mind that the existing subway was designed chiefly for surface cars, it is thoroughly essential that the new tunnel be kept as free as possible from the distortions of alignment and grade which a too conservatiove financial policy would produce. Too much insistence upon moderate grades and easy curves can hardly be made by the designing engineers. The decrease in operating expenses of the subway, maintenance of equipment, and increase in comfort to passengers cannot be lightly passed by, if compared with the heavy wear and tear existing in the Tremont Street tunnel at the present time. If the Washington Street subway is built upon the lines which follow the most modern scientific principles of transportation engineering, there will be little cause for criticism of the kind which has at times been applied to the first attempt which Boston made in subway building. The first subway was one of the pioneers of its kind, and is very well suited for surface car operation, having been studied by railroad men from many countries, to the extent that it constitutes one of Boston's proudest achievements in recent years, but its radical defects for the present type of rapid transit service should be well heeded in the new work now to be begun. Washington Street is notoriously narrow and lined with business blocks throughout the entire tunnel's length, so that the new tunnel will be necessary to depart somewhat from the surface type of subway if the best results are to be secured. Even though the cost of going deeper into the earth be considerably greater, the money must be expended if modern rapid transit is to be secured. It is of little use to purchase expensive, high-powered, rapidly accelerating car equipment designed for high maximum speeds, if the alignment and grade of the track throttles clean and regular speed-time curves between stations into distorted vagaries representing neither rapid transit, economy of operation, nor comfort. Nor must the stations be too close together, especially as the trains will doubtless be operated upon the long free stretches of track of the overhead structure.

While the completion of the new subway will involve a considerable change in the immediate operation of the Boston transportation system, there are likely to be no such radical changes in a limited time, as were evidenced when the present elevated system began to carry passengers. In the latter case the traffic underwent little short of a revolution, and the result was remarkably successful, considering the enormous difficulties involved in handling many thousands of passengers who had never ridden upon an elevated train in Boston before, with new equipment and operating force. Much of this will be avoided when the Washington Street subway opens for business, and if past experience is noted with the liberality and public spirit which has enabled the elevated management to build up the present efficient system, there is little doubt that the new subway will be a pronounced success from the start. Its connection with the East Boston tunnel, and the new Cambridge Street subway, if the latter is carried out, will help weld into a harmonious whole the avenues of high-speed service which add so much to the transportation facilities of the city. Its employment of large numbers of skilled and unskilled laborers; its destined additions to the operating staff of the Elevated Railway Company, and, above all, its relief of the present greatly congested conditions in the business center of the city, are features which justify its being classed as a general public benefit and a work of enduring good to the Boston community.

Proposition for Municipal Ownership in Illinois

Provision for the municipal ownership of street railways is contained in a bill which has been prepared by a special committee of the Chicago City Council. This bill, upon approval by the Council, is to be presented to the State Legislature. It provides that every city in the State shall have the power to own, construct and operate such railways. When it is proposed to carry the lines outside the corporate limits, but within the county, the consent of the county must be obtained. The act providing for municipal ownership in any city is not to take effect unless the proposition to adopt it is first submitted to the voters and then receives a majority of votes cast on the proposition.

The proposition to vote for the adoption of the act is to be by ordinance of the City Council after a petition for such an ordinance, signed by 10 per cent of the legal voters, shall have been filed with the city clerk. The Council must pass such a measure on the receipt of a petition. The vote may be taken at a general, municipal or special election. A separate ballot will be provided.

If the act is adopted it will require another vote on a similar petition to compel the corporate authorities to take such measures as may be necessary to acquire, own or operate a street railway system.

To finance street railways the city may issue certificates of indebtedness or bonds for twenty years at 6 per cent, based on the earnings and excluded from the general obligations or liabilities of the city. The sinking fund to meet interest on bonds and to discharge the principal is to be kept in a separate fund, which cannot be touched for any other purpose. All earnings are to be paid into a fund to be designated "the street railway fund." After the certificates have been paid the surplus from this fund can be applied to other corporate purposes.

The city adopting the act is given the power to acquire existing street railway lines, either by purchase or by condemnation proceedings. The lines may be mortgaged or a deed of trust executed in order to raise money for operation. If the mortgage is foreclosed the purchaser is to get the right to operate the lines for twenty years. Any street railways acquired under such foreclosure proceedings are to be subject to regulation by the corporate authorities. The bonds or certificates are to be only a lien on the street railway property and franchise, and will not become general obligations or liabilities of the city. The bonds will not become valid until the ordinances providing for their issue shall first have been submitted to a vote of the people, and have received a majority of the votes cast for the proposition.

The city is given the power to lease all lines and to license cars for not more than twenty years after a favorable vote of the people. The Mayor of any city is given the power to appoint a street railway commission or commission to manage and control the street railway system. A provision is made for an eight-hour day, the placing of all employees under civil service and the doing of work under the day labor system by the city.

The Sale of the Detroit & Lake Shore Railway—Financing the Lake Shore

The bankers' committee in charge of the affairs of the Everett-Moore syndicate, of Cleveland, met last week and formally ratified the sale of the Detroit & Toledo Shore Line to the Grand Trunk & Clover Leaf Railroads. The deal has been pending for many months. The price paid for the property was $1,500,000 in 4 per cent bonds, which will be guaranteed by the Grand Trunk & Clover Leaf. The Everett-Moore syndicate will retain the electrical equipment, and will dispose of it for about $200,000. The syndicate will finance its indebtedness on the property with the new bonds. A large majority of the creditors have agreed to take the bonds for their indebtedness. Among these creditors are the

Strang Construction Company, which built the road, and which now holds receivers' certificates. Eastern bankers who hold Everett-Moore callateral on the road have agreed to exchange the new bonds for the old. After all transactions in connection with the sale of the road are closed the syndicate will emerge without loss.

It is announced that the completion of the financing of the Lake Shore Electric Railway will be postponed for a short time. All of the necessary bonds have been subscribed for, but the banking syndicate which will handle the securities does not care to close up the deal until money becomes somewhat easier in Cleveland. The liquidation of its debts on the Detroit & Toledo Shore Line lifts a great burden from the syndicate, and will enable it to go ahead with other propositions.

New York Central's Terminal Plans

The New York Central & Hudson River Railroad Company has completed its terminal plans, and last week it presented them to the Board of Estimate and Apportionment for consideration. The plan involves the depression of the railroad tracks in Park Avenue, south of Fifty-Sixth Street, and the carrying of streets, now closed, over the railway tracks. In view of the expense of depressing the railroad tracks so as to permit streets to be carried over them, and maintaining the present pavement in Park Avenue by placing additional tracks in a subway, the company asks that the city shall bear the cost of the bridges or viaducts on which the streets are to go over the tracks. The company also offers to eliminate grade crossings at several places in the Bronx.

President Newman, in submitting the drawings and description of the proposed improvements, explained very clearly the position of the company and its views on the relative responsibilities of the corporation and the municipality. In part this communication says:

These proposed changes were to be made to enable the railroad company to enlarge the surface yard forming a part of its terminal at the Grand Central Station. The proceeding thus begun was the result of an effort on the part of the officials of the railroad company, after conference with city officials, to do whatever might be possible under existing law of the work necessary to be done in order to effect the proposed change of motive power to be used in the Park Avenue Tunnel, specific enabling legislation having failed at the last session of the Legislature. The enlargement of the existing yard was regarded by the railroad company as absolutely essential, and its enlargement as a surface yard was regarded as the most advantageous method for railroad purposes, and it was supposed that this method, in connection with the proposed adoption of electricity as a motive power, would be satisfactory to the city.

While the depression of the railroad company's tracks to enable the streets to be carried over them would result in advantage to the city, and in great benefit to certain of the property in the vicinity of the terminal, it would make the railroad yard much less desirable for railroad purposes than the proposed surface yard; therefore, it is respectfully submitted that the railroad company, in justice and fairness, should not be called upon to stand the entire expense incurred by such a change, which would benefit the city and property holders solely.

More or less closely related to the proposed change in motive power, two other subjects are under consideration with the city authorities, and these should also be disposed of prior to the carrying out of the contemplated change of motive power.

First—The elimination of grade crossings at Morris Heights, Fordham Heights and Highbridge.

Second—The elimination of grade crossings in the vicinity of Kingsbridge, including Kingsbridge Road, East 230th Street, Broadway, Corlear Street, Tibbet Avenue, West 230th Street and West 227th Street.

The best method, and probably the only feasible one, of eliminating the grade crossings at Morris Heights, Fordham Heights and Highbridge, is by carrying the streets over the railroad tracks by means of bridges, with suitable approaches.

If the method of depressing the entire terminal yard and its approaches to such an extent as may be necessary to carry existing streets over the tracks by means of viaducts or bridges shall be adopted, it will be necessary for the railroad company to obtain the right to use certain portions of Park Avenue and of the intersecting streets beneath the surface. The plan of widening Park Avenue and of widening the existing cut from Forty-Ninth Street to Fifty-Seventh Street, and of closing certain portions of Forty-Sixth, Forty-Seventh, Forty-Eighth and Forty-Ninth Streets could then be abandoned.

With the desire to treat all these matters not only in a fair but in a liberal spirit, and, if possible, to show to the city and its citizens that it is willing to meet any reasonable demand, provided it is not called upon to make changes that will be seriously detrimental to its terminal property, or to incur an expense which would not be justifiable in the proper management of the property, the company submits the following propositions:

(1) The elimination of grade crossings at Morris Heights, Fordham Heights and Highbridge. The company will construct the necessary bridges and abutments to carry the streets over its tracks, and will do all the work within its own lines at its own expense, the city to bring the streets by proper approaches to the grade of the bridges in such a manner as it shall see fit.

(2) The elimination of grade crossings in the vicinity of Kingsbridge, including Kingsbridge Road, East 230th Street, Broadway, Corlear Street, Tibbet Avenue, West 230th Street and West 227th Street. The company will either (a) construct the necessary bridges and abutments to carry the streets over its tracks on the existing line, and will do all the work within its own lines at its own expense; the city to bring the streets by proper approaches to the grade of the bridges, in such manner as it shall see fit; or (b) it will unite with the city in eliminating these seven grade crossings in accordance with the provisions of chapter 516 of the Laws of 1901.

(3) The enlargement of the terminal yard:

The company will depress all its tracks between the southerly line of Forty-Fifth Street and Fifty-Seventh Street to such an extent as may be necessary to enable the city to carry by means of viaducts or bridges over the tracks, at a grade not exceeding 4 per cent, such of the intersecting streets from Forty-Fifth to Fifty-Sixth Street, both inclusive, as the city may deem necessary in the public interest, the expense of extending these streets over the railroad company's tracks to be borne by the city.

In consideration of the great expense of the railroad company in depressing its tracks for the above purpose, the latter shall be given the right to use, subject to the right of the city to construct and maintain such bridges or viaducts, those portions of Forty-Fifth, Forty-Sixth, Forty-Seventh, Forty-Eighth and Forty-Ninth Streets included within the limits of its enlarged yard, and of Park Avenue from the southerly side of Forty-Fifth Street northerly to Fifty-Seventh Street (the existing roadways of Park Avenue not to be interfered with) and to a connection with the Rapid Transit Subway at Forty-Second Street, and the right to erect and maintain on any bridges or viaducts carrying streets over its tracks such signal, electrical, and other apparatus as may be required for the operation of its road.

If the changes of the terminals at the Grand Central Station are made it may be found necessary to use the land under the surface of Vanderbilt Avenue and Depew Place, but without interfering with the surface of these streets.

The proposition is now under consideration, and it is commended by many property owners along the line, who are especially interested in restoring the grades of cross streets that are now interrupted by the company's cut. The community, as a whole, and the traveling public generally, will welcome any plan that may relieve the present congestion at the Grand Central Station.

The Reorganization of the Northern Ohio Traction Company

The Northern Ohio Traction & Light Company, which is to succeed the Northern Ohio Traction Company, has been incorporated, with a temporary capital stock of $10,000, by J. R. Nutt, W. B. Whitney, H. J. Crawford, C. E. Sanders and V. J. Terrell. The majority of the stockholders of the old company have agreed to the change, which will be effected Dec. 29. It has been announced that the company will complete its connection of Akron, Barberton, Cuyahoga Falls, Doylestown, Wadsworth, Ravenna and Cleveland. This means that the Barberton line will be extended to Doylestown and Wadsworth. There is also talk of extending to Medina.

The new company will have an authorized capital stock of $7,500,000, and the new bond issue will be the same amount. The bonds will be thirty-year bonds, and $1,000,000 will bear 5 per cent interest and the remainder 4 per cent. For every share of the common stock of the Northern Ohio Traction Company, two shares of the stock of the Northern Ohio Traction & Light Company and $50 in 4 per cent bonds will be given. For every share of the preferred stock of the Northern Ohio Traction Company, one share of the new stock and $100 in 5 per cent bonds will be given.

The division of stock of the new company will be as follows: To present common stockholders, $5,000,000; to present preferred stockholders, $1,000,000; to be used as a bonus for selling $500,000 treasury bonds, $500,000; in treasury, $1,000,000. The bonds will be divided as follows: Four per cent bonds held to escrow to retire present bonds, $3,000,000; 4 per cent bonds to common stockholders, $1,250,000; 5 per cent bonds to preferred stockholders, $1,000,000; 4 per cent bonds to be sold for improvements and extensions, $500,000; 4 per cent bonds to be retained in the treasury, $1,750,000. This plan will increase the fixed charges $70,000 per annum.

Report of a Deal at Indianapolis

The incorporation of the Indiana Company at Trenton, N. J., a few days ago, with a capital stock of $1,000,000, gives rise to the statement that a deal is pending for bringing under the management of that company or the Indianapolis Terminal & Traction Company, the Indianapolis Street Railway Company and a number of companies now operating or building lines in the vicinity of Indianapolis. The avowed intention of the new company is the construction of the new terminal for the interurban lines at Indianapolis, the building of a belt line in that city and the extension of lines of the Indianapolis Street Railway, for which the Indianapolis Terminal & Traction Company recently secured rights. It is said that if present plans are carried out a meeting

of the stockholders of the Indianapolis Street Railway Company will be held in thirty days to vote on a proposition to lease the property on a sliding scale, starting at a low rate, with a bonus of stock of the lessee. The incorporators of the Indiana Company are: Randall Morgan, Thomas Dolan, F. N. MacMorris, C. G. Latorette and G. S. Martin.

Power Development at Baltimore

On Nov. 15 the Continental Trust Company, of Baltimore, as previously stated in the STREET RAILWAY JOURNAL, in behalf of a syndicate, exercised its option to purchase from the United Railways & Electric Company, of Baltimore, the entire electric light and power business of the city; but it is only within the last few days that details regarding this transaction and the plans for development of water power on the Susquehanna River have become available.

The purchase involves a payment of the United Railways of $900,000, together with the assumption of the cost of certain improvements to the property, and embraces the $2,000,000 of common stock of the United Electric Light & Power Company, and the bonds and stock of the Mount Washington Electric Light & Power Company. A forfeit of $25,000, pledged by the trust company when the option was secured, was applied in part payment when the deal was negotiated, the balance to be paid by Jan. 15. How the acquisitions are to be financed has not been made public. Where one or two companies will be organized is not yet known. A plan which it is said meets favor at the hands of the projectors, is to organize two companies, one to produce the power and transmit it to Baltimore, and the other to distribute it for use.

In connection with its purchase the trust company, for its clients, secures a contract to supply power necessary for the requirements of the United Railways for a period of thirty years. The maximum stipulated is 40,000 of which over one-half will be required when the company to be organized to assume this work is ready to supply power. This company is to be prepared to begin this service by October 1, 1905. It is reported that the contract price for this power is $35 per horse power per year, indicating a maximum revenue possible from this source to the power company of $1,500,000 a year. With this contract there is secured a lease for thirty years of all the power houses in the city of Baltimore of the United Railways.

The construction work involved in this undertaking is very elaborate. The scope of the operations on the Susquehanna River extends from the Peach Bottom Pool, just north of the Maryland State line, to a point about Deer Creek. Within these limits two developments of 50,000 gross horse power each are planned. The first starts the building of a dam from the west bank of the river, following a diagonal course down the stream for about 8000 ft., until it reaches a point about 500 ft. from the east side of the river, and then to run parallel to that side to the site of the power house which may be in the neighborhood of Broad Creek. The power house will be built squarely across the head race formed by this construction. Toward the upper end of the dam the walls will slope down, so that in time of floods the excess of water may pass over the walls into the river below the dam and not be carried into the head race to damage the power house. The tail race will also be protected from flooding.

At the power house will be installed ten 6000-hp units. Each unit requires three sets of 48-in. turbine wheels, two being in each set, or six to a unit, and for the ten units sixty turbines will be required. These will be placed in horizontal shafts, built of concrete, and to these shafts the head race will carry 16,000 cu. ft. of water a second. This water, after passing through the turbines, will escape into a tail race, which will be separated from the river channel by a dam. This tail race will then become the head race for the second development, which will be in the vicinity of Conowingo bridge. Here a duplication of the first plant is contemplated, but the present undertaking deals with the first development. To carry the electric current to Baltimore, a transmission line 35 miles long will be built.

The Chicago Electrical Association Officers

The Chicago Electrical Association has elected as officers for the following year: President, Professor P. B. Woodworth; vice-president, Peter Junkersfeld; secretary, W. B. Hale; treasurer, H. G. Dimick; auditor, DeW. C. Tanner; directors, W. J. Warder, Jr., C. W. Whitney, Albert Scheible.

The next meeting will be held Friday evening, Jan. 16, 1903. H. M. Brinckerhoff, general manager of the Metropolitan West Side Railway Company, will give a lecture on third-rail electric railway systems.

Electrolysis Ordinance for Atlantic City

The City Council of Atlantic City, N. J., passed what is known as the "Electrolysis Ordinance" recently, the object of which is to enable the city to enforce a supervision over the trolley lines and make tests to see that current from the railway system does not destroy the water mains, gas pipes or sewer system. It is provided that before Feb. 1, 1903, adequate measures be taken by existing operating companies to prevent injury to water mains, service pipes and other metallic structures on account of electrolysis, and details of the plans adopted to accomplish this result must be filed with the water department. In the case of new lines of track plans shall be filed before construction is commenced.

"In no case will bonding to the water mains or other conductors, not provided for the express purpose, be allowed in order to equalize the potential between such conductor and the rail, but means must be taken by furnishing and insulating a complete metallic circuit, both inside and outside of city limits, effectually to prevent leakage of current from the wires or rails of the railway."

The city shifts all the responsibility upon the company, and it does not even suggest a plan that would be acceptable to the municipality. The ordinance says:

"The company or individual operating the street railway may select the particular method of securing this protection and will be held responsible only for the result." The ordinance does, however, specify the following conditions which must be complied with:

"(a) The maximum difference in potential between any part of the metallic return circuit and any water or service pipe, or other metal conductor not intended as a part of such return circuit, shall not at any time exceed ¼ volt.

"(b) The difference in potential between any two points upon said metallic return circuit within a distance of 200 ft. from each other, shall not at any time exceed ¼ volt.

"(c) The current passing along any water or service pipes or other metallic conductor not intended as a part of said return circuit shall not, at any given time and point, exceed 1 amp."

Provision is made for two tests every year, in February and August, "for the purpose of detecting the passage of stray currents in the ground, and between the metallic circuit of the railway and the water and service pipes and other metallic conductors liable to be effected thereby." Should it be discovered, as a result of these tests or at any other time, that damage to water or service pipes, or other metallic conductors, has been caused by electrolysis due to the operation of a street railway, the operating company will be held responsible for damages amounting to the cost of the water department of discovering and repairing the injury, and failure to remedy the cause of the injury without delay shall constitute a violation of the ordinance, for which a penalty is provided.

This ordinance is said to be the first of the kind that has been enacted.

Eighty Miles by Trolley Through Connecticut

The Connecticut Railways & Lighting Company, which controls and operates 161 miles of electric railway and gas and lighting plants, extending, with connections, from Hartford, Conn., to Stamford, in that State, has in contemplation the construction of the final link—that between Seymour and Naugatuck—in a through line from Waterbury down the populous Naugatuck Valley to Derby, thence through Bridgeport and the Norwalks to Stamford, a distance of nearly 80 miles. The lines of the New York, New Haven & Hartford Railroad will be paralleled for the entire distance, and traffic will be drawn from towns whose aggregate population is nearly 240,000.

The next session of the General Assembly will be petitioned for the right of way, and, this granted, work will begin early in the spring and be completed in time for the heavy summer travel. For the only other section yet unbuilt, from Ansonia to Seymour, the right of way has already been procured, and the material deposited along the route ready for the work, which will be begun at once.

Besides this trunk line a branch from Derby to New Haven, to connect with the lines of the Fair Haven & Westville Street Railway, is being constructed. This will allow of continuous travel as far east as Branford, Conn., along the line destined to become a through route from Boston to New York.

The towns through which the system will run are Waterbury, Naugatuck, Union City, Beacon Falls, Seymour, Ansonia, Derby, Shelton, Oronoque, Putney, Stratford, Bridgeport, Fairfield, Southport, Westport, Saugatuck, Norwalk, South Norwalk and Stamford.

Franchise Tax Arguments Close in New York

The argument begun Dec. 1 in the appeal from the decision of ex-Judge Robert Earl, referee, declaring constitutional the Franchise Tax law, passed by the Legislature of New York in 1898, were continued for three days at Albany. Forty-seven corporations, among the largest in New York city, were parties to the controversy, but the arguments were made on behalf of the appeals of the Metropolitan Street Railway, the Brooklyn City Railway, the Consolidated Gas Company, the Coney Island & Brooklyn Railroad Company, the New Amsterdam Gas Company and the Consolidated Telegraph & Electrical Subway Company, which corporations were selected because their cases cover all of the points of law and fact involved in the entire controversy.

The opening argument on Dec. 1 was made by William H. Page, Jr. He discussed the "home rule" objection, directing his attention especially to the ground upon which the referee based his conclusion, that Section 2 of Article 10 was not, as Mr. Page expressed it, "sufficiently violated" to warrant judicial interference. Mr. Dykman presented his argument, and he was followed by Mr. Tomlinson, who appeared in behalf of the New Amsterdam and the Central Union Gas Companies.

When the argument in the cases was continued on Dec. 2 Professor Charles A. Collin, for the companies, presented arguments designed to show the unconstitutionality of the law. He presented to the court what has been called the "Federal point." This is the contention that the Special Franchise Tax act is in contravention of Section 10 of Article 1 of the Federal Constitution, providing that "no State shall pass any law impairing the obligation of contracts," and in contravention of the Fourteenth Amendment prohibiting the taking of property without due process of law. Professor Collin urged that the annual payments by various companies, for which he appeared, of a percentage of the gross receipts, and in some cases of additional lump sums annually, were not a part of the consideration for which the franchise was granted, but were a tax upon the franchise and were so specifically described in the Franchise Tax act itself, and that they were a feature of the contract between grantor and grantee under conditions which assured the grantee that no other or additional tax was at any time to be imposed than that fixed in the grant. Among other things Professor Collin pleaded that it is the plain right of the companies to know how much their tangible property is assessed at and what part of the assessment relates to the franchise.

The argument on behalf of the State was made by Deputy Attorney General Henry B. Coman, assisted by J. Newton Fiero, special counsel. Mr. Coman held that the law does not violate any provision of the Federal Constitution prohibiting the impairment of the obligation of a contract, since the franchise to use the street is property and taxable as such. To escape taxation it must come under some well settled rule of exemption, and a claim for exemption from taxation as against the State must be very clearly shown. No such exemption, he asserted, is shown on the part of the corporations, and no contract, either express or implied, exists on the part of the State that any of the corporations shall not be subject to taxation on their franchises. In connection with this point he cited numerous recent decisions of the Federal Court. Mr. Fiero argued upon the question that the law is capable of enforcement. The value of the special franchise for purposes of taxation can be and has been, he said, ascertained and determined by the State Board with a reasonable degree of certainty.

The argument was closed Dec. 4 when J. Newton Fiero completed his presentation of the State's case. Mr. Fiero devoted his argument to the question of constitutionality, declaring that the law in no particular violated any section of the State or Federal constitution. He cited numerous recent decisions to bear out his contention.

It is not expected that the court will reach a decision before the January term, owing to the mass of testimony to be examined.

The Interurban Line for Porto Rico

A despatch from San Jnan, Porto Rico, says that the Vandegrift Construction Company, of Philadelphia, has accepted the proposition of the executive council of that city for a franchise to build an electric railway to connect San Juan and Catano, 70 miles distant, and that cash to the amount of $10,000 has been deposited to insure the faithful performance of the work. As previously stated in the Street Railway Journal this project also calls for the development of water power, for lighting and railway service. It is proposed to construct a line of ferryboats between Catano and San Juan, on the San Juan Bay, and thus cut off 10 miles of track, which would be required to connect the two cities by rail. It is also planned to build several piers on the Catano side of the bay, to allow ocean-going steamships to dock. Passenger and wagon traffic will be carried on the ferryboats, and until the concessions for the construction of the piers are granted heavy freight for export trade will be carried out into the bay on lighters and loaded on the steamers. The road will pass through the coffee, sugar and fruit belts of the island, which are densely populated, and the belief is that large quantities of freight will be handled. Electric locomotives will be used for freight work. It is said that the plan for power development calls for the building of a power house of 5000 hp in the mountainous district of the interior of the island.

Entertainment for the Brooklyn Rapid Transit Company's Employees

The first large entertainment given by the Brooklyn Rapid Transit Employees' Benefit Association took place at the Academy of Music, Brooklyn, on Monday evening, Dec. 8. The great auditorium was crowded with the employees, their relatives and friends to witness the initial annual vaudeville, and the performance, like all the previous entertainments and outings of the association, was thoroughly enjoyed by all fortunate enough to attend. The boxes were filled with the principal officers of the company and their guests. President J. L. Greatsinger was, of course, present, but following out his principle of never taking active part in any of the proceedings of organizations among the employees of the properties which he has controlled, he remained merely an interested spectator of the performance. After the overture a few remarks were made by prominent members of the association, which not only put the audience into excellent humor, but gave to the ladies present an insight as to what was being accomplished for their husbands and brothers by the organization. The speakers were introduced by Vice-President G. F. Wolfram, whose earnest remarks reflected the enthusiasm which has marked his active labors as an executive of the society. J. C. Brackenridge, first president of the association, thanked the members for the manner in which they had co-operated in increasing and rendering more valuable the membership during the earlier days of its existence. Secretary J. M. Dudley, who has been giving his entire time to organizing the Benefit Association and perfecting the systems that have been adopted of aiding the needy members, read the following interesting report on the progress which has been made:

REPORT FROM JUNE 1 TO DEC. 1, 1902

This report covers the first six months that the Brooklyn Rapid Transit Employees' Benefit Association has been in existence:

The receipts have been as follows:

Donation from the Brooklyn Rapid Transit Company..	$1,853.15
Paid by the members for the initiation fees, etc........	11,543.00
Total receipts....................................	$13,396.15

The expenditures have been as follows:

The amount paid for sick and death benefits, medical attendance and other miscellaneous expenses........	$9,404.33
Balance on hand Dec. 1, 1902.....................	$3,991.82
The amount paid for sick benefits.....................	5,140.00
Amount paid for death benefits......................	900.00

Six members have died since June 1, beneficiaries of whom have received $150 each.

Sick benefits have been received by 260 men.

Five men have drawn $90 each, the limit that can be paid to a member in any one year.

Twenty-three members have drawn over $50 each.

Twenty-eight members have drawn over $25 each

Average amount paid to each sick beneficiary is $19.

Seventeen members are on the sick list drawing benefits at the present time.

The membership on Dec. 1 was 2856. Applications on hand, to be entered in December, 244; making a total membership of 3100.

Special mention should be made of the Canarsie division, which has enrolled in its membership all of the eligible men employed, with the exception of four, and the bridge department of the elevated division, which has all of its eligible men enrolled with the exception of seven.

The Crosstown division, with 287 members, has the largest number of any single depot.

Ridgewood, Bergen Street, Flatbush, East New York and the line department all make a splendid showing.

It has been the custom of the Brooklyn Rapid Transit Company to require of all conductors a bond guaranteed by a surety company. After Jan. 1, 1903, conductors will pay $1 per year to a sinking fund, from which the company will be reimbursed for all

shortages occurring during the year. The remainder, instead of swelling the profits of a surety company, will be given to the benefit association. Judging from the experience of past years this will amount to several thousand dollars annually.

One of the objects of the benefit association, as stated in the constitution, is to promote the social welfare of its members. Carrying out that purpose the association gave a series of excursions in the month of August, running eleven trains to Rockaway Beach, and carrying all told 3100 people (railroad employees and their families). The only charge for these excursions was to cover the cost of the dinner and incidental expenses, the company providing the trains free of charge.

Another important social feature is the bowling tournament that is now in progress, in which fifteen teams, representing every department of the Brooklyn Rapid Transit system, are participating. A beautiful cup is the trophy to be given to the winning team, and ten prizes, ranging in value from $5 to $50, will be given to the individuals making the highest records. It should be stated that the prizes were purchased from a special fund and not by the benefit association.

The board of trustees take great pleasure in stating that the contract has been let for the new building at East New York. Ground will be broken within a few days and the work pushed to a finish at the earliest possible date.

Dow S. Smith, the general superintendent of the railway company and president of the Benefit Association, gave the men a hearty talk on the importance of having a community of interest between the men themselves and with the officers of the road. Mr. Smith's remarks were greeted with great applause, and, though brief, showed that the operating department of the road has the welfare of the rank and file at heart, and is giving its enthusiastic support to everything by which the condition of the man on the platform can be made better either when on or off duty. The present officers of the association are: President, Dow S. Smith; vice-president, George F. Wolfram; treasurer, Charles D. Meneely; secretary, Joseph M. Dudley; board of trustees, C. E. Roehl, H. Glassey, George W. Edwards, J. Keating, J. Otten and D. W. Collin.

Employees' Benefit Association at Mobile

During the last year the employees of the Mobile Light & Railroad Company have formed an athletic and benefit association. The principal object of this association is to aid members while they are disabled by reason of sickness or injuries, and in case of death to contribute aid to their families. The organization was perfected on June 11, and now comprises 153 members. The membership is restricted to the white employees. The company has furnished the association a meeting hall with baths, and also gives heat and light free. At the present time the officers are arranging for the establishment of a reading room.

Each member is assessed an initiation fee of 50 cents, and the dues are 50 cents a month, payment being made by the auditor of the company, who deducts the amount from the wages of the men. It is provided that in case a member be discharged from the service he shall forfeit all his rights and privileges in the association. At the present time the association has over $500 in its treasury. The benefits to be derived from membership include financial assistance to the extent of $1 a day, commencing on the fifth day after the member is reported sick, and all the necessary medicine and medical attention, free of charge, provided such disability or sickness does not exceed fifty days in one year. In order to secure the benefits from the association sick members are obliged to notify the secretary immediately and also to furnish a doctor's certificate.

It is further provided that each member of the association shall pay $1 to the treasurer upon the death of any member, and that the sum thus realized shall be used in defraying the burial expenses. The officers of the association are: President, James M. Maloney; vice-president, Thomas McCowan; secretary, James W. Sconyers; treasurer, P. P. Priester; sergeant-at-arms, W. E. Truett; trustees, S. M. Coffin, J. W. Barnett, R. H. Savage.

Further Delay on Tunnel Franchise

The form of contract for the Pennsylvania Railroad tunnel, which has been approved by the Rapid Transit Commission and is acceptable to the railroad company, was favorably reported to the Board of Aldermen by the railroad committee of that body on Tuesday, but action upon this report was postponed until next week. There has been considerable influence brought to bear on the Aldermen during the last ten days, and the first result was apparent when the friends of the measure succeeded in mustering a majority of the railroad committee to the support of the measure. Mayor Low sent a special message to the Board of Aldermen urging favorable action, and pointing out the advantages to be derived from the proposed tunnel. Neither the friends nor the opponents of the measure, however, were certain of enough votes to win, and neither cared to take the risk of pressing the issue. Accordingly, the entire matter was put over for a week.

Meeting of Engine Builders' Association

Four papers were read at the annual meeting of the Engine Builders' Association of the United States in New York on the following subjects: "Superheated Steam," by Ernest H. Foster, of New York; "High-Pressure Steam Piping," by William Andrews, of New York; "The Early History of the Corliss Engine," by George R. Phillips, of Greene, R. I.; "The History of the High-Speed Engine," by Professor John E. Sweet, of Syracuse, N. Y.

Mr. Foster explained the advantages to be derived from the use of superheated steam, and pointed out the precautions to be observed in designing engines and piping systems where it is to be used. No difficulty is now met in dealing with the moderate superheat. To employ high degrees of superheating, it is at present considered important to use poppet valves on the high-pressure cylinder at least. Superheating will enable the steam pipes and ports to be reduced in area, and the use of the steam jacket to be eliminated. No difficulty is experienced in lubrication if a reasonably good grade of mineral oil is used. Finally, superheated steam is destined to play an important part in the adoption of the steam turbine.

Mr. Andrews sketched the evolution of steam piping the last quarter of a century. Wrought steel piping, in its present form, was introduced about 1892. With the advent of high-pressure superheated steam the size of pipes has been much reduced.

Mr. Phillips presented a biographical sketch of George H. Corliss. The more important early Corliss engine plants were described in detail, and a chronological account given of the improvements made by Corliss from time to time.

Professor Sweet's recollections of the early days of the high-speed engine industry, beginning about 1862 with the Allen engine, and its commercial development under Charles T. Porter, were followed by reference to a number of other automatic engines, including the Buckeye, Payne, "Straightline," Armington & Sims, Westinghouse and Ball.

Officers for the ensuing year were elected as follows: W. M. Taylor, president; C. A. Gates, vice-president; C. S. Bonsall, treasurer, and F. P. Ide, secretary. The meeting closed with a banquet at Sherry's, which was well attended and thoroughly enjoyed.

Annual Meeting of the Mechanical Engineers

The American Society of Mechanical Engineers held its forty-sixth annual meeting, in New York, Dec. 2 to 5. The sessions were held at the society's house on Thirty-First Street, and at the Sturtevant House, where excellent accommodations were made for the large audiences which attended the reading of the papers. On Thursday evening, Dec. 4, the usual reception was held at Sherry's, where the visiting delegates and their New York friends had a chance to meet each other socially. Owing to a slight illness the president, Edwin H. Reynolds, of the Allis-Chalmers Company, was unable to attend the convention, and Vice-President Arthur M. Waitt became the acting president. The report of the council announced the appointment of Professors Gaetano Lanza and John E. Sweet, S. T. Wellman and R. W. Hunt as representatives of the socety on the joint committee for selecting the next recipient of the John Fritz medal. Other committees were also appointed on the standardization of screw threads and to act in conjunction with the American Institute of Architects in planning tests of steel I-beams of large size.

A large amount of time was given at one of the sessions to the subject of junior membership in the society. Out of 531 junior members in good standing 177 were of seven to twenty and one-half years connection with the society, with an average of 10.13 years. The necessity of regulating the junior membership dues was apparent, and the following rule, which was claimed not only to put the membership upon a more logical basis but would increase the revenue of the society, was adopted, viz.: "That after reaching the age of 31 years all juniors should cease to be members of the society unless they affiliated with the grades in which they were eligible, except those elected juniors prior to this rule."

Announcement was made of the election of fifty members, ten associates and thirty-three juniors, ninety-three additions to membership in all.

Considerable attention was given during the convention to discussing the metric system and its adoption by the Government. A paper, presented by F. A. Halsey, on "The Metric System," strongly condemned the proposed bill before the House of Representatives, and in the animated discussion of this paper it was shown that in the opinion of many members there was much ground for opposing it, although a large number of arguments were presented in its favor by Congressman James H. Southard, of Ohio, chairman of the House committee on coinage, weights and measures, F. J. Miller and others. A number of representatives were appointed by the council to confer with other engineering and scientific societies on the subject, and a resolution was adopted to the effect that the society has never officially withdrawn its opposition to the metric system. A paper on "A Rational Solution of the Problem of Weights and Measures," advocating a system which sub-divides by halves, thirds and quarters, was read by Professor S. A. Reeve.

Professor Reeve also read a paper entitled "Entropy Analysis of the Otto Cycle." Among the other papers presented were: "Heat Resistance, the Reciprocal of Heat Conductivity," by William Kent; "Apparatus for Obtaining a Continuous Record of the Position of an Engine Governor and the Speed of the Engine which it is Governing," by J. C. Riley; "Finer Screw Threads," by C. T. Porter; "Fly-Wheel Capacity for Engine-Driven Alternators," by W. I. Slichter; "Filing System for Office Use," by H. M. Lane; "A New Oil Testing Machine," by Albert Kingsbury.

At the annual meeting the following officers were elected: President, James M. Dodge; vice-presidents, F. H. Daniels, James Christie and John R. Freeman; managers, R. C. McKinney, S. S. Weber and Newell Sanders. Treasurer William H. Wiley and Secretary F. R. Hutton continue in those positions.

Manhattan Elevated Lease

The directors of the Interborough Rapid Transit Company and of the Manhattan Railway Company, on Dec. 10, approved the form of the lease which is to be signed by the two companies. The following formal notice was authorized by the Subway Commission:

At a meeting of the board of directors of the Interborough Rapid Transit Company to-day a form of lease with the Manhattan Railway Company was submitted and in substance approved and the proper officers of the company were authorized to complete the same under advice of counsel, to be submitted to the stockholders of the Interborough Rapid Transit Company for their approval at a meeting to be called for Jan. 15, 1903.

By reason of the practical difficulties connected with the operation of the railroad property under the circumstances that would have been necessary if the rental until Jan. 1, 1906, had depended only on the ascertainment of the net earnings, it was deemed best in the interest of both parties that the rental for that period should be a guaranteed 6 per centum dividend, and an additional 1 per centum per annum if earned.

A similar announcement was authorized by the Manhattan directors. The Manhattan stockholders' meeting has been called for Jan. 16.

Vote Against Municipal Ownership in San Francisco

At the special election held in San Francisco Dec. 2, the proposition to acquire the Geary Street, Park & Ocean Railroad Company was defeated by a vote of 15,120 to 11,334. A two-thirds majority was necessary to carry the measure. The plan was to issue bonds to the amount of $700,000 for purchasing the property. The franchise for the road expires Nov. 6, 1903. The question of taking over the property was gone into thoroughly by the city authorities, and an estimate was made by the city engineer of the cost of reconstructing and maintaining the road under municipal ownership.

A Reported Combination

The announcement a few days ago of the incorporation at Trenton, N. J., of the Inter-State Railways Company, capitalized at $10,000,000, has caused to be circulated numerous rumors as to the plan of the company. Of course the articles of incorporation divulge nothing, but that an important deal in traction affairs is pending is certain. From one source it is said that the company plans to merge all the lines in New Jersey and operate a high-speed electric railway between New York and Philadelphia. From other sources the statement is made that the company is organized by the Pennsylvania Railroad in connection with its New York Tunnel plans. From still another source the information is conveyed that one of the most gigantic deals ever put through by the Widener-Elkins syndicate is under way. This report says that the United Gas & Improvement Company and the Connecticut Lighting & Railway Company are involved, and that the plan is to a sort of "community of interest" between the electric railways in New Jersey, the Connecticut Lighting & Railway Company, the New York, New Haven & Hartford Railroad and the Pennsylvania Railroad. No authentic information is obtainable. Frank B. Housel, William F. Eidel and George B. Martin are named as the incorporators of the company.

Annual Report of the Connecticut Railway & Lighting Company

The annual report of the Connecticut Railway & Lighting Company for the fiscal year ended June 30, 1902, as filed with the Railroad Commissioners of the State, shows:

Gross earnings of all companies:	
From railway	$1,113,777
From electric lighting	297,137
From gas plants	204,470
Total	$1,615,384
Expenses of operation of all companies:	
For railway	$616,724
For electric lighting	188,938
For gas plants	130,639
Total	$936,301
Net earnings	679,082
Taxes and miscellaneous interest	107,179
Net earnings applicable to bond interest	$571,903
Interest on funded debt	426,556
Surplus before deducting extraordinary expenses	145,347
Less expenses incurred in improvements of permanent nature, extensions, etc	57,584
Balance surplus	87,813

The combined balance sheet shows:

ASSETS	
Construction and equipment	$24,523,339
Cash on hand June 30, 1902	41,130
Material and supplies on hand June 30, 1902	128,234
Accounts receivable	111,541
Accounts paid in advance	21,845
Total	$24,826,089

LIABILITIES		
Capital stock		$15,000,000
Funded debt		9,350,000
Bills payable		260,000
Accounts payable		79,494
Advance ticket sales and deposits		4,221
Accident insurance fund		51,359
Total undivided profits June 30, 1902	99,007	
Less adjustment during year applicable prior to July 1, 1901	17,992	
		81,015
Total		$24,826,089

This company controls and operates 161 miles of electric railway and gas and electric lighting plants, extending, with connections, from Hartford to Stamford.

Elevated Motor Car Burned in Chicago

A motor car on the Northwestern Elevated Railroad, Chicago, was almost completely destroyed by fire one evening last week. The fire started from a short circuit in the motorman's cab. The motorman was badly burned. The incident only calls attention to the importance of precaution against fire in motor cars operating on underground roads, and wiring and controlling apparatus not likely to permit the starting of dangerous arcs.

A special cable from London says that Royal assent has been given to all the bills relating to Charles T. Yerkes' "tube" railroad plans for London. The bills providing for the construction of the roads cover an aggregate of 100 miles of underground and surface tracks.

Complete Second-Hand Equipments

The growth and extent of the business of Rossiter, MacGovern & Co. is shown by the fact that this firm is doing a large business in complete station equipments for lighting and for railway power stations. For instance, a prospective buyer, such as a new street railway company, can procure a complete station equipment erected and ready for operation, including boilers, engines, generators, switchboards, etc., and even comprising cars and motors, if desired. This should prove a very satisfactory plan to many new companies, as well as a profitable one to the older companies who can thus dispose, if desired, of complete equipments which are perfectly good for many years' service on a less important road, but which, owing to the local conditions, have to be superseded by a more modern or different type of equipment.

An example of the large scale on which the firm does business was shown by a recent purchase in New York city. Owing to the approaching completion of the Metropolitan Street Railway Company's power plant at Kingsbridge, the Metropolitan company has been closing down some of its branch stations. A few months ago the 145th Street station was dispensed with, and the apparatus was purchased by Rossiter, MacGovern & Co., New York. The Metropolitan Company has also recently been able to dispense with its large Twenty-Fifth Street station equipment, and the entire plant, direct-connected generators, engines, etc., has also been purchased by the same enterprising firm.

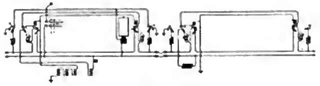
United States Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED NOV. 25, 1902

714,126. Hose Protector for Railway Tracks; H. H. Arnold, Cincinnati, Ohio. App. filed July 10, 1902. Bridging rails are blocked above the ordinary rails and detachably secured thereto, the hose passing between the two.

714,142. Railway Switch; A. C. Cambridge, Charleston, S. C. App. filed Feb. 17, 1902. The switch tongue is engaged by a disc or wheel depressed in the track bed and actuated by eccentric connections correspondingly attached to discs or wheels along the track and capable of being turned by extensions adapted to be operated by the traveling wheel of a car.



PATENT NO 714,366

714,167. Method of and Means for the Fixation of Track Rails on Tramway or Railway Lines; W. J. Foot, London, England. App. filed Dec. 19, 1901. The tread of the rail is provided with a tongue on its under side adapted to be seated in a channel in a supporting rail. At the joints, side walls seated upon base flanges, form boxes, whereby the rail can be removed without taking up the pavement.

714,240. Switch for Street Railways; S. S. Roberts, Louisville, Ky. App. filed Sept. 2, 1902. The bar connecting the switch tongue with the switch operating mechanism, is spring mounted, so that the tongue will give when a car is backed down opposite to the switch and spring back to place after the car has passed.

714,267. Trolley Pole Harp; J. H. Walker, Lexington, Ky. App. filed Jan. 14, 1902. A truss-like frame between the end members of which the wheel is sprung into place. Other features are designed.

714,268. Contact for Trolley Harps; J. H. Walker, Lexington, Ky. App. filed Feb. 12, 1902. A modification of the preceding patent.

714,366. Train Signal System; A. G. Davis, Schenectady, N. Y. App. filed March 10, 1902. The starting signal cannot reach the motorman until notice is sent from each platform of the train where passengers enter.

714,370. Adjustable Seat; D. M. Haverly and E. G. Solomon, Omaha, Neb. App. filed June 29, 1901. A reversible car seat in which the seat and back portions may be extended so as to enable the occupant to recline.

714,398. Mechanism for Shifting Points of Tramway Lines; G. D. Ross, Glasgow, Scotland. App. filed July 11, 1902. Details.

714,446. Protector for Third Rails of Electric Railways; H. Brooks, Wheator, Ill. App. filed June 23, 1902. Consists of a tube non-conducting material, open on one side to admit the contact-shoe.

714,453. Car Fender; W. B. Collins, North Dartmouth, Mass. App. filed May 10, 1902. The motorman presses a spring to throw the fender to operative position in case there is an obstruction on the track.

714,497. Railway Electric Motor Cooling System; C. O. Mailloux and W. C. Gotshall, New York, N. Y. App. filed Aug. 26, 1902. The motor is kept cool by compressed air or gas, which is caused to circulate about the motor in accordance with temperature changes thereof and by automatic means.

714,498. Railway Electric Motor Cooling System; C. O. Mailloux and W. C. Gotshall, New York, N. Y. App. filed Sept. 13, 1902. A modification of the preceding patent.

714,608. Trolley Guard; C. O. Prince, Canton, Ohio. App. filed Sept. 2, 1902. Details.

UNITED STATES PATENTS ISSUED DEC. 2, 1902

714,695. Electromagnetic Traction Increasing Device; A. A. Honey, Tacoma, Washington. App. filed April 1, 1902. An iron bar is pivoted to the axle at one end and carries a truck at the other, and is surrounded by a magnet coil which can be thrown into circuit at will to increase the traction by bringing the truck into engagement with the rail, thereby establishing magnetic attraction between the two and between the car wheel and the truck.

714,725. Plate Metal Car Wheel; H. F. Mann, Allegheny, Pa. App. filed June 21, 1902. The web, tread and rail-flange of the wheel are made of a single plate of steel, or steel and iron, the hub being formed separately of suitable material and securely attached to the center of the web.

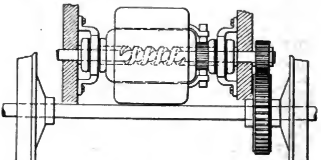
714,734. Electric Block Signal; E. M. North, Brooklyn, N. Y. App. filed March 22, 1902. A combined semaphore and switch lever, adapted to be moved mechanically by the pressure of the car wheel on a push rod.

714,752. Car Spring; T. A. Shea, Oswego, N. Y. App. filed March 1, 1902. Relates to cap plates for coil springs made of tempered spring steel with flat bases and integral opposite side flanges.

714,798. Slipper Brake for Tramway Cars; J. Mitchell and W. G. Rhodes, Manchester, England. App. filed Nov. 2, 1902. Details.

714,851. Railway and Car and Magnetic Appliances Therefor; A. C. Albertson, New York, N. Y. App. filed April 8, 1902. The car carries magnets whose poles are presented to an iron rail so placed that the attractive force tends to lift the car from the track, thereby decreasing running friction.

714,910. Car Fender; H. E. Itter, Bay City, Mich. App. filed Oct. 1, 1902. The front of the fender is provided with wheels on a shaft which bear on the pavement, and in advance of these wheels short rollers, which are oppositely rotated by friction contact with the wheels, whereby an obstruction is rolled upon the fender. Other features are shown.



PATENT NO. 714,916

714,913. Track Brake for Electric Cars; O. Keen, Allentown, Pa. App. filed April 23, 1902. An emergency brake in which the brake-shoe is hung from the wheel piece of the truck intermediate of the wheels, and adapted to be forced downward into contact with the rail by a spring released by a system of levers from the platform of the car, which normally holds the brake in inoperative position.

714,915. Car Brake Lever; W. C. Keithly, San Francisco, Cal. App. filed March 20, 1902. A hand-lever apparatus designed for use on street cars where brakes are applied through the action of a lever.

714,916. Automatic Clutch; J. W. Kellogg, Schenectady, N. Y. App. filed March 17, 1902. The combination in a wheeled vehicle of the driving motor, the motor supporting frame, the traction wheels, power transmitting gearing from the motor to the traction wheels, friction-clutch mechanism interposed in said gearing, and means whereby said friction-clutch mechanism becomes locked to the motor supporting frame when the power transmission gearing begins to run faster than the motor.

714,979. Locking Device for Car Seats; M. Weber, St. Louis, Mo. App. filed Jan. 24, 1902. A device for locking seats known as "walk-over" seats in position while in use.

715,036. Trolley Harp; H. S. Doyle, St. Louis, Mo. App. filed Aug. 15, 1902. A spring fork in which the wheel is mounted is provided with nuts which screw up and down on the neck of the fork to adjust the spring pressure.

715,129. Fare Register; J. F. Ohmer and H. Tyler, Dayton, Ohio. App. filed March 18, 1901. This invention relates to means for recording separately a multiplicity of different denominations of fares and for indicating separately the fares of each denomination and for recording and indicating a total of all fares registered irrespective of the different denominations or classes.

715,153. Automatic Car Fender; H. F. Rooney, Randolph, Mass. App. filed July 26, 1902. The main body portion of the fender is composed of two parts, one forming the seat or platform and hinged to the other part, which is spring mounted upon the dashboard of the car, thereby allowing the fender to tilt downward when an obstruction is encountered.

715,190. Trolley Catcher; E. M. Zwing, Philadelphia, Pa. App. filed Aug. 30, 1902. When the trolley leaves the wire a brake is released, which acts on the trolley rope to prevent the trolley from flying upward.

ENGINEERING SOCIETY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—The next meeting of this society will be held on Friday evening, Dec. 19, when the subject for discussion will be "Braking and Traction Brakes." J. D. Keiley and R. A. Parke will contribute papers on the subject.

PERSONAL MENTION

MR. A. W. SCHALL has been appointed superintendent of shops of the Niles Car & Manufacturing Company, to fill the vacancy caused by the resignation of Mr. A. L. Jacobs. Mr. Schall was assistant under Mr. Jacobs, and has had an experience in practical car building which covers twenty-two years of active work.

MR. GEORGE W. ALDRIDGE has been appointed secretary of the State Board of Railroad Commissioners of New York, to succeed the late Colonel John S. Kenyon. Mr. Aldridge has been in public life ever since he attained his majority, and in that time he has occupied several prominent offices, but he has never been identified with steam or electric railway interests.

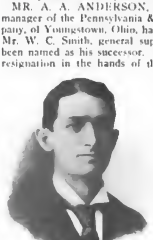
MR. JOHN B. McDONALD is the subject of an interesting biographical sketch in the current issue of "The World's Work." As the builder of the New York subway Mr. McDonald has become a man of national, if not world-wide, reputation, and the general public will find interesting reading in an account of his earlier successes as a contractor for engineering "impossibilities." An excellent full-page portrait accompanies the article.

MR. R. S. MASSON has been appointed consulting electrical engineer of the Los Angeles Railway Company. In the official announcement of this appointment it is stated that it will be the duty of the consulting electrical engineer to prepare or to pass upon all plans of electrical machinery and apparatus and to outline the arrangement of installation. The execution of the work, however, will, as heretofore, be subject to the control of the heads of the respective departments, the office of consulting electrical engineer being advisory rather than executive.

MR. O. W. BRAIN, electrical engineer for the New South Wales government railways, is in America for an extended tour of investigation. Mr. Brain intends, after visiting the principal centers of electric railway interest in the East, to stop at various points in the West on his trip to San Francisco, where he sails for home. While in New York his headquarters are at the Hoffman House. Although a young man for such a responsible commission Mr. Brain's knowledge of engineering and his ready appreciation of the good points in the examples of American practice which he has already inspected, have made him a welcome visitor, and his many new made friends are doing their best to make his journey a profitable and pleasant one.

MR. W. C. SMITH, who succeeds Mr. A. A. Anderson as general manager of the Pennsylvania & Mahoning Valley Railway Company, of Youngstown, Ohio, has been connected with the company since February, 1902, as assistant general manager. He was formerly a resident of Pittsburgh, where he was connected with the local street railway companies for twenty years. Later he was appointed general superintendent of the Central Traction Company, and was connected with that company from 1890 to 1896. He also acted as superintendent of transportation after the consolidation of that company with other Pittsburgh interests. Mr. Smith, because of his connection with the Pennsylvania & Mahoning Valley Railway Company, has a familiarity with local conditions that could be gained in no other way, and is well qualified for the position to which he has been chosen.

MR. A. A. ANDERSON, for a number of years general manager of the Pennsylvania & Mahoning Valley Railway Company, of Youngstown, Ohio, has resigned from the company, and Mr. W. C. Smith, general superintendent of the company, has been named as his successor. In July Mr. Anderson placed his resignation in the hands of the directors of the company, but they declined to accept it. He finally consented to remain in charge until matters, then in an embryo stage, could be developed. In November a second resignation was presented. This the company accepted. Mr. Anderson's street railway career began in 1878, when he became associated with Mr. Tom L. Johnson in the street railway lines of Indianapolis. He remained there until May, 1893, and on Jan. 1, 1894, took charge of the Mahoning Valley system, which, under his management, has grown to be one of the most important properties in Ohio. Mr. Anderson is considering several propositions, but before making any engagement he will take an extended trip through the West, also to Cuba. On Nov. 24 the employees of the company, as a token of esteem for Mr. Anderson, presented him with a handsome clock, paying also a glowing tribute to the recipient as a man, who, by his energy, absolute integrity and fairness, had won their respect. Mr. W. C. Smith will succeed Mr. Anderson.



A. A. ANDERSON

MR. GEORGE M. COLE has just been appointed general manager of the Oneonta, Cooperstown & Richfield Springs Railway Company. Mr. Cole is an engineer of established reputation and has had wide experience in the construction and operation of electric railway properties, and also of gas and electric light and power plants. He was formerly associated with Sanderson & Porter, in charge of construction at Youngstown, of the Youngstown-Sharon Railway & Light Company's properties. He has also been general manager of the Plattsburg Traction Company since it was built, and general manager of the Plattsburg Light, Heat & Power Company since 1890. He was also associated with Mr. E. N. Sanderson in the construction of the People's Tramway Company at Putnam, Conn., and with the late Mr. Alfred T. Heyn in building the Columbia (S. C.) Street Railway lines in 1886, and in rebuilding the Newburg Street Railway in 1887. He also had charge of the building of the Hicks Street line in Brooklyn in 1888. Mr. Cole will have entire charge of the management of the Oneonta, Cooperstown & Richfield Springs Railway, which extends from Oneonta to Mohawk, a distance of 67 miles. The company will handle both a freight and passenger business, and will open up a very rich country hitherto inaccessible, particularly north from Cooperstown to the Mohawk Valley. The road will be operated from one power house, and distribution will be effected by means of the three-phase system to sub-stations, of which there are five. The company will have track connections at Oneonta with the Delaware & Hudson and the Ulster & Delaware; at Richfield Springs with the Delaware, Lackawanna & Western, and at Mohawk with the West Shore and New York Central.

GEORGE M. COLE

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR

Res Ipsa Loquitur

In Paynter vs. Bridgeton & M. Traction Company, decided by the Court of Errors and Appeals of New Jersey, in June, 1902 (52 Atl., 367), it was held that a mere fall from a street car, without any evidence to show how the fall was occasioned, raises no presumption of negligence on the part of the operators of the car; that the so-called doctrine of *res ipsa loquitur* is applicable only when the thing shown speaks of the negligence of the defendant, not merely of the happening of the accident. This decision was by the highest court of New Jersey; it carefully considers the evidence in the case at bar and cites a large number of authorities touching the subject in the courts of New Jersey and other States. The decision is well sustained on principle as well as by authority, and it may be commended as a typical illustration of the application of the technical doctrine of *res ipsa loquitur* to street railroad companies.

Literally translated this doctrine means simply that the thing itself speaks. In an ordinary case of negligence—as indeed in the general run of litigations—the plaintiff has the whole burden of proof. He must prove his entire case; in a negligence case, not only that the plaintiff was injured, but that his injury was caused by the defendant's negligence, and that plaintiff was free from negligence. The purport of this New Jersey decision is that the doctrine that the fact itself speaks may be made applicable only to the negligence of the defendant. In other words, it is not sufficient to make out a *prima facie* case to show merely the happening of an accident; there must be in addition something tending to show that the cause of the accident is peculiarly within the defendant's knowledge and not within that of the plaintiff.

That the distinction so drawn is just will be apparent upon very slight analysis. If it merely be shown that the plaintiff fell from a street car, there may be a dozen conflicting explanations on the part of both the plaintiff and the defendant tending to establish that the negligence either of one or the other was the proximate cause of the accident. The matter is one of common observation, and its probable cause may properly be cleared up by the facts stated by eye-witnesses. If, however, a passenger seated inside of a railroad carriage or inside of a street car be injured by a collision, or derailment, or electric shock, it is evident that something outside of his own observation, and, therefore, something beyond his own ability to take proper precaution against, was the cause of his injury. As to these occult causes—causes necessarily and peculiarly within the knowledge of a person operating a railroad and not within the knowledge of a passenger—the increasing tendency is to administer the doctrine of *res ipsa loquitur*. When an accident of the latter class occurs, the courts say that as the plaintiff cannot explain just how the calamity occurred, he will be permitted to make out a *prima facie* case on the theory that the fact itself speaks and that the burden of explanation and excuse is placed upon the defendant.

In the recent case in the Court of Appeals of New York, Griffen vs. Manice (166 N. Y., 188), the doctrine has been applied to the case of an elevator accident in an office building. The New York Court of Appeals, while it declined to class the proprietors of elevators as common carriers, nevertheless held that if an accident occurred to a member of the public, invited to take passage in an elevator and guiltless of any affirmative fault of conduct, through the breaking down of the elevator or other presumable defect in its machinery, the doctrine *res ipsa loquitur* applied and the burden was placed upon the defendant of showing that it had not been guilty of negligence. The opinion in this case contains a careful discussion of the arguments for and against the doctrine of *res ipsa loquitur*. The most cogent and just reason assigned for the unmistakable tendency to extend the doctrine is contained in the following language by Judge Cullen:

"The maxim is also in part based on the consideration that where the management and control of the thing which has produced the injury is exclusively vested in the defendant, it is within his power to produce evidence of the actual cause that produced the accident which the plaintiff is unable to present."

When it is considered that an accident to a railroad train, or a street car, or an elevator, frequently in the general wreck destroys all possibility of tracing the original cause of the calamity, the justice and expediency of applying the rule *res ipsa loquitur* is quite apparent in the nature of things. This doctrine cannot be resorted to as commonly in street car accidents as in those upon steam railroads, but with regard to electric traction companies, it may properly be applied in the case of accidents resulting from the motor apparatus.

NOTE.—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York City.

LIABILITY FOR NEGLIGENCE.

ILLINOIS.—Carriers—Street Railroads—Trial—Verdict—Sufficiency—Instructions—Refusal of Requested Instruction.

1. A verdict against "defendant," in an action for personal injuries by a passenger against a company operating a street railroad and a company owning the road and leasing it to the operating company, in which but one defense is interposed, is sufficient to support a verdict against both companies, both being liable for such injuries.

2. When the instructions given fully state the law applicable to the case, the refusal to give requested instructions is not error.—(West Chicago St. Ry. Co. et al. vs. Horne, 64 N. E. Rep. 331.)

MASSACHUSETTS.—Street Railroads—Repair of Streets—Constitutional Law—Obligation of Contracts—Mandatory Injunction.

1. The grant of a location to a street railroad company required the materials and details of the construction of its tracks to be "to the acceptance of the supervisors of highways and bridges," and its tracks were constructed in accordance with the grant; T-rails being used. The company subsequently replaced such rails, at a large expense, with similar rails of a heavier weight; but they occupied no greater portion of the surface of the street, which was replaced in its former condition, nor rendered it less suitable for travel or less safe. The company accidentally omitted to obtain permission from the supervisors, but there was no intent to evade the laws, and it was not shown that the city objected to such work. The city had intended to require the company to use grooved rails when new rails were laid. Held, that the city was not entitled to a mandatory injunction requiring the removal of the rails, even if the supervisors could have required grooved rails to be laid; the violation of an established right not entitling the injured party to a mandatory injunction as a matter of course.

2. Under St. 1898, c. 578, sections 4, 7, 10, 13, providing that street railroads shall be subject to a certain tax, levied according to mileage, to be adjusted so that the amount collected shall correspond to the amount formerly paid by the company for the repair of the streets, and providing that street railroads shall not be required to keep any portion of the streets and highways in repair, except that such railroads shall remain subject to all legal obligations imposed in original grants of locations granted to the company in the city or town, such railroads are not bound to repair streets over which their lines run which are not embraced in their original location.

3. St. 1898, c. 578, providing that street railroads shall not be required to repair any portion of the streets or highways, is not 52 Atlantic Rep., 461.)

NEW YORK.—Verdict—Indefiniteness—Mistrial.

A jury rendered a sealed verdict as follows: "The jury say that they find a verdict for defendant, with recommendation to the court to award plaintiff $300 as compensation for her losses." Held that, as the intention of the jury could not be ascertained from the verdict, there was a mistrial.—(Conrey vs. Metropolitan St. Ry. Co., 77 N. Y. Supp., 222.)

NEW YORK.—Street Railroads—Injuries to Passengers—Action—Instruction—Degree of Care to Prevent Injuries—Negligence—Sufficiency of Evidence—Admissibility of Evidence—dence—Custom of Notifying Passengers of Curves—Evidence—Customary Motion in Rounding Curve—Admissibility of Evi-Materiality—Instructions—Rules for Protection of Passengers.

1. In an action against a street railroad company for injuries to a passenger caused by another passenger being precipitated upon her by a jolt of the car as it rounded a curve, the refusal to charge that defendant owed a "very high degree of care and skill to prevent any injuries" to its passengers was not error, but a charge that the measure of the duty of defendant's servants was "to conduct themselves with reasonable care under all the circumstances, with a view of protecting their passengers," was a correct statement of the law.

2. The mere fact that while a street car is rounding a curve a

passenger is injured by reason of another passenger being thrown upon her is insufficient, in the absence of excessive speed or of the application of more power than necessary to round the curve, to justify a recovery against the company for the injuries thus received.

3. Where the complaint in an action against a street railroad company for injuries to a passenger, caused by another passenger being thrown upon her while the car was rounding a curve, contained no allegations that the roadbed was out of order or improperly constructed, or that the car was not a proper one or not properly equipped, and there was no evidence that the conductor did not warn the passengers of the approach of the curve, the refusal to admit testimony of peculiar motions of the car in going around the curve at other times was not error.

4. In an action against a street railroad company for injuries to a passenger caused by another passenger being thrown upon her while the car was rounding a curve, wherein there was no evidence that the conductor did not notify the passengers of the approach to the curve, there was no error in excluding evidence that it was customary to give such notice.

5. In an action against a street railroad company, for injuries to a passenger caused by another passenger, who was about to enter the car, being thrown upon her while the car was rounding a curve, the fact that the passenger who was so thrown upon plaintiff was talking to the conductor just before the accident was immaterial.

6. There being no evidence in the case that defendant had not made rules and regulations for the protection of its passengers, a charge that it was defendant's duty to make such rules and that failure to make them was negligence was properly refused.—(Merrill vs. Metropolitan St. Ry. Co., 77 N. Y. Supp., 122.)

NEW YORK.—Appeal—Question of Damages—Review—Damages—Personal Injuries—Excessiveness.

1. In an action for death, the appellate court can review the jury's determination on the question of damages.

2. Where an only daughter, twenty years of age, who was well developed physically and mentally, a successful musician, intending to engage in music as a profession, and who assisted her mother in housekeeping and her father occasionally in his store, is negligently killed, a verdict for $9,500 to compensate the father for his pecuniary injury resulting from her death is excessive.—(Kellogg vs. Albany & H. Ry. & Power Co., 76 N. Y., Supp. 85.)

NEW YORK.—Trial—Directed Verdict—Weight of Evidence.

The fact that the evidence so preponderates in defendant's favor that a verdict for plaintiff will be set aside as against the weight of the evidence does not authorize a directed verdict for defendant.—(Padbury vs. Metropolitan St. Ry. Co., 75 N. Y. Supp. 952.)

OREGON.—Appeal—Dismissal—Defective Notice.

A notice of appeal, reciting the judgment as rendered June 18, whereas it was actually rendered June 8, was not ground for dismissing the appeal, where it was manifest from the appeal papers that there was a mere clerical error, and no injury.—(Salem Light & Traction Co. vs. Anson, 67 Pac. Rep., 1015.)

PENNSYLVANIA.—Contracts—Evidence to Avoid Written by Contemporaneous Parol—Indefiniteness.

1. That, for a while after an employee got out of the house after his injury, the employers, according to their custom, gave him light employment at $1.50 per day, is not evidence that an oral agreement that they should give him such employment for life was made contemporaneously with a written agreement whereby he, in consideration of certain payments, released them from all liability on account of his injury.

2. A written contract whereby, in consideration of $20, and payment of $1.50 per day during time an employee is confined in the house, he expressly releases the employers from all liability for his injury, cannot be avoided by evidence of a contemporaneous oral agreement that they were to pay his doctor's bill, and, from the time he was able to get out of the house, would employ him at $1.50 per day for the rest of his life; he and his wife alone testifying to this, and two employees testifying to the contrary.

3. Contract that employers should employ an injured employee at $1.50 per day for the rest of his life is too indefinite to be enforced; there being no provision as to the nature of the employment, or how it should be determined.—(Ogden vs. Philadelphia & W. C. Traction Co., 52 Atlanta Rep. 9.)

PENNSYLVANIA.—Corporations—Actions Against—Venue.

A street railway corporation, whose roadbed, principal office, car houses and rolling stock are in one county, may be sued in another, where its president and secretary reside, where part of its banking business is transacted and where its secretary has its office, from which much of its correspondence is carried on, and in which its board of directors meet, the corporate seal is kept and used part of the year, its stock certificates are attested and issued, and its ledger account kept, and much other corporate business transacted.—(Jansen vs. Philadelphia M. & S. St. Ry. Co., 51 At. Rep., 311.)

PENNSYLVANIA.—Partnership — Evidence — Appeal — Assignment of Error.

1. Recovery against defendants, sued on a policy as general partners doing business under a certain association name, cannot be had, no business relations between defendants being shown, the policy being signed by the general managers, and not by the individual members of the association, and it or no other evidence disclosing who the members were, though the policy showed the members signed the agreement under which the association was organized; the printing of the names of the officers on the back of the policy not showing that they were officers, much less that they were interested as individuals or partners in the association.

2. Rulings excluding evidence, though excepted to, cannot be considered on appeal, the only assignment of error being the refusal to take off nonsuit.—(Scranton Traction Co. vs. Schlichter et al., 51 At. Rep., 353.)

TEXAS.—Street Railroads—Municipal Corporation—Rail Above Street—Injury to Traveler—Instruction.

An instruction in an action against a city and street railroad company for a death, alleged to have been caused by a rail in the railroad track being allowed to remain above the level of the street, that if the defendants permitted the surface of the street to become lower than the rail, so as to interfere with the safe crossing of the street with vehicles, and if deceased was caused to fall from his wagon and was fatally injured by reason thereof, while in the exercise of due care, the plaintiff could recover, was erroneous, as taking from the jury the question of negligence and the question of proper care in keeping the street in proper repair, though such instruction was immediately preceded by an instruction that the defendants were only liable for failure to use ordinary care.—(Citizens' Ry. Co. vs. Gossett et al., 68 S. W. Rep. 706.)

TEXAS.—Carriers—Injuries to Passengers—Street Railways—Charged Cars—Electric Shock—Proof—Res Ipsa Loquitur—Instructions—Care Required—Definition of Terms—Request—Necessity—Evidence—Similar Accidents—Trial—Statement by Court.

1. Where plaintiff was shocked by electricity as he took hold of the handhold of an electric car for the purpose of boarding it at a point where it had stopped to take on passengers, and he was badly injured, the circumstances surrounding the injury were sufficient to raise a presumption of negligence on the part of the company.

2. In an action for injuries to a passenger on a street car, an instruction that the defendant owed its passengers the duty of exercising "great care and caution" to keep the machinery and appliances of its cars in a reasonably safe condition and repair, was not objectionable as imposing on the company a higher degree of care than is required by law.

3. It was not error for the court, in an action for injuries to a passenger on a street car, to omit to define the term "great care and caution" in an instruction defining the degree of care required of defendant, in the absence of a request designed to correct the omission.

4. Where, in an action for injuries to a passenger from an electric shock from a charged street car, there was no evidence that at the time of the accident the car or its appliances were in proper condition, or that the danger could not have been discovered by the exercise of care, or that the car had been recently inspected, and found in good repair, an instruction that if the jury found that if defendant, by the use of the highest care, could not have discovered the danger, and could not have prevented the same, then the jury could not presume defendant guilty of negligence from the mere fact of the accident, etc., was properly refused.

5. In an action for injuries to a passenger from an electric shock received from a charged street car, evidence of another person that he was shocked by the same car on the same day was admissible as tending to show that the car and equipment were not in proper condition, and that the company knew, or ought to have known, such fact by the use of ordinary care.

6. Where, during the trial, the court asked counsel for defendant if they had any further evidence, and they replied that they had two more witnesses, and requested an adjournment until the next morning, promising to finish with them in a short time, and to offer no further testimony, a statement by the judge on the reconvening of the court and on counsel calling more witnesses than two, that he did not think counsel were treating the court fairly, was not erroneous or prejudicial, either as prejudicing defendant's cause or as tending to impair the weight of defendant's testimony or the argument of its counsel to the jury.—(Dallas Consol. Electric St. Ry Co. vs. Broadhurst, 68 S. W. Rep. 315.)

VIRGINIA.—Street Railways—Personal Injuries—Declaration —Proof—Variance.

1. In an action by a passenger against a street car company for personal injuries, where plaintiff testified that the step of the car was slippery from frost or ice, he could not tell which, and the motorman testified that there might have been some frost on the step, but he did not think there was any ice, giving as his reason that the car stayed in a shed over-night, an allegation that defendant negligently permitted the step to remain covered with ice was not sustained.

2. The complaint alleged that the motorman negligently permitted plaintiff, a minor, to ride on the footboard from the time he first boarded the car. The testimony of both plaintiff and the motorman showed that plaintiff rode on the front platform until within a square of his home, where it was the motorman's purpose to stop and let him off, at which point he stepped down on the footboard for the purpose of leaving the car. Held, a variance from the declaration.

3 Testimony that the plaintiff, while standing on the footboard, lost his balance, because of the rough condition of the track and consequent jolting of the car, was inadmissible, where not averred in the declaration.—(Richmond Ry. & Electric Co. vs. West, 40 L. E. Rep., 643.)

VIRGINIA.—Appeal—Bill of Exceptions—Rulings on Evidence —Negligence—Exemplary Damages.

1. An exception to the ruling of a trial court on a motion to reject or admit evidence cannot be reviewed unless there is a bill of exceptions, signed by the judge, clearly pointing out the erroneous ruling complained of.

2. Though there may be several exceptions saved by the same bill, each must set forth distinctly the ground of objection relied on.

3. One bill of exceptions duly taken is sufficient to bring up for review all of the instructions given over objection thereto or all those refused.

4. In an action to recover for negligence of defendant, exemplary damages may be awarded if the facts warranting them are stated with sufficient distinctness to inform the defendant of the charge which he is required to meet, though damages are not claimed in the declaration.—(Richmond Passenger & Power Co. vs. Robinson, 41 S. E. Rep. 719.)

VIRGINIA.—Street Railroads—Degree of Care—Injury to Pedestrian—Evidence—Instructions—Harmless Error.

1. It is the duty of a street railroad company to exercise reasonable care to avoid injuring persons who have the right to be on the street, and who are neither trespassers nor licensees as to it.

2. Expert evidence is admissible to determine within what space a car running under certain conditions may be stopped.

3. Where a street railway company was running its cars in excess of the speed allowed by the statutes and valid municipal ordinances, such fact is competent evidence in an action by a traveler on the highway, injured by the cars, though the statute simply imposes a penalty for its violation.

4. That a street railway company has direct authority from the Legislature to use the streets of a city does not exempt it from reasonable municipal control.

5. It is error to give an instruction where there is no evidence tending to prove the facts on which it is based.

6. An erroneous instruction will be presumed to have affected the verdict of the jury, unless it plainly appears from the whole record that the error did not affect, and could not have affected, the result.—(Norfolk Ry. & Light Co. vs. Corletto, 41 S. E. Rep. 740.)

VIRGINIA.—Street Railroads—Negligence—Presumption from places of work.—(Kings vs. Interstate Consol. St. Ry. Co., Morrison vs. Same, 51 At. Rep., 301.)

WASHINGTON—Master and Servant— Injuries to Servant—Negligence—Evidence—Sufficiency—Instructions—Expert Witnesses.

1. Plaintiff was injured while attempting to lower the gins of a pile driver by being caught in the rope of the driver. Defendant's superintendent ordered plaintiff and five other servants to lower the gins. Plaintiff's evidence showed that the men directed to hold the rope and prevent the rapid falling of the gins were unable to do so, and that the safe way to lower the gins was to first let down the hammer, and that there was risk connected with the method adopted under the superintendant's direction. There was a conflict in the evidence as to the number of men actually having hold of the rope. Held, to warrant the submission of the issue of defendant's negligence to the jury.

2. An instruction that it was the duty of the master to furnish to the servant reasonably safe machinery in the performance of his work, and "not to expose the servant to danger," was proper; the expression "not to expose to danger," etc., when taken in connection with the entire instruction, not being prejudicial.

3. An instruction that the jury were to carefully separate what an expert witness testified to as a fact and what he testified to as to his opinion, and that the testimony as to the latter should be weighed with "caution," and carefully considered with reference to the supposed or proven facts upon which his expert opinion was founded, was erroneous, as discrediting the evidence of the expert. —(Gustafson vs. Seattle Traction Co., 68 Pacific Rep., 721.)

WASHINGTON.—Street Railways—Injury to Passenger—Negligence—Evidence.

In an action by a passenger against a street railway for personal injuries, evidence examined, and held to sufficiently show that she was injured while attempting to alight from the car while it was in motion, and without the knowledge of the car employees that she desired to get off, and that, therefore, they were not guilty of negligence in increasing the speed of the car.—(Blakney vs. Seattle Electric Co., 68 Pacific Rep. 1037.)

WASHINGTON.—Appeal—Motion for New Trial—Discretion —Street Railways—Evidence—Conductor's Report.

1. Where a motion for new trial is based on corruption of the jury, undue influence brought to bear on them, and fraud in the defense, the appellate court is not in as good position to judge of such matters as the trial court; and, if no abuse of discretion is shown, the order made thereon should be affirmed.

2. The plaintiff was found lying unconscious near a street railway track. She testified that she boarded a car, delivering to the conductor a transfer slip, and, while getting off at the point where she was found, the car suddenly started, throwing her to the ground, and causing unconsciousness and serious injury. The conductor testified to the names and number of passengers he carried on such trip, that they all paid cash fares, that she was not a passenger, and that he had no knowledge of the injury until she was discovered on the return trip of the car. At the end of the trip on which she claimed to be a passenger, the conductor made his usual report of the number of passengers carried and fares received, and whether in cash or transfer slips. Held, that such report, which agreed with his testimony as to the number of passengers, and that all paid cash, was properly received in evidence. —(Callihan et al. vs. Washington Water Power Co., 67 Pac. Rep., 697.)

CHARTERS, FRANCHISES AND ORDINANCES.

ILLINOIS.—Elevated Railroads—Assessment for Taxation.

Elevated railroads, constructed in part over the street and in part over their own right of way, and organized under Rev. St. 1874, c. 32, providing for the incorporation of railroads, should be assessed for taxation by the State board of equalization under Hurd's Rev. St. 1899, p. 1401, sec. 15, providing for the assessment of railroads, and not by the county board of review under Id., p. 1306, sections 40-52, providing for the assessment of street railways. —Knopf et al. vs. Lake St. El. R. Co.; Same vs. Metropolitan West Side El. Ry. Co.; Same vs. South Side El. R Co.; Same vs. Northwestern El. R. Co.; Same vs. Union El. R. Co.; 64 N. E. Rep. 340.)

MARYLAND.—Street Railroads—Crossing Railroad Track—Damages—Maintaining Crossing.

1. A street railroad company has no right to construct its line across railroad tracks rightfully maintained in a city street, without first compensating the railroad company for damages resulting therefrom.

2. A railroad company rightfully maintaining its tracks in a city street is entitled to require a street railroad company constructing a line across such tracks to pay for the construction of the crossing, and any change in the tracks necessitated by the crossing, but is not entitled to damages for the impairment of the easement in the street.

3. A street railroad company constructing its track across steam railroad tracks rightfully located in a city street must perpetually maintain and repair such crossing according to the direction of the engineer of the steam road.

4. A street railroad company constructing its track across a steam railroad track rightfully located in a city street is not required to pay a portion of the expense of the steam road in maintaining crossing gates and other safety appliances at the crossing —(Central Pass. Ry. Co. vs. Philadelphia, W. & B. R. Co., 52 Atlantic Rep., 752.)

MASSACHUSETTS.—Street Railroads—Repair of Streets—Constitutional Law—Obligation of Contracts—Impairment.

1. Under St. 1898, c. 578, sections 4, 7, 10, 13, providing that street railroads shall be subject to a certain tax, levied according to mileage, to be adjusted so that the amount collected shall correspond to the amount formerly paid by the company for the

repair of the streets, and providing that street railroads shall not be required to keep any portion of the streets and highways in repair, but declaring that such railroads shall remain subject to all legal obligations imposed in original locations granted to the company in the city or town (defined by section 1 to mean the first location granted to the company in the city or town), such railroads are not bound to repair streets over which their lines run which are not embraced in their original location.

2. Laws 1898, c. 578, providing that street railroads shall not be required to repair any portion of the streets or highways, is not unconstitutional, as impairing contracts, in relieving the roads from such obligations imposed on them by a city in granting locations to them.—(City of Worcester vs. Worcester Consol. St. Ry. Co. (three cases), 64 N. E. Rep., 581.)

NEW HAMPSHIRE.—Railroads — Extension — Nature and Scope—Finding as to Public Good—Preliminary Showing—Alteration of Original Purpose of Corporation—Procedure.

1. Pub. St. c. 156, section 18, provides that, if a railroad desires to extend or build a branch road, it may file a petition to determine whether for the public good, and may build if the question is decided in its favor. Sections 28 to 37 provide that, if any stockholder dissents from the decision to build, the corporation may, by application to court, have the value of his stock determined, and buy it in. Held, that the latter sections indicate that the building of extensions and branches of such a nature as to change the original purposes of the corporation was within the legislative contemplation, so that under the section first quoted a corporation had a right to construct an extension longer than the existing line, and, in effect, constituting a new system.

2. Pub. St. c. 156, section 18, provides that, if a railroad desires to extend or build a branch road, it may file a petition to determine whether for the public good, and may build if the question is decided in its favor. Section 10, relative to the organization of railroad companies in general, provides that, if it appears to the court that the capital stock of the proposed corporation has been subscribed by responsible parties, and no sufficient objection is made, the court shall refer the petition to the Board of Railroad Commissioners, or to a board of three referees Section 19 provides that, if the court determines that the public good requires the extension or branch, the decision shall be filed with the Secretary of State, and the corporation shall thereupon have authority to raise the necessary money by increasing its capital stock or issuing bonds. Held, that the provision of section 10, when applied to a petition for the construction of a branch, does not require that it be made to appear that stock has been subscribed by responsible parties, but merely that it be shown that there are sufficient resources for that purpose.

3. Pub. St. c. 156, section 10, provides that if it appears in support of a petition for a determination of public necessity authorizing the construction of a branch railroad that there is sufficient capital to build the branch, and no sufficient objection is made, the court shall refer the petition to the Board of Railroad Commissioners or three referees appointed by the court. Held, that on submission to the Board of Railroad Commissioners or referees the financial ability to build the extension would not be considered, but they would assume that that fact has already been determined.

4. Pub. St. c. 156, section 10, relative to petitions to the court for authority to construct a branch or extension of an existing railway, provides that, if it appears that the capital stock has been subscribed by responsible parties, that sufficient notice has been given, that all preliminary steps have been taken, and no sufficient objection is made, the matter shall be referred to the Railway Commissioners or referees. Held, that in determining the preliminary questions an attested copy of all the proceedings of the corporation relating to the subject of the petition should be filed, and also affidavits relating to relevant facts not matters of record, on which the questions may be determined if no issue is raised by an objecting party, but, if issue is made on any of the questions, the objecting party should be allowed to introduce testimony and cross-examine petitioner's witnesses, which may be done by sending the matter to a referee.—(In re Laconia St. Ry., 52 Atlantic Rep., 458.)

NEW HAMPSHIRE. — Corporations — Organization — Subscription Rights—Character—Transfer—Evidence—Title — Ultra Vires—Corporate Franchise—Surrender.

1. After a charter has been granted to a proposed corporation, and all the stock subscribed for, the subscription rights are property rights representing the corporate property and franchise, capable of being assigned, and carrying with them the right to participate in the management of the corporation, though no stock has yet been issued.

2. Subscription rights in a proposed corporation need not be evidenced by written instrument in any particular form, but may be established by parol.

3. The title of the holder of subscription rights in a proposed corporation is not affected by the subsequent action of the corporation in recognizing or refusing to recognize his title.

4. A subscription right in a proposed corporation is assignable by parol, and ownership passes immediately on consummation of the sale, and by force thereof, and not by operation of law.

5. The fact that an officer of a corporation, buying subscription rights in another corporation in process of organization, took receipts for the amount paid in his own name, and advanced the purchase price from his own funds, did not conclusively show that he bought the rights as an individual.

6. Where an officer of a corporation was authorized to purchase subscription rights in another corporation, a finding that he purchased the rights for his corporation was equivalent to finding that title thereto vested in the corporation immediately on completion of the sale to him.

7. The majority stockholder, president, and general manager of a corporation was directed to purchase for it a majority of the subscription rights in another corporation which was being organized, and which would become a competing corporation, and actually purchased a majority thereof, for which he was subsequently reimbursed by the corporation. Held, that even though he had no formal authorization to make such purchase, so as to vest title immediately in the corporation, he would be estopped, in a suit between himself and the corporation, to deny that he was its agent, and the title would pass to the corporation on its ratication of the purchase.

8. An officer of a corporation was directed to purchase for it a majority of the subscription rights in another corporation being organized, and did so, using his own funds in payment. Held that, if title to the subscription rights thereby vested in the corporation, a vote of the directors, made subsequent to the purchase, that "this corporation should acquire a controlling interest" in the new corporation, did not devest its title.

9. Where an officer of a corporation purchased for it a majority of the subscription rights in another corporation, a purchaser from the executors of such officer, with knowledge, of the facts, acquired no better title thereto than his vendor had had.

10. An officer of a corporation was directed to purchase for it a majority of the subscription rights in another corporation, and did so. Held, that even if the purchase in behalf of the corporation was void for want of formal authorization, etc., title would vest in the officer individually.

11. An officer of a corporation was directed to purchase for it a majority of the subscription rights in another corporation, which he did; using his own money, and being reimbursed by the corporation. He subsequently sold a part thereof as his own property. Held, that even if the purchase was ultra vires, contrary to public policy and illegal, the purchaser would acquire no rights as against the corporation.

12. An officer of a corporation was directed to purchase for it a majority of the subscription rights in another corporation, which he did; using his own money, and being reimbursed by the corporation. He subsequently sold a part thereof as his own property, and thereafter purchased an equal quantity of shares on his individual account. Held, that such after-acquired rights should be considered as held for the benefit of the purchaser, who obtained no title to the rights first transferred.

13. On an issue as to whether there had been a surrender of a corporate franchise effected by the action or non-action of the stockholders intending to surrender the franchise, evidence as to the intention of another corporation holding a majority of its stock was admissible.—(Manchester St. Ry. vs. Williams et al.)

NEW YORK.—Street Railroad—Lease to Similar Corporation—Rights of Minority Stockholders—Directors—Presumptions—Consideration for Lease.

1. The majority of the stockholders of a street railway company sought to restrain the delivery and operation of a lease by it to another railway company on a vote of 80 per cent of the stockholders of the lessor and unanimous vote of those of the lessee. Held that the lease was not void on its face, as constituting an illegal transfer of the properties and effects of the lessor.

2. Where the guaranteed rental did not appear to be inadequate, the lease was not a fraud on the minority stockholders.

3. The directors of a street railway company, in the absence of proof to the contrary, will be presumed to have acted in good faith in leasing the railroad to another company.

4. The execution of a lease by a street railway company to another for ninety-nine years at a rental of 7 per cent on the valuation of the property is not a fraud on the minority stockholders, in that it limits the annual dividends, no matter how great the earnings and the profits of the system may become.—(Content et al. vs. Metropolitan St. Ry. Co. et al.; Wormser vs. Same., 76 N. Y., Supp. 151.)

FINANCIAL INTELLIGENCE

THE MARKETS

WALL STREET, Dec. 10, 1902.

The Money Market

Increased firmness developed in all departments of the local money market during the last week, as a result of the continued heavy losses in cash by the banks to the Sub-Treasury, and the preparations making for the interest and dividend disbursements due Jan. 1, which promise to be the largest on record. The statement published by the associated banks on last Saturday showed a loss in cash of over $6,000,000, and since then an additional loss of over $2,500,000 is indicated by the figures at hand. This heavy loss was due in a measure to the shipment of $1,000,000 gold to South America, but the greater part of the week's loss was due directly to heavy custom payments. The time money market shows increased firmness. The supply of lendable funds appears to be considerably smaller than a week ago, and the larger lenders prefer to deal with the strongest houses only. Short time accommodations show the greatest firmness. For sixty and ninety days contracts which were obtainable last week at 6 and 6½ per cent have risen to 7 per cent, and in some cases 8 per cent is said to have been paid. For the periods running from four to six months, 6 per cent is asked and generally obtained. The call money market was also firmer, the open market rate ranging between 4½ and 7½ per cent, the average rate being about 6 per cent. The indications at present point to a continued firm market until after the first of the new year. The continued strength of the foreign exchange market is being watched with much interest, but while gold exports to Europe are not expected, the indications are that additional shipments will be made to South America before the close of the present week.

The Stock Market

Speculation on the Stock Exchange has been practically lifeless. Total transactions have fallen to the smallest proportions in months, and prices generally have suffered further recession as a result of the uncertainty regarding the immediate future of the local money market. The bank statement of last Saturday, showing a further large falling off in cash was very unfavorable, but that the showing was not unexpected was demonstrated by the recovery which followed the publication of the official figures. The upward movement, however, was of short duration, and values during the early part of this week have shown a downward tendency, being influenced by the further heavy loss in cash by the banks, and the indication of further gold exports. There were a number of favorable influences, however, chief of which were the continued large increases in railroad earnings, and an increased movement of wheat and corn. These factors, however, were entirely disregarded, and there appears to be a general disposition to await further developments in the money market before taking on fresh lines of stocks.

The local traction stocks have ruled dull, and prices moved within a narrow range. Manhattan rose slightly on the covering by shorts, while Brooklyn Rapid Transit was stimulated by the favorable statement of earnings, showing an increase in gross for the month of November of $62,428. The daily average earnings for the month were $34,013, a gain of $2,081 per day, while the gain from July 1 amounted to $73,183.

Philadelphia

The Philadelphia traction specialties have been extremely dull in the market for the last two weeks. There is no foundation for the rumor that an immediate assessment call would be made upon holders of Philadelphia Rapid Transit shares, for the money will not be needed before next summer. But the story circulated in speculative circles had its effect in carrying down the stock from 16¾ to 15½, on light dealings. Union Traction meanwhile weakened in sympathy to 46⅞, and Philadelphia Traction lost a half point to 97½. American Railways reacted to 52 on disappointment over the failure to increase the dividend rate. Indianapolis Street Railway broke 3 points to 90 on sales of a hundred shares, recovering later to 91. Consolidated Traction of New Jersey was weak at a decline from 69 to 67½. Other minor transactions comprise Railways General at 4⅞, Reading Traction at 30, Columbus Street Railway at 59¾, Hestonville Passenger at 48, Rochester Passenger preferred at 100, and Easton Electric at 20½.

Chicago

The traction securities in Chicago have, with one or two exceptions, inclined to weakness during the last fortnight. The exceptions are City Railway, which has held steady around 212, and South Side Elevated, which has reflected some demand around 109. On the other hand Metropolitan Elevated shares are lower at 37 for the common, and 85 for the preferred; Lake Street has weakened to 8⅞. Northwestern Elevated has recorded the lowest prices in a long time—31 for the common and 76 for the preferred—North Chicago Street Railway has broken from 168 to 162, and West Chicago has sold as low as 84. For the most part selling has been extremely light, the market reflecting simply complete absence of demand. Not a share of Union Traction has been dealt in during the entire two weeks, which is the most striking evidence of the prevailing dullness. November was a comparatively bad month for earnings on the elevated roads. Increases continued to be reported over the month last year, ranging from 8½ per cent, on the South Side, to 13¼ on the Metropolitan. But these comparisons were much less favorable than during the summer and the early autumn.

Other Traction Securities

Dealings in the various markets for local traction securities, outside of those already reviewed, have developed little that is really noteworthy during the last fortnight. In Boston business has been next to nothing. Massachusetts Electric common, the only stock in which even a semblance of activity has appeared, has fluctuated within a half-point range between 35½ and 36, with sales for the most part at 35¾. The preferred selling "ex" the semi-annual dividend of 2 per cent, brings 95. West End common has changed hands at 94¼ to 94¾, and the preferred at 113¾; while Boston Elevated dropped on scattering sales from 154½ to 153. The principal feature in the Baltimore market is the weakness of United Railways of Baltimore securities. The income bonds which sold at 68⅞ two weeks ago, went at one time as low as 65¼, rallying later to 66¼. The stock fell from 13¾ to 13, but the general 4s held steady around 95. No explanation is apparent for this movement, save general speculative liquidation. Other Baltimore transactions include Knoxville Traction 5s at 101, Anacostia and Potomac 5s at 99, North Baltimore Traction 5s at 119¼, City Passenger 5s at 106¼, Knoxville Traction stock at 27, Norfolk Railway and Lighting stock at 13, and Nashville stock at 3⅞ down to 3¼, then back to 4½. On the New York curb the feature was the drop in Interborough Rapid Transit stock from 116 to 109, about 1500 shares of the "40 per cent paid-in" stock changing hands on the decline. Selling by speculators who bought previous to the confirmation of the Manhattan "deal" is the obvious reason for this decline. Other local curb transactions include American Elevated (400 shares) at 1 and ⅞, New Orleans (1000 shares) between 14 and 14½, St. Louis Transit at 27½, United Railways of St. Louis preferred at 82, American Light and Traction at 36⅝ and 36½, Brooklyn City Railroad at 247 and 246½, New Orleans 4½ per cent bonds between 77½ and 78½, United Railways of St. Louis 4s at 84½, Washington Traction 4s at 80, and Lexington Avenue and Pavonia Ferry 5s at 121⅛ and 121.

Business continues very quiet on the Cleveland Stock Exchange, and last week was the smallest in some time, so far as traction sales were concerned: only 225 shares changed hands. Western Ohio receipts dropped to 26½ on sales of 100 shares. A small lot of Miami & Erie Canal sold at 30, and another small lot of Aurora, Elgin & Chicago receipts at 35. Lake Shore Electric common dropped to 15¼ on a small lot. All of these figures were the lowest that have been recorded for their respective stocks in some time, but sales were not large enough to indicate anything important.

Iron and Steel

A quieter tone is noted in the iron market which is reflecting itself, especially in reduced premiums for prompt deliveries of foundry iron and structural material. The customary decline in consumption during the winter months is the main reason assignable for this change. The general opinion is that prices ought to fall to a level where importations of the foreign product will no longer be profitable. Quotations are as follows: Bessemer pig iron $21.75 to $22, steel billets $29 to $31, and steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 11¾ cents, tin 24.90 cents, lead 4⅛ cents, and spelter 5.05 cents.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Nov. 25	Closing Bid Dec. 9
American Railways Company	53½	52
Aurora, Elgin & Chicago	22	a39
Boston Elevated	154	153
Brooklyn R. T.	61¼	64½
Chicago City	211	210
Chicago Union Tr. (common)	15	14
Chicago Union Tr. (preferred)	45	45
Cleveland Electric	88	85
Columbus (common)	58½	58
Columbus (preferred)	106	105
Consolidated Traction of N. J.	69¾	68⅞
Consolidated Traction of N. J. 5s	110½	107¼
Detroit United	b95	—
Electric People's Traction (Philadelphia) 4s	98⅜	98
Elgin, Aurora & Southern	57	45
Indianapolis Street Railway 4s	—	—
Lake Shore Electric	12½	12½
Lake Street Elevated	9	9¼
Manhattan Railway	153⅞	147⅞
Massachusetts Elec. Cos. (common)	36	35¾
Massachusetts Elec. Cos. (preferred)	96½	94
Metropolitan Elevated, Chicago (common)	37	36
Metropolitan Elevated, Chicago (preferred)	86	83
Metropolitan Street	139	129¾
New Orleans Railways (common)	15	13¾
New Orleans Railways (preferred)	48½	45½
North American	118½	115
Northern Ohio Traction (common)	—	—
Northern Ohio Traction (preferred)	—	95
North Jersey	31	30
Northwestern Elevated, Chicago (common)	32½	30
Philadelphia Rapid Transit	17	15⅝
Philadelphia Traction	98	97¼
St. Louis Transit (common)	28	27
South Side Elevated (Chicago)	107	107
Syracuse Rapid Transit	30⅝	30¾
Syracuse Rapid Transit (preferred)	76	75
Third Avenue	126	—
Toledo Railway & Light	b37	a35
Twin City, Minneapolis (common)	116	115½
United Railways, St. Louis (preferred)	—	61
United Railways, St. Louis, 4s	84⅝	84⅝
Union Traction (Philadelphia)	46¾	47
Western Ohio Receipts	27	27¾

a Asked. b Last sale.

SAN FRANCISCO, CAL.—A report in financial circles has it that the gross earnings of the United Railroads Company for November are $485,000, an increase of 11 per cent over the same period of last year.

COLORADO SPRINGS, COL.—The Colorado Springs & Cripple Creek District Railway Company has filed for record a mortgage for $3,000,000, given in favor of the Morton Trust Company, of New York, to secure an issue of consolidated mortgage 5 per cent forty year bonds. The first and second mortgage bonds are taken up by the new issue, and over $900,000 additional is raised for improvements.

CHICAGO, ILL.—The directors of the Chicago City Railway Company have declared a dividend of 2¼ per cent, payable Dec. 30, 1902, to stockholders of record Dec. 8, 1902.

CHICAGO, ILL.—The Elgin, Aurora & Chicago Traction Company will pay a semi-annual dividend of 3 per cent on its preferred stock Dec. 17.

LEXINGTON, KY.—The Blue Grass Traction Company, which plans to build an extensive system of electric railways in this vicinity, has increased its capital stock from $10,000 to $350,000.

WARE, MASS.—The Hampshire & Worcester Street Railway Company has petitioned the Railroad Commissioners for the approval of an issue of $80,000 5 per cent bonds to run to 1921. The company now has $50,000 bonds outstanding.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company has petitioned the Railroad Commissioners for authority to issue $225,000 twenty-year 4 per cent bonds, and for authority to purchase Nipmuc Park, in the town of Mendon, which may be bought for less than $25,000.

BOSTON, MASS.—The Uxbridge & Blackstone Street Railway Company has petitioned the Railroad Commissioners for authority to issue its original capital stock of $80,000.

ST. LOUIS, MO.—The St. Louis Transit Company's earnings for the month of November are stated at $650,000, an increase of 15 per cent over the same month in 1901.

UTICA, N. Y.—The Railroad Commissioners have granted the Utica & Mohawk Valley Railway authority to issue a mortgage on its property for $1,500,000. This is part of a $4,000,000 mortgage already authorized.

SCHENECTADY, N. Y.—The Railroad Commissioners have granted the Schenectady Railway Company authority to issue a mortgage for $500,000, part of an original mortgage for $2,000,000.

BUFFALO, N. Y.—The Buffalo, Hamburg & Aurora Railway, which was sold by the receiver at public auction a few days ago, was purchased by A. E. Leon, of Boston, representing the bondholders. The purchase price was $51,500.

NEW YORK, N. Y.—A special meeting of the stockholders of the Manhattan Elevated Railway will be held on Jan. 16 to vote on the proposition to increase the authorized capital stock from $48,000,000 to $60,000,000. Of this increase 72,000 shares will be issued as soon as authorized, and the remaining 48,000 will be issued not prior to Jan. 1, 1906. The purpose of the increase is to provide funds for improvements. This increase of $12,000,000 in the capital stock of Manhattan was provided for in the lease of the company to the Interborough Rapid Transit Company.

NEW YORK, N. Y.—The Manhattan Elevated Railway Company has declared a quarterly dividend of 1½ per cent, an increase of ½ per cent over last previous payment. The dividend is payable Jan. 2. Under the terms of the lease of the company to the Interborough Rapid Transit Company earnings up to Jan. 1, 1906, are applicable to demands on the stock not exceeding 7 per cent.

CLEVELAND, OHIO.—Details of the consolidation of the Cleveland, Elyria & Western Railway with the Cleveland & Southern and the Norwalk Gas & Electric Company have been completed. The new company will probably be known as the Cleveland & Southwestern Railway. The capital stock will be $5,000,000, and, as the three properties have a combined capitalization of much less than this amount, it would appear that a portion of the issue will be retained for the purchase of the Cleveland, Ashland & Mansfield and the Ohio Central Traction Company when the systems are connected. Two millions of this capitalization will be preferred and the balance common stock. For the present the bond issue will be $2,100,000, covering the underlying issues of the three properties. The $2,000,000 of the Cleveland, Elyria & Western stock will be exchanged on a basis of 60 per cent of new preferred and 100 per cent of common for each old share. Subscribers to the underwriting of the Cleveland & Southern will receive for each $10,000 of their subscription $5,000 in bonds, $5,000 in preferred stock, and $10,000 common stock.

CINCINNATI, OHIO.—It is said that the Cincinnati Street Railway will show earnings for the year of $4,000,000, an increase over last year.

CLEVELAND, OHIO.—The Pomeroy-Mandelbaum syndicate will announce the plan for financing the Ohio Central Traction Company, about Jan. 1. The road is a consolidation of the old road of the same name and the new Mansfield, Crestline & Galion Railway. The entire line extends from Bucyrus to Mansfield, a distance of 35 miles. It will be bonded at $700,000 with stock of the same amount. The road is now fully in operation, and next year it will be connected with the Cleveland, Elyria & Western Railway by a connecting link from Mansfield to Wellington.

CLEVELAND, OHIO.—There are repeated rumors that the Pomeroy-Mandelbaum syndicate is negotiating for the purchase of the Toledo, Bowling Green & Southern Railway, in order to afford the Cincinnati, Dayton & Toledo Traction Company an entrance to Toledo. If a purchase is not made it is stated an effort will be made to lease the road.

TOLEDO, OHIO.—The stockholders of the Toledo & Western Railway Company have formally ratified the purchase of the Toledo, Fayette & Western, a company formed to build an extension of the Toledo & Western. The Toledo & Western is capitalized at $1,800,000, of which $1,500,000 has been issued. Its bonded indebtedness amounts to $1,250,000, with interest at 5 per cent. The company is famous for its freight business, which is constantly increasing. During the recent summer months the company handled on an average 1,000,000 lbs. of freight a month.

PHILADELPHIA, PA.—The Philadelphia News Bureau thinks that the Philadelphia Rapid Transit Company has certainly, in its conduct, furnished abundant food for the persistent reports that another deal is about to materialize.

PHILADELPHIA, PA.—The directors of the Union Traction Company have declared a semi-annual dividend of 1½ per cent, equal to 75 cents per share, payable Jan. 1. This is the first dividend declared under the lease to the Philadelphia Rapid Transit Company.

WILKESBARRE, PA.—Hancock & Company, of Philadelphia, are offering for subscription $5,000,000 bonds of the Lackawanna & Wyoming Valley Rapid Transit Company, which is now building a double-track electric railway between Wilkesbarre and Scranton.

WOONSOCKET, R. I.—The Woonsocket Street Railway Company reports earnings as follows:

Year ended Sept. 30	1902	1901
Gross receipts	$102,962	$97,690
Operating expenses	77,048	66,115
Earnings from operation	$25,914	$31,575
Fixed charges	18,198	24,631
Net earnings	$7,716	$6,944
Total deficiency Sept. 30	45,456	37,740

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., Oct. '02	65,087	36,833	29,201	12,603	16,692
	1 " " '01	51,479	28,769	22,710	12,438	10,272
	6 " June '02	318,987	185,392	133,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,491	41,016
	12 " Dec. '01	617,011	*330,845	290,166	156,162	130,004
	12 " " '00	518,722	*317,478	196,244	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., Sept. '02	132,606	81,990	50,616	23,866	26,750
	3 " " '02	414,653	251,780	162,867	71,598	91,269
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., Oct. '02	17,107	10,693	6,414	......	......
	1 " " '01	16,884	9,298	7,592	......	......
	4 " " '02	82,350	44,675	37,685	......	......
	4 " " '01	80,044	40,317	39,727	......	......
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,336,507	3,532,989	2,886,850	646,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,819	476,044
Massachusetts Elec. Cos.	12 m., Sept. '01	5,779,133	3,915,485	1,862,648	937,200	925,447
	12 " " '00	5,518,867	3,650,337	1,868,530	904,294	963,206
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., Sept. '02	1,124,384	607,581	516,803	......	......
	1 " " '01	1,080,158	664,611	415,548	......	......
	3 " " '02	3,587,776	1,881,7[illegible]4	1,705,905	......	......
	3 " " '01	3,411,101	2,002,245	1,408,855	......	......
	12 " June '02	12,780,116	*6892214	5,887,400	......	......
	12 " " '01	12,101,198	*7970885	4,130,605	......	......
BUFFALO, N. Y. International Tr. Co.	1 m., *a* Sept. '02	321,356	161,525	150,831	77,702	62,329
	1 " " '00	255,822	108,911	146,888	81,981	64,457
	3 " " '02	1,012,518	500,664	512,854	235,741	277,113
	3 " " '00	791,470	344,745	446,725	245,730	200,992
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., Oct. '02	40,739	27,246	13,494	13,469	25
	1 " " '01	39,038	24,562	14,476	13,842	634
	8 " " '02	449,007	256,962	192,045	118,062	73,984
	8 " " '01	344,180	211,970	132,250	130,019	2,231
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Oct. '02	15,781	6,548	9,233	......	......
	1 " " '01	15,253	6,312	8,941	......	......
	10 " " '02	163,139	66,496	96,743	......	......
	10 " " '01	147,412	62,431	84,981	......	......
CLEVELAND, O. Eastern Ohio Traction Co.	1 m., Oct. '02	17,365	10,147	7,224	6,088	1,150
	10 " " '02	161,071	89,093	71,978	51,574	10,404
Cleveland, Elyria & Western	1 m., Nov. '02	27,931	16,745	11,186	......	......
	1 " " '01	21,125	12,370	8,755	......	......
	11 " " '02	276,135	154,825	121,310	......	......
	11 " " '01	229,853	125,768	104,085	......	......
	12 " Dec. '01	249,280	136,962	112,284	57,023	55,271
	12 " " '00	179,998	102,391	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Oct. '02	16,219	9,673	6,546	......	......
	1 " " '01	15,639	8,538	7,081	......	......
	10 " " '02	160,077	86,020	74,057	......	......
	10 " " '01	139,921	71,901	68,022	......	......
	12 " Dec. '01	161,971	*87,102	77,869	72,500	5,369
	12 " " '00	141,112	*69,592	71,520	72,500	†980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.				41,921	22,236	20,985
	1 m., Aug. '02	90,118	*53,235	28,784	15,807	12,977
	1 " " '01	[illegible]	*65,711	222,190	131,540	190,692
	8 " " '02	520,156	*311,925	208,169	125,328	82,841
	8 " " '01	535,764	*326,615			
DETROIT, MICH. Detroit United Ry.	1 m., Oct. '02	303,868	176,925	126,963	......	......
	1 " " '01	257,061	143,504	113,577	......	......
	10 " " '02	2,887,081	1,623,924	1,277,290	......	......
	10 " " '01	2,519,026	1,385,[illegible]	1,130,267	......	......
	12 " Dec. '01	2,918,172	*1596776	1,322,145	652,277	670,139
	12 " " '00	2,575,277	*1438408	1,136,377	616,468	519,731
Detroit and Port Huron Shore Line, Rapid Ry. System	1 m., Oct. '02	34,860	21,200	13,660	......	......
	1 " " '01	31,088	18,717	12,351	......	......
	4 " " '02	172,587	96,176	76,351	......	......
	4 " " '01	156,056	81,001	75,055	......	......
DULUTH, MINN. Duluth-Superior Tr.	1 m., Oct. '02	46,567	26,254	20,323	9,580	10,742
	1 " " '01	38,678	22,523	16,156	9,181	6,975
	10 " " '02	442,941	253,248	189,707	96,410	113,198
	10 " " '01	373,946	204,074	169,872	91,259	78,613
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., Oct. '02	33,648	21,041	12,607	8,333	4,274
	1 " " '01	28,578	16,964	11,614	8,333	3,280
	10 " " '02	341,890	200,158	141,735	83,833	58,891
	10 " " '01	304,144	170,289	133,856	83,333	0,522
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., Sept. '02	24,290	13,178	11,116	1,991	9,125
	1 " " '01	15,833	11,067	4,766	635	4,130
	7 " June '02	142,108	76,225	65,880	28,980	36,800
	7 " " '01	105,329	67,674	37,649	20,752	16,898
HAMILTON, O. The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Oct. '02	41,747	22,648	19,099	16,612	2,487
	5 " " '02	226,249	113,854	112,395	81,753	30,642
LONDON, ONT. London St. Ry. Co.	1 m., Oct. '02	11,645	7,408	4,237	1,911	2,32[illegible]
	1 " " '01	10,100	6,356	3,749	1,967	1,7[illegible]
	10 " " '02	127,917	78,290	49,086	22,195	26,891
	10 " " '01	116,814	72,274	44,539	19,800	24,739
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Oct. '02	239,858	114,902	124,951	67,814	57,137
	1 " " '01	206,812	99,249	107,563	63,409	44,154
	10 " " '02	2,254,794	1,061,410	1,193,383	664,625	528,758
	10 " " '01	1,992,080	977,849	1,014,471	641,810	389,661
	12 " Dec. '01	2,442,342	1,185,531	1,256,808	755,139	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	884,663	206,247
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Oct. '02	304,317	140,226	164,091	60,933	[illegible]1,157
	1 " " '01	270,962	118,054	152,908	58,161	94,734
	10 " " '02	2,971,411	1,331,546	1,639,865	590,967	1,048,898
	10 " " '01	2,611,118	1,186,902	1,424,216	561,437	862,779
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Oct. '02	181,408	96,419	84,990	15,962	68,985
	1 " " '01	166,041	86,210	80,850	15,384	65,466
	12 m., Sept. '02	2,046,2[illegible]9	1,135,170	911,082	......	......
	12 " " '01	1,900,690	1,105,287	795,418	......	......
NEW YORK CITY. Manhattan Ry. Co.	12 m., Sept. '02	11,588,546	5,548,395	6,038,151	2,712,069	3,326,082
	12 " " '01	10,456,872	5,328,640	5,127,232	2,683,189	2,444,091
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,738,972	2,148,964	1,151,140	992,824
	3 " " '00	3,786,090	1,699,640	2,086,381	1,138,467	947,914
	12 " June '02	15,866,641	7,380,863	8,480,758	4,815,421	3,665,337
	12 " " '01	14,720,767	6,750,181	7,966,686	4,534,099	3,431,067
OLEAN, N. Y. Olean St. Ry. Co.	3 m., Sept. '02	18,401	8,135	10,266	4,063	6,203
	3 " " '01	16,372	6,887	9,485	4,200	5,285
	12 m., June '02	56,065	29,118	26,987	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co.	1 m., Oct. '02	9,023	5,706	3,317	2,083	1,234
	4 " " '02	37,690	21,586	16,110	8,533	7,577
	12 " June '02	86,795	*56,392	30,403	23,126	7,277
PHILADELPHIA, PA. Union Traction Co.	12 m., June '02	14,118,180	6,402,338	7,715,830	*6637781	1,078,068
	12 " " '01	13,431,681	5,836,186	7,595,494	*6734338	861,156
American Railways	1 m., Nov. '02	94,600	......	......	......	......
	1 " " '01	73,815	......	......	......	......
	5 " " '02	344,050	......	......	......	......
	5 " " '01	418,947	......	......	......	......
	12 " June '02	1,000,500	......	......	......	......
	12 " " '01	841,298	......	......	......	......
ROCHESTER, N. Y. Rochester Ry.	1 m., Sept. '02	93,702	46,063	47,699	24,853	22,856
	1 " " '01	82,028	45,454	36,573	24,942	11,632
	9 " " '02	821,851	453,691	368,161	203,361	164,800
	9 " " '01	758,110	449,352	308,658	222,018	86,640
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., Sept. '02	61,104	33,545	27,619	19,085	8,534
	1 " " '01	53,092	29,096	24,300	19,085	5,275
	3 " " '02	184,814	101,224	83,040	57,075	26,015
	3 " " '01	168,508	91,586	76,842	57,081	19,861
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., Oct. '02	124,498	60,494	64,004	38,833	25,171
	1 " " '01	114,666	51,617	63,050	37,818	22,237
	10 " " '02	1,193,546	607,072	586,474	381,541	204,933
	10 " " '01	1,073,766	515,092	558,284	339,543	218,731
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	*616,945	565,572	409,051	156,521
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,635	158,911	78,944	......	......
	7 " " '01	187,270	133,263	53,967	......	......
NEW BRIGHTON, S. I. Staten Island Elec. Ry.	1 m., June '02	56,633	35,625	21,013	25,000	†3,986
	1 " " '01	56,936	35,600	22,336	25,000	†2,663
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co.	1 m., Oct. '02	41,494	*23,900	17,594	......	......
	4 " " '02	155,956	*86,940	69,016	......	......
	8 " June '02	198,050	*110,391	87,659	......	......

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Right to Regulate Transfers

The result of litigation in Baltimore involving the right of the street railway company to impose restrictions on the use of transfers is reported in detail elsewhere in this issue. The company was sustained in its position, and the rulings of the trial judge, as well as the verdict of the jury, will be generally commended by unprejudiced observers. One point which was very clearly established in this proceeding was that the company could impose a time limit on the use of transfers, which effectually disposes of the theory that a transfer may be used as a stop-over privilege and the holder take advantage of it to do shopping or transact other business. This is the practice in many places, and in others it has been customary to use the transfers at any time on the day they were issued. This naturally has a tendency to encourage trading in transfers, and results in serious loss to the company.

In the Baltimore litigation the court ruled that the transfer was conclusive evidence between the passenger and the conductor as to the passenger's right to ride. The transfer was stamped "Not good after hour punched in the margin," and the time limit thus fixed had expired. Therefore as the transfer was bad on its face, the conductor had the right to demand that the passenger pay his fare or get off the car, and in the event of his refusal he had the right to use all reasonable and necessary force to expel him. It was further contended that as the transfer was conclusive evidence between the passenger and the conductor, if there had been any error by an agent of the company by which the passenger had been injuriously affected, the latter's rights were in action for breach of contract. It was the duty of the passenger, under the circumstances, to pay his fare, postpone his claim, and not compel the conductor to eject him. Any other ruling, it was pointed out, would either compel a conductor to accept the word of every passenger who had a transfer that was bad upon its face, and thus open the door to continuous frauds, or else eject every passenger who had a bad transfer and refused either to pay or leave the car. This view is both reasonable and just, and it will undoubtedly command the approval of fair-minded men.

Efficient Discipline

One of the striking developments in railway work during the last decade has been the introduction of system and method in the discipline of employees. In the early days of railroading, both street and steam, the relations between the employees of the company and the superintendent or manager were similar to those in a small company in any industry. That is, the man in charge was a sort of Czar, whose government was sometimes very fair, but more often was characterized by rulings which were both arbitrary and erratic. The idea of the introduction of system, except in a most general way, was considered impossible in a department in which so many human elements entered as in that of discipline. Matters have changed, however, on both steam and street railroads, and the most thoughtful managers in both branches of the work are those who give closest attention to this subject, as the articles published in this paper recently and the discussions before bodies of street and steam railroad men testify.

Properly to understand the most accepted views on discipline, however, the word itself should be divorced from the common, though incorrect, meaning which has often attached to it, and which makes it synonymous with punishment. Discipline means instruction as well as correction, and the object of efficient discipline should be to teach the correct way quite as much, if not more, than to punish those who do not comply with the rules of a company. The subject, broadly speaking, divides itself into three parts; first, the establishment of the best rules for the government of employees; second, the enforcement of such rules by the employees, both in their spirit and in their letter; and third, the disposition of the cases of those men who do not comply with the regulations of the company. Each of these subjects is worthy of exhaustive study, and it is hard to say which is the most important, although the third has perhaps been given more atten-

tion in the papers read on this topic at the meetings of the different associations, and is the one to which most of the speakers at the recent meeting of the New York Railroad Club devoted their attention.

It is a very significant fact that all of the seven speakers on this subject at the recent meeting of the New York Railroad Club, and whose remarks have been published in these columns, advocated a broad and sympathetic policy of treatment in the government of employees. Much has been written on this subject from the moral standpoint, but we consider it a very significant fact when seven speakers, representing practically as many important transportation corporations, argue the same policy as best serving the commercial interests of the company. If this sort of thing is continued, the business of the walking delegate and others whose function in life it is to foment discord between employer and employee will be gone. We do not mean to say that the millenium has come, or that there will not be points of difference between the managers and the working force of the future transportation companies. But if the employee meets the management upon anywhere the same basis in favor of fair dealing which prominent managers now advocate in their relations to him, such differences as do exist should be so slight that they can be removed without serious friction.

Possibility of an International Street Railway Congress

Elsewhere the announcement is made of a proposed plan of the directors of the St. Louis World's Fair to hold a series of world's congresses during the Exposition in 1904, and we sincerely trust that arrangement will be made for the inclusion in the subjects to be discussed of electric railway topics. Congresses of this general kind have been held at the last two or three international fairs, but it is only within the last few years that the electrical railway industry has grown to such proportions that its importance has warranted a demand for a conference of this kind.

The first, in fact the only, international street railway congress which has ever been held at a World's Fair, was in 1900, at the time of the Paris Exposition. At this congress four days were set aside for the discussion of topics connected with street railway work, and the proceedings, which were reported in the STREET RAILWAY JOURNAL, indicated that a great deal of interest was taken in the movement. Official delegates were sent by the principal European governments to attend and take part in the meetings and to report as to the improvements brought out at the meeting and on any other points in which the governmental authorities would be interested. The president of the congress was L. Janssen, president of the International Street Railway Association.

A world's congress on electric railway matters, however, without the active participation of American engineers, is like the play of Hamlet with Hamlet left out. On the other hand, the leading position of this country in all matters pertaining to transportation by electric power would insure the success of a world's fair congress on electric railway matters if held in this country, and if given the active participation of a body like the American Street Railway Association. We believe that a meeting of this kind would also be attended by a large number of foreign delegates if invitations were extended to them in an official way. In the first place, it is reasonably certain that all of the Continental governments who make a practice of sending official representatives to all meetings of the International Street Railway Association, would follow a similar course in the case of an international congress held in this country. It is also reasonably certain that many, if not all, of the various street railway associations in Europe would be represented and the congress would be as well attended by many independent engineers and investigators. The paramount position of this country in electrical railway development has been the means of bringing to this country during the last five or six years, as most of our readers know, many electrical engineers who have made a tour of inspection of the principal lines, and an occasion of this kind would form an additional reason for such a trip. It is needless to say, therefore, that such a congress would bring forth results of international importance, which would only be possible for a convention held on American soil.

The Snow Problem

This is the strenuous season in which the street railway manager, especially of suburban roads, reads the weather reports more in sorrow than in anger, and buckles down to hard work. When the community depends, as it now does, mainly on electric cars for getting about its business, the maintenance of service in spite of the weather is a matter of fundamental importance. The growth of street railways has done a splendid work in increasing the mean radius of urban population, but this very fact makes complete continuity of service doubly important. A heavy snowstorm has now become a far more serious matter than it once was, and it must be dealt with actively and continuously. The work varies widely in character, according to local conditions, but it may be divided broadly into preventive and curative measures, differing radically in relative importance as the road involved is strictly urban or largely suburban. In either case, however, there is trouble enough and to spare. On urban systems the main work must of necessity be preventive, for once delays begin they accumulate with frightful rapidity and coalesce into blockades of a disastrous character. The only remedy is to keep the tracks clear in an operative sense from the very start. There is little leeway in the schedules, and whatever is done must be done promptly. Once let the snow get a start and all is lost. The usual resort is to working cars equipped with shear or nose plows and sent over the lines as frequently as possible. As soon as snow starts out come the plows, and if the manager is really alert the plow crews are kept at call whenever snow is predicted or probable. Under favorable circumstances this procedure works well, but we wish here to call attention to its weak point.

It is this—that the plows must be sent over the line between cars, and the number of plows being limited it is exceedingly easy to get one after another put out of service behind a stalled car. We have then all the elements of a severe blockade, and trouble ensues at once. So long as a car can keep going, the following plow can clear the way well for the cars beind, but at the first stop the procession stops too. It seems to us, therefore, that there is room for great development in the line of track-clearing devices on the individual cars. Such there are, and they do pretty good work, but not quite well enough, and the problem of applying them deserves thorough study. If every car that runs after the snowfall begins is equipped to make its own way it takes a very formidable storm to cause a blockade. Of course such devices are not equal to the regular plows, and may fail in a bad storm, but they make up by their number on an urban system for lack of individual power, and will keep the track open for traffic in cases where the regular plows would fail. It is the clearing power per minute of storm that counts, rather than the capacity of the plows that might be in action if they could reach the obstruction. On lines where the cars are frequent the individual plowing devices count for the most, and the heavier apparatus can be put into full action only after the mischief has been done. Aside from this their best work is in keeping the track clear during the hours when few regular cars are running. Once a procession of cars is stopped it is a question of shovels to get it started, with every minute of delay rendering the task more difficult.

On suburban lines, running comparatively few cars, troubles increase. If the snow is falling heavily it may pile up too fast for the clearing devices of individual cars to deal with it, but with the looser schedule there is more chance for a car to work its way to a point where a plow can get in ahead of it and clear the way. In any case, however, the capacity of each individual car for pushing its way is a most important element in the game that must not be neglected. The regular shear or shovel plows will do admirable work in storms of moderate severity, but on long lines

through open country the drifts will often get a start that puts ordinary apparatus out of action. In such an exigency the rotary plow is the last word in the controversy. The steam railroads of the country have threshed out the snow question through years of toilsome and costly experience and have settled pretty firmly on the rotary plow as the most efficient weapon. Not only will it bite its way through prodigious drifts, but it will rip through any ordinary snows fast enough to open track almost on schedule time. Of course a rotary plow is a costly machine and uses a very large amount of power, a point which should be kept in mind in laying out the feeders for country lines, but it does the work and ought not to be left out of the equipment of any road that has to contend with severe snowstorms. The ordinary plows are most useful machines, and do all that can be reasonably expected of them, but they cannot do everything, even if they can get into action, or anything if they get caught in a procession. It is for this reason that the snow-fighting equipments of the individual cars should receive more attention than is usually given them. Snow-fighting is a costly business at best, and there has to be enough shovelling anyway, without doing more of it than is absolutely necessary. The less such labor has to be supplied the better, and we think that the cheapest course in the long run is to be very liberal with the mechanical equipment of the system, and to make each car as far as practicable independent of outside help. And when worst comes to worst it will not take many hard storms to pay for a rotary plow of the most efficient description.

The Brooklyn Bridge Traffic Problem

For the relief of the present traffic congestion on the Brooklyn Bridge, the Brooklyn Rapid Transit Company has recently been authorized to install four additional loops at the New York terminal. The decision that this would provide the best form of temporary relief was reached by a committee of experts appointed by the Mayor. Contracts have been let, and as soon as possible the work will be begun with prospect of its completion early in the coming spring.

It is interesting at this time to consider what measure of relief will be afforded by the installation of the four additional loops. As is well known, the annoyance and inconvenience arising from the terribly overcrowded condition of the New York terminal at the rush hour is owing largely to the concentration of an immense traffic in the narrow space occupied by the four existing loops used by the surface lines. To scatter this concentration over a much larger terminal area is the object sought in the new plan. That it will aid greatly in doing this can hardly be questioned, as it will enable the cars of the seventeen different lines to be distributed over the terminal with regard to territorial assignement. In other words, all cars for the South Brooklyn section may be assigned to one place; those for the Eastern (or Williamsburg) District grouped in another place, etc. By so doing the streams of traffic going to the different sections of the city will not be brought into such close contact with one another. Moreover the cars may be permitted to stand longer, instead of being pushed out, as at present, by the necessity of making room for the following cars. All of this will add greatly to the convenience and comfort of the patrons of the road, and will make it possible for men and women to get through the crush without having their buttons torn off.

But will it do anything more than this toward the relief of the traffic congestion itself? It would seem that the really important question is whether it will enable any more cars to be run over the bridge at the time of maximum traffic. To subserve the comfort and convenience of the passengers in boarding and alighting from the cars in the New York terminal by scattering the masses of people over a larger area is one thing, but to move them faster and with more comfort on the cars is quite another thing. To increase the length of the platforms on the Manhattan Elevated Road, as is now being done, will certainly add to the convenience and comfort of the people waiting at stations for trains, but unless more cars are run at the time of maximum load the same old crush will be unavoidable on the trains. The object in increasing the length of the platforms is to enable the handling of six cars per train, instead of five, thereby increasing the traffic carrying capacity by one-fifth. But it is not as yet clear how the four additional loops are going to enable the running of more surface cars over the bridge.

Those who are familiar with the bridge operation know that the capacity of the single track on each roadway is not limited by the existing four loops at the New York terminal, but by other and more difficult considerations. Sands Street on the Brooklyn side may be likened to the neck of the bottle at which all the streams of traffic converge, and through which they must flow. As previously stated, there are seventeen different lines of surface cars reaching the bridge through three or four avenues, which, at or near Sands Street, must pass on to a single track before entering on the north roadway of the bridge. Under the present arrangement nine of these lines, comprising about half of the cars operated over the bridge, must, upon their return from New York, cross at grade at the Brooklyn entrance at or near Sands Street the entire traffic of seventeen lines going toward New York. At the same point on Sands Street where the car traffic crosses itself a large portion of the vehicle traffic coming from New York crosses the vehicle and car traffic going toward New York. This narrow space where both car and vehicle traffic crosses itself will, until something is done, fix the limit upon the number of cars that can be operated. President Greatsinger's plan for elevating the New York bound track and carrying it on a level with the bridge floor over Sands Street, if he is permitted by the city and bridge authorities to carry it into effect, will effectually remedy the difficulty at that point, but will they let him do it?

With that difficulty removed there still remains another which is perhaps equally as serious. The cars and vehicles on the bridge occupy jointly the narrow space of a single roadway. The speed of the cars is limited by that of the vehicles. The latter, for some unaccountable reason, are not restricted to a certain space, but have the liberty of the entire roadway, dodging in between the cars here and there, oftentimes effectually blocking their progress. The cars, under all circumstances, are expected to keep a distance of 102 ft. apart, which is an invitation to the drivers to run in front of and between them.

The unfortunate feature of the whole situation is that the maximum vehicle traffic comes at the same time as the maximum car traffic. The vehicle traffic is increasing almost in the same proportion as the passenger traffic, and as there seems to be no disposition on the part of the city authorities to regulate the volume or the movements of the vehicle traffic, the interference from it will gradually become more pronounced. When the bridge was first opened to the cars of the surface lines it was possible, in the rush hours, to pass 300 cars per hour through the New York terminal, and the number often ran up to 310 or 315 per hour. The most that can be done at the present time, as the reports of the operation indicate, is 270 to 280 cars, and occasionally a maximum of 290. The decrease may be ascribed almost solely to the interference of the vehicle traffic on the bridge and at the Brooklyn entrance. If this interference is to be permitted to go on increasing from year to year the time will soon come when 250 cars or less will be the maximum number which can be run through the terminal in an hour.

It seems, therefore, that the condition which all those interested have sooner or later to face is a constantly increasing demand for passenger transportation with a gradually increasing vehicle interference resulting in a gradual decline in the number of cars operated. This condition, it is needless to say, will not be remedied by the addition of four loops, or twenty loops to the surface car terminal in New York.

Equipment of the Toledo & Western Railway

Very few interurban electric railways have attracted so much attention as the Toledo & Western, which has been the subject of several articles in these columns during the last year. It will be recalled that this company is an important factor in the combination of interurban lines which maintain union passenger and

CAR SHEDS AND REPAIR SHOPS AT SYLVANIA

freight stations at Toledo. It has developed a very efficient method of handling freight and express, as well as a heavy passenger service, and it has had experience both in competing with established steam lines and opening new territory which had never before been favored with transportation facilities. The construction and equipment of this road, which it is the purpose of this article to describe and illustrate, are consequently of great

SIDING SHOWING OVERHEAD CONSTRUCTION AND TELEPHONE BOOTH

interest, not only because of the extent of the business transacted, but on account of the varied character of the service, particulars of which have been given in the STREET RAILWAY JOURNAL of Oct. 4 and 25, and Nov. 29

The company's headquarters and power house are located at Sylvania The general offices, which have recently been removed from Toledo, together with the car house, repair shop, paint shop, club rooms for employees, train despatchers' office and stock rooms are contained in a single brick building illustrated herewith. There is space for the storage of twenty cars with pits for four cars. The machine shop is well equipped with all appliances for this class of work, as are the paint shop and armature winding department. In the men's club room are pool tables, a reading-room and a bathroom, with individual lockers.

In the construction of the road, steam practice was followed as closely as possible. The country traversed is extremely level and there are no grades over 1½ per cent, and the highest curve is 14 degs. With the exception of where the road passes through towns, 95 per cent of the mileage is private right of way ranging from 18 ft. to 35 ft. wide, the majority being the latter width. The extension to Fayette is 50 ft. wide, and future extensions will follow the same rule. All of the right of way has been purchased outright. For 6 miles running into Adrian the company purchased the abandoned right of way of the old Erie & Kalamazoo Railway, the first steam road built in the West.

TRACK AND LINE CONSTRUCTION

The track is laid with 60-lb. steel, 30 ft. and 32 ft. lengths. Ties are cedar and white oak, 6 ft x 8 in. x 8 in., laid on 2-ft. centers. Crushed stone with 2 ins. of sand for a cushion is used for ballast. No. 10 frogs are used for switches. At towns the sidings are 400 ft. long, and those between stations, 200 ft. There are four stopping points to the mile, in addition to stations where all trains stop. The pole-line construction consists of 35-ft. cedar poles with Richmond flexible brackets and extra braces, set 90 ft. apart. Single 000 Fig. 8 trolley wire is used, with hangers of the Ohio brass type. The direct-current feeders are aluminum and copper, the former seven-strand No. 12, and the latter No. 4. The alternating-current feeders consist of three No. 4 aluminum, spaced 21 ins. apart. Porcelain insulators are used throughout, and the whole 13,000-volt construction is arranged to be changed, if required, to 26,000 volts. There are three grade crossings and two undergrade crossings. Two of the crossings are protected by derailers where the motorman must cross the track to throw the point, while the third crossing has

CROSSING UNDER STEAM RAILROAD

a semi-interlocking device. There is a semaphore on the steam road and a derailer on the electric. The signal on the steam track is set at "danger" before the derailer can be opened for the electric.

ROLLING STOCK

At present the rolling stock consists of ten straight passenger coaches, two combination coaches, three express cars, three fifteen-bench open cars, twelve 60,000-lb. box cars, eight 60,000-lb.

hopper bottom gondolas, twenty 60,000-lb. flat cars, three 50,000-lb. stock cars, one rotary snowplow, one inspection car, one rotary transformer car and two electric locomotives.

The passenger cars were built by the Jewett Car Company, and one of them is illustrated herewith. They are 50 ft. over all, 8½ ft. wide, and have vestibules at both ends. The passenger coaches seat fifty-four passengers and the combination cars forty-four. There are smoking compartments, toilet rooms, and ice coolers. Interior finish is cherry, and the floors are deadened by a layer of sawdust. Hale & Kilburn walk-over seats, Christensen air brakes, air sanders and air brakes and Providence fenders are used, and the cars are heated by the Peter Smith hot-water system. Power equipment consists of four 50-hp motors, about equally divided between Steel, Westinghouse and General Electric, which are mounted on Peckham 14-X high-speed trucks.

The freight cars are fitted with M. C. B. couplers, Westinghouse air brakes operated by a compressor located on the locomotive, and they have standard steam flanges and tread. These cars were built by the American Car & Foundry Company. The freight business of the road has increased to such an extent that orders have been placed which will practically double the present equipment.

The electric locomotives which have been rigged up for temporary use, are flat cars, upon which cabs have been built. They are weighted for traction, and one of them is equipped with four 50-hp motors, and the other with four 75-hp motors; the former handles four cars, and the latter seven. These cars, or locomotives, are not heavy enough to take care of the trains which the company is now desirous of handling, and an electric locomotive patterned after those used by the Baltimore & Ohio Railway at Baltimore has been constructed at the Sylvania shops. It weighs 35 tons and is equipped to handle sixteen loaded cars. The McGuire rotary snow plow is fitted with four 50-hp Steel motors for propelling the machine, and two 50-hp motors for operating the sweepers.

ELECTRIC LOCOMOTIVE BUILT IN TOLEDO AND WESTERN SHOPS

PASSENGER CAR WITH SMOKING COMPARTMENT

The inspection car before mentioned is a valuable acquisition to the rolling stock. It is a light gasolene car of the hand-car pattern, and was built by the Sheffield Car Company, Three Rivers, Mich. Two small gasolene motors mounted at the sides give the car a maximum speed of 40 miles an hour, which can be maintained all day if necessary. The operation is simple, and five passengers can be seated. The car can be lifted from the track by two men, and it has been found of great value for inspection work, permitting officials to stop off at any point without interfering with schedules.

POWER PLANT

The power plant is located on the banks of a small stream which

CONSTRUCTION TRAIN HAULED BY A "HOME MADE" ELECTRIC LOCOMOTIVE

has been dammed to form a pond, affording ample water supply of good quality. The impression given by the building is utility, rather than elegance, and the whole arrangement is such that the plant may be extended at any time without interfering with the part already installed, and still retain its uniformity of design. The engine room and boiler room are of the same size, 48 ft. wide by 77½ ft. long. The floor level of the boiler room is 6 ft. below that of the engine and the floor level of the engine room basement is 10 ft. below that of the engine room.

MAIN POWER HOUSE AT SYLVANIA

The boiler plant consists of four Stirling water-tube boilers of 300 hp capacity each, set in two batteries. The boilers are of standard design and are built with flat grates for hand firing. The stack is located between the two batteries of boilers, and is supported at the floor line on a heavy cast-iron base resting on a substantial stone foundation. The stack is 6 ft. in diameter and 125 ft. high, of heavy steel, double guyed, and is provided with an ornamental top.

Feed-water is supplied to the boilers by two Laidlow-Dunn-Gordon duplex piston pumps, set in front of the stack between the boilers. Either of these pumps is capable of supplying all the boilers, and they are cross-connected so that either can draw from the heater and feed the boilers, while the other draws from the cold-water supply and discharges to the washout and fire lines. The feed-water is heated by a Cochrane open feed-water heater placed in the rear of the stack. It receives the exhaust steam from the auxiliary steam machinery, and the piping is by-passed so that the heater may be cleaned while the plant is in operation. Water is supplied to the heater by a low duty duplex pump, placed in the engine room basement, which draws its supply either from the cold well or from the condenser overflow.

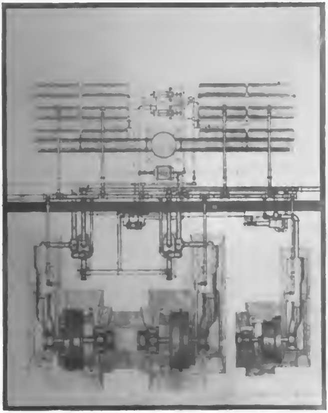
The steam header is 12 ins., and consists of two sections joined in the middle of the power house by a 10-in. U bend and valve. It is supported about 18 ft. above the boiler room floor on roller stands which allow perfect freedom from expansion. The roller stands rest on I-beams, the ends of which are imbedded in the division wall, and the rear walls of the boilers. Steam is led to the header from each boiler through two 90-deg. bends, with a high pressure valve at boiler and header. Steam for the engines is taken from the top of the header through angle gate valves and bends to the throttles. The auxiliary header, which supplies the pumps and condensers, is located under the boiler room floor, directly under the main header, in a shallow basement, 4 ft. deep, which extends the length of the boiler room, and from the rear boiler walls to the division wall. This header is drained into a trap, while both sections of the main header are drained into a receiver connected to a steam pump, which delivers the condensation to the heater.

The engines, three in number, are of the four-valve tandem compound condensing type, built by the Russell Engine Company, Massillon, Ohio. Two of these have cylinders 22 ins. and 40 ins. in diameter, with 40-in. stroke, and operate at 125 r. p. m., giving a rated horse-power each of 750. The third engine is rated at 500 hp, has cylinders 18 ins. and 32 ins. in diameter, with 24-in. stroke and operates at 150 r. p. m. The steam pressure carried is 150 lbs. and the engines are guaranteed to operate continuously at 25 per cent overload. The engine shafts carry the revolving fields of the alternating-current generators between the bearings and the armatures of the exciters outside the outboard bearings.

INTERIOR OF POWER HOUSE, SHOWING TWO UNITS AND SWITCHBOARD

The engines are lubricated by a gravity system, the oil being led from an elevated tank in the boiler room to all the engines, and distributed to independent sight feed connections at each point to be lubricated. After it is used the oil passes to a filter in the engine room basement and is raised by a small steam pump to the supply tank.

For each engine there is an independent jet condenser, connected to a steam-driven, direct acting air pump. These were supplied by the Laidlow-Dunn-Gordon Company and are located in the basement of the engine room. Those for the large units are 12 ins. x 18 ins., and the one for the smaller unit is 10 ins. x 14 ins. x 18 ins. Between each engine and condenser is placed an automatic three-way exhaust relief valve, so connected that in case of a break in the vacuum, the exhaust is thrown automatically to the atmosphere, and the passage to the condenser closed, thus preventing the possibility of the water from the condenser backing up into the exhaust pipe of the engine, without the intervention of an additional gate valve. After the condenser is again started the valve may easily be thrown over to the other



LAYOUT OF POWER HOUSE

position, when the vacuum will firmly hold it. The condensers draw from a 14-in. suction line in common, and discharge also through a common line, these being located in the boiler room basement before mentioned. Pockets are provided in the discharge lines, from which the heater is supplied as before outlined.

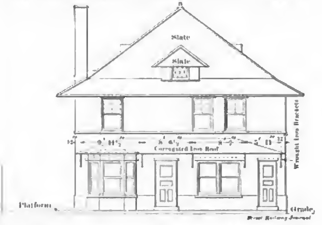
The electrical equipment consists of two 540-kw and one 360-kw revolving field type, three-phase, 25-cycle, 13,000-volt generators; two 17-kw exciters running at 125 r. p. m., and one 15-kw exciter running at 150 r. p. m., each directly connected to the shaft of its respective generator; one 360-kw rotary converter, and four 110-kw oil cooled transformers. The 13,000-volt cables running from the generators are carried directly to the oil switches in the oil switch room, which is located in the engine room directly back of the switchboard, as shown in the cut. All transformers, lightning arresters and automatic overload devices are contained in the oil switch room.

The switchboard is located about 3 ft. from the wall of the oil switch room, and only the instrument wires and the wires for operating the magnets controlling the oil switches are brought to the board. These wires are brought out in brass tubes which form a part of the switchboard construction. There are fourteen switchboard panels as follows: Three alternating-current panels, three exciter panels, four 13,000-volt feeder panels, two 600-volt direct-current feeder panels and two lighting panels for commercial lighting.

The entire electric equipment for the station was furnished by the General Electric Company, and the entire steam equipment by the Arbuckle-Ryan Company, of Toledo.

SUB-STATIONS

The sub-stations, of which there are six, are located at Morenci, Lyons, Metamora, Adrian, Blissfield and West Toledo, with an average distance between stations of about 10 miles. Each sta-



FRONT ELEVATION OF A TYPICAL SUB-STATION

tion contains one 360-kw rotary converter and three 110-kw oil cooled transformers, and one 35-kw reactance coil with three switchboard panels, one for the alternating current, one for direct current, and one for commercial lighting. The 13,000-volt current is controlled by oil switches which are enclosed in marble compartments, and are arranged to be operated either by automatic relay or hand controlled.

The low-tension side of the transformers is arranged with an intermediate tap furnishing 185 volts, which is used for starting the rotaries, a three-pole, double switch being used to throw from low to high voltage when the rotaries are up to speed. All rotary stations are arranged with a view of supplying current for commercial lighting, as well as the operation of railway lines.

In addition to the regular sub-stations there is a portable

ELECTRICAL EQUIPMENT IN SUB-STATION

station, consisting of a box car equipped with one 250-kw rotary converter and three 90-kw oil cooled transformers, and the necessary switchboard and connections arranged for quick connection of both 13,000-volt and 6000-volt lines. This station is also ready for use in case of accident to any of the sub-stations, or for extra service at points where unusually heavy service is required. Under ordinary conditions this car can be connected to the line at any point, and be ready for use in less than two hours from time of starting.

The sub-station buildings are all of similar design. They are located in the villages, making them convenient for passenger and freight requirements. The buildings, one of which is illustrated, are of unusually attractive design. They are two stories high and are built of paving brick with stone trimmings, and cost about $3,500 each. Ticket office, waiting-room and baggage room occupy the front half of the first floor, while the attendant and his family occupy a fine suite of seven rooms on the upper floor. Rent and light are furnished free to the attendant, and in this way a very superior class of help can be secured at a reasonable figure for this service. The attendant has entire charge of the station, taking care of the electrical equipment, besides handling baggage and freight and selling tickets. He is also supposed to keep the passenger and freight solicitors informed as to opportunities for securing business. At these stations patrons are permitted to use the telephone in ordering goods to be shipped over the electric road. At Blissfield there is a freight station in addition to the usual rotary station, while at several of the smaller towns there are neat frame buildings designed for the service and known as second-class stations.

PARKS AND OTHER ATTRACTIONS

Within a short run of Toledo the company has established a baseball park and racetrack. On Sundays during the last season a professional team played regular scheduled games. On other days the park is turned over to clubs who arrange for dates. Admission to the park is free, but a small charge is made for grandstand seats. Another season the company will probably establish a park and summer resort on a site that has been selected because of its many natural advantages.

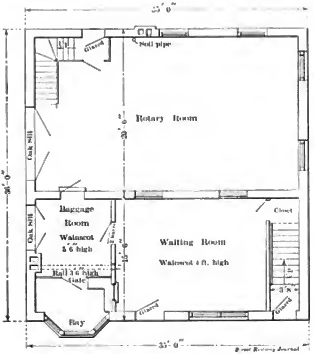
ORGANIZATION

The Toledo & Western Railway Company has an authorized capital stock of $1,800,000, with $1,300,000 issued or to be issued. The bonded indebtedness is $1,250,000, or less than $19,000 per mile. At the present time the stockholders are considering a proposition to increase the bonded indebtedness by $250,000 to take over the road and property of the Toledo, Fayette & Western, a company formed recently to build a 12-mile extension from Fayette to Pioneer. This is now under construction, and when the deal is effected the Toledo & Western mileage will be increased to 80 miles.

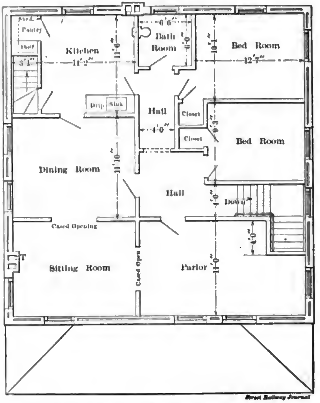
The stock of the company is closely held by Cleveland and Toledo people who took up the proposition in its infancy, with the belief that it would prove a safe investment, and already the property is showing up in a most satisfactory manner. The gross earnings for a recent month were about $14,000, of which over $4,000 was derived from freight and milk. The figures have increased each month since the road has been in operation, and the proportion of the freight receipts to the total is steadily gaining At the present the property is being operated for 53 per cent, but it is believed when everything is in smooth running order this will be brought below 50 per cent. The road is already paying fixed charges, and the earnings will be largely increased when the new extension is completed and better terminal facilities are afforded at Adrian. An expensive undergrade crossing is being built on the outskirts of that city to enable the Toledo & Western cars to connect with the city line. When this work is completed they will run to a terminal station now being arranged for.

The officers of the company are: Hon. Luther Allen, Cleveland, president; J. R. Seagrave, Cleveland, vice-president; F. E. Seagrave, Toledo, secretary and assistant treasurer; C. F. Franklin, general manager; J. S. Clark, purchasing agent; C. T. Chapman, general freight and passenger agent; Frank T. Oakley, chief engineer, and Frederick B. Perkins, consulting mechanical and electrical engineer. Mr. Perkins had entire charge of the designing of the electrical and mechanical equipment of road.

Hon. Luther Allen, president of the company, is also president of the Cleveland, Painesville & Ashtabula Railway, which is being built between Painesville and Ashtabula, and of the Buffalo, Dunkirk & Western Railway, which is projected from Buffalo westward. These two roads will close the last gaps between Buffalo and Toledo, and it is probable that by the time both are completed the Indiana links will have been closed up, affording an unbroken line from Buffalo to Chicago, in which the syndicate headed by Mr. Allen will be a most important factor in case of ultimate consolidation.



First-Floor Plan.



Second-Floor Plan; Arranged for Attendant's Home

GENERAL ARRANGEMENT OF SUB-STATION BUILDINGS

Jersey Trolley Tunnel

The New York & New Jersey Company's tunnel franchise was passed by the Board of Aldermen last Tuesday, and, as there has been no opposition to the project, it will doubtless receive the Mayor's approval. It is proposed, under the terms of this grant, to complete the Hudson tunnel and operate trolley cars betwen Jersey City and Christopher Street, New York, under thirty-second headway and making the trip in ten minutes. Under the terms of the franchise the city is to receive 3 per cent of the gross receipts of the company on that portion of the railway lines in New York for the first five years, and 5 per cent thereafter. The tunnel will enter New York at Morton Street, and will run up Morton to Greenwich Street, thence along Greenwich Street to the block bounded by Christopher Street, West Tenth Street, Greenwich Street and Hudson Street, where the terminal for Manhattan is to be located. The terminals for New Jersey probably will be at the Erie and Delaware & Lackawanna stations.

The Series Alternating Motor Problem

BY GEORGE T. HANCHETT

In view of the brilliant promises which have been made by prominent manufacturing companies with reference to single-phase alternating current railway motors, it becomes interesting to review the problem which they profess to have successfully solved.

A preliminary paragraph reviewing the condition of direct-current motor commutation may be useful in considering the matter. For this purpose reference may be had to Fig. 1, which illustrates diagrammatically the relative mechanical arrangement of the pole piece, commutator and brush, and also the armature coils. In this illustration a ring armature is chosen, as it is somewhat simpler to show diagrammatically, and the following discussion applies to that type of winding, but it will be understood that the same principles apply equally to all forms of drum armature commutation.

For perfect commutation the bobbin *V* is received under the brush and held short-circuited thereby until its motion in the field has induced a sufficient electromotive force to reverse the current and give it the same magnitude as that of the working circuit of the armature to which it is about to be delivered. The bobbin *V* is already in a field generating such an electromotive force, which,

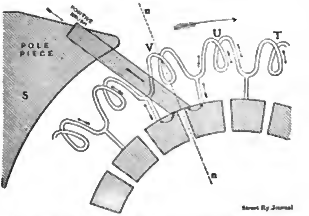


FIG. 1.—RELATIVE POSITION OF POLE PIECE, BRUSH, COMMUTATOR, AND ARMATURE COILS

while it was in an earlier position was opposing the flow of current from the positive brush. The act of commutation, therefore, takes place before *V* has passed out of this field, and as the resistance of the bobbin is small, it usually takes place at a point in the rotation where the time-rate of change, due to its motion, is not very great. In fixed brush commutation, which is the only commutation we can consider in railway motor work, the current in the bobbin *V*, while it is short circuited by the brush, which we will call the short-circuit current, depends for its magnitude upon the velocity of the motion of the bobbin, its reactance and the strength of the field. It is not absolutely necessary that the current in *V* shall be equal in magnitude to the current in *U* when it is released. Reasonably sparkless commutation can occur without this condition being exactly fulfilled. For example, in motors having a practically constant speed and field, the final value of the short-circuit current is always the same, also while that of the bobbin *U* and *T* may vary quite considerably, according to the load on the machine. The reason that alternating-current series motors have encountered such formidable commutation troubles is because other and very variable influences influence the magnitude and direction of this short-circuit current, and it is these variable influences which are about to be discussed.

In the case of the alternating-current railway motor, concerning which performance and construction data are awaited, the frequency has been reduced to 16 2-3 cycles per second. This figure is so much lower than the number of commutations per second that there are probably not less than 150 commutations per cycle, or 75 per alternation. Consulting Fig. 2 it is plain that these commutations occur at equal linear distances along the horizontal axis of the alternating-current curve, and for convenience these have been marked off on the diagram and numbered one to twelve respectively, each interval denoting a space during which about six commutations take place. This curve can also be used to represent the strength of the field, to which it is directly proportional, and upon which the commutation directly depends. It will be easily seen that there are, therefore, seventy-five different commutation conditions due to this cause alone, which must be met by a single construction of brush and armature coil arrangement, and which is, therefore, a severe tax on the designer's skill.

In any of these commutation positions it will be seen at once that the short-circuit current is due to an electromotive force which has two components, one the component due to the motion in the field, as in the case of direct currents, and the second due to the variation of the field itself, the resultant voltage being equal to their vector sum.

It will be noticed that at zero current in the system, and at zero field the motion of the bobbin can induce very little electromotive force, but the rapid variation of the field is capable of considerably influencing the short-circuit current; in fact the bobbin must depend for its current reversal very largely on the rate of change due to the increasing field. Further up the crest, as positions three and four, the motion of the bobbin and the increasing field combine together in more equal measure to produce the resultant voltage. At the top of the crest, say at position seven, where the field is for the instant steady, the resultant voltage is due almost entirely to the motion of the bobbin. On the other side of the crest the resultant voltage is increased by the motion of the bobbin and diminished by the diminishing field, and the vector sum thereof may be less than either of the components.

It is now necessary to take into account the fact that as the commutation occurs at various points along the crest, it is necessary for sparkless operation to adjust the short-circuit current to harmonize in direction and magnitude with a varying and not a constant current, as is the case in direct-current work. As has been pointed out in a previous paragraph there is, fortunately, a considerable latitude in this particular, and the currents need not agree so closely in magnitude provided that they agree in direction. As long as the current is well reversed and given reasonable magnitude, we need not fear trouble at the commutator. Therefore, on the ascending side of the crest, where the two forces

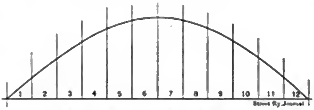


FIG. 2.—DISTANCES OF COMMUTATION

unite to effect reversal, we may expect reasonably good commutation if the current with which it is to be harmonized is increasing also. As the top of the crest is passed the field magnetism begins to die away and induce in the bobbin an electromotive force opposed to that due to its motion, thus reducing the resultant current as the event occurs to a greater degree as the commutation occurs further and further down the curve. The load current with which it is to be commutated is, however, reducing also, and hence, for a portion of the curve at least, we may expect reasonable commutation. In short, these variations at some points tend to harmonize with good commutation, and if the clever designer can so evaluate the two component electromotive forces as to produce a resultant voltage which, when impressed on the bobbin, will give a short-circuit current, which will rise and fall with the load current and agree with it in direction, we may expect even better commutation than obtains in direct-current work. Unfortunately, it is very difficult to do this so that the result will be sufficiently good for practical purposes. In order that the motor shall have a strong torque and shall be of light weight its field must be strong, and hence the component of the resultant short-circuit voltage due to varying field is correspondingly large, and on the descending side of the curve it may overpower the component due to the bobbin's motion, and even deliver the bobbin to the working circuit carrying current opposite in direction from that which it should have, and trouble from sparking can, therefore, be expected at those commutations which occur when the current is diminishing. If it so happened that the motor was run for a long time at commutation frequency which was an even multiple of the alternating-current frequency, the commutation troubles might be expected to blacken the commutator in stripes. It, therefore, becomes interesting to speculate as to the ways and means which have been employed to meet this very formidable difficulty, even though we have been promised exact data at a very early date.

The simplest way to avoid the trouble is to proceed as has been

indicated in the preliminary announcements, namely, to reduce the commutating component due to varying field. This can be accomplished in two ways. First, by weakening the field, which is objectionable for several reasons, and second, by increasing the peripheral speed of the armature so that the bobbins are moving in the field very rapidly, and the electromotive force due to their motion is therefore large, as compared with the electromotive force due to field variation. A third expedient is to make the number of turns per bar a minimum. This has a very beneficial effect, because it materially increases the permissible difference between short-circuit current and working current on precisely the same principle that open circuiting a large number of lamps into a constant current-arc circuit produces a greater spark at the switch than does a similar action with a single lamp. A further advantage obtains in the fact that the inductance of the bobbin is thereby much reduced. This inductance is a very unmanagable variable. It is plain that the bobbin is received under the brush carrying all values of flux from zero to maximum, and if the iron has a tendency to hysteresis, it is almost impossible to predict what these values will be, and the best plan is to reduce their effects to a minimum. This has undoubtedly received most careful consideration at the hands of the designers. In discussing the relative values of these various expedients it may be stated at once that reduction of field strength can only be indulged in to a very limited extent. The reduction of the field strength undoubtedly reduces the strength of the disturbing commutation component due to alternating field, but it brings in its train a long line of evils due to armature reaction with which every one is familiar. An intense field has been the salvation of railway commutators with fixed brushes, and it is not reasonable to believe that any wider departure than necessary has been made in this case. However, a moment's consideration will render plain that some step of this kind has been to a certain extent unavoidable.

A well-known 117-hp direct-current railway motor, recomputed to operate at 220 volts, the same voltage that is used on the single-phase motor, would have seventy-nine turns on its field magnets, each of which will surround 23,800,000 lines of force. It may readily be computed that if such a field were used in an equal alternating-current motor of power factor 90, the necessary voltage to force 440 amps. through the field coils at 16 2-3 cycles per second, would be over 200. As there are only 220 volts available per motor, it is highly probable that a field structure of a lesser number of flux-turns has been employed. It must not be forgotten, however, that this is mostly reactance drop, and if the armature is fairly non-inductive the net volts at its terminals will not suffer such serious diminution as if the field drop were due entirely to resistance. The current in the field coils is practically wattless, and the voltage at their terminals is therefore almost 90 degs. displaced. If the armature circuit operates practically non-inductively, and it must do so if the power factor is to be kept down, 200 volts could be available at its terminals, and leave 90 volts for the field coils, even though the total voltage were only 220. However, it will be seen that in spite of this alternate current peculiarity in favor of the machine a field of considerably reduced flux turns must be employed.

The speed of the new motor is 700 r. p. m., an increase of some 30 per cent over the speeds commonly used in direct-current work for motors of this capacity, and as the motor has eight poles it is evident that there are many conductors on the surface of the armature, which is, therefore, of large diameter and high bobbin velocity, which is in accordance with previous considerations. Moreover, the necessarily reduced field would demand more conductors in order to preserve the torque intact and keep the speed within rasonable limits. The designer has been fortunate in the fact that because of the flexibility of alternating currents he is able to reduce the voltage at the brushes, for that will materially assist in obtaining good commutation.

It remains to be said that the design of the entire machine has, without doubt, been a struggle between two fires. The field must be strong to preserve torque and keep down the armature reaction. It must be weaker than usual to reduce the commutating component due to the field variations, and to present a circuit of a reasonably small number of flux turns, which is necessary both for the purpose of reducing the voltage necessary to force the current through them and to keep up the power factor. The armature is preferably of small diameter and few turns, in order to keep down armature reaction, fly-wheel capacity and cost of construction. It must be large in diameter to provide increased bobbin velocity, and must have many turns to preserve its torque and keep down its speed. The commutator must have few bars, to keep down its cost, but on the other hand there must be few turns per bar, and consequently many bars in order to keep down the bobbin reactance. Lastly, the designer has new losses to take from the merit of his efficiency curve, first, the increased hysteresis in the armature, and an entirely new hysteresis in the field, together with increased eddy-current losses in both of these structures. Secondly, an increased C^2R loss in the entire structure, due to the fact that it uses alternating currents, and, therefore, has a power factor. Thirdly, the losses of the various transformers and balance coils which are a necessary adjunct to the equipment must be figured in; in short, the entire design is handicapped with contradictory conditions and increased sources of loss.

The production of a series alternating-current motor of this capacity that will give any sort of commercial service, is a subject for congratulation, but to produce one that will rival a direct-current proposition to the degree shown in the curves that have been presented, is indeed a triumph, on which the designer is to be most warmly congratulated.

In conclusion it is gratifying to observe that the enterprise is backed by a large company, who is willing to risk much financially and more in reputation in the endeavor to evolve practical results from this daring experiment. Its success is earnestly to be hoped for, and the commercial reward which will inevitably follow will be well deserved.

Plans for East Side Subway

It is announced that with the adoption of the real estate assessment roll of New York for 1903, the increased value of the city's real estate will enable the municipality to engage in actual work upon the extension of the present subway system, and that the needs of the East Side will then be considered. Last September the Rapid Transit Commission passed a resolution instructing Chief Engineer Parsons to prepare a general plan for a complete tunnel system, embracing all parts of the city, and work in this comprehensive plan has since been under way. It was understood then that the East Side line would be built, but the prospect of having it started during 1903 was not considered until a few weeks ago.

Now, however, Mayor Low, Comptroller Grout and President Alexander E. Orr, of the Rapid Transit Commission, have agreed that the city shall have an East Side subway soon.

The building of an East Side line, which has been speculated upon as something in the vague future, was not provided in the original subway scheme, because the necessary outlay of money was not possible with the constitutional provision as to the municipal debt in the way. As soon as the debt limit is increased, it is the intention of the commission immediately to adopt plans for this extension. Although the chief engineer has not submitted his report on the matter, it is considered probable that the route will be along Lexington Avenue. Trains bound for the upper East Side will travel on the regular tracks of the original underground railroad from the downtown terminal up to a point in Park Avenue not far south of Fortieth Street. Then they will be switched to other rails, and at Forty-Second Street, opposite the Grand Central Station, the curve eastward will be made underneath the tracks that run west toward Broadway.

Rules for New York State Street Railway Association

At the September meeting of the Street Railway Association of the State of New York, the report of the committee on rules was very carefully discussed, but no definite action was taken; instead, a resolution was adopted, it will be remembered, providing that the committee on rules be continued; that the report of the committee on rules be referred back to the committee; that each company be given thirty days in which to file any objections, suggestions or amendments to the rules with the committee; that within thirty days after the expiration of such terms the committee formulate and make its final report in printed form to the executive committee, and the executive committee be authorized to promulgate and make effective these rules.

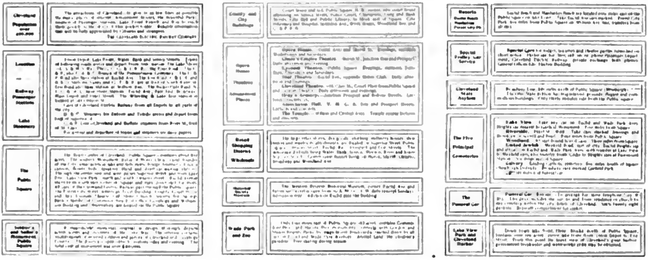
The committee, consisting of E. G. Connette, of the Syracuse Rapid Transit Company; Oren Root, Jr., of the Metropolitan Street Railway Company; J. C. Brackenridge, of the Brooklyn Heights Railroad Company; Edgar S. Fassett, of the United Traction Company, of Albany; J. P. E. Clark, of the Binghamton Railroad Company, and T. E. Mitten, of the International Railway Company of Buffalo, has agreed upon a form of rules, and has reported them to the executive committee in compliance with the resolution.

Some members of the association's executive committee have made suggestions with reference to the rules, more particularly in regard to the form than in the matter of substance, and Secretary Robinson has ordered them printed. It is expected that copies will be ready for distribution early in the year.

Traffic Circulars of the Cleveland Electric Railway Company

In a recent issue the traffic circulars of the Aurora, Elgin & Chicago Railway were published, and the statement was made at that time that it was the intention of this paper to publish similar circulars of other railway companies. It is thought that these leaflets will furnish suggestions which will be of assistance to other companies in publishing similar literature.

The Cleveland Electric Railway Company has given especial attention to the subject of developing traffic, and has a department similar to the general passenger department of a steam railroad company, but called an "Outing Department." This department is under the management of J. W. Butler, who has charge of all of the advertising of the company, the publication of traffic circulars, etc., in addition to other duties which pertain to that department. It is often thought that while interurban railways may find it profitable to publish circulars in regard to the points of interest reached by their lines, the same arguments would not apply to city companies. This is not the theory, however, held in Cleveland, and some of the most attractive circulars issued by the Outing Department relate to encouraging city traffic. One of these is a sheet 21 ins. x 6¼ ins., but so folded that it is brought down to a convenient pocket size. It is entitled "Nickel Trolley Rides in and About Ohio's Greatest City, Points of Interest, Public Parks and Boulevards, How to Reach Them." The leaflet is printed in green type with red borders. This fact makes a good photographic reproduction very difficult, but samples of a few of the pages are presented herewith.



SAMPLE PAGES FROM CLEVELAND TRAFFIC CIRCULAR

The circular, as shown from the sample pages, gives directions to strangers for reaching the principal points of interest in the city, including the hotels, express offices, etc., and is decorated on the back leaf by an engraving of the Garfield tomb, with which are given directions for reaching this monument.

These advertisements are distributed in a variety of ways, as, through hotel and depot time-table racks, and in other ways by which they will be brought to the attention of strangers and others who would be particularly interested in taking trips about the city. The experience of the company with them as promoters of traffic has been most gratifying.

Time Limit on Transfers

In the case of Garrison against the United Railways & Electric Company in the Court of Common Pleas, of Baltimore, Judge Harlan made a ruling upon transfers which is of interest to the public. The action was for wrongful ejection from a street car, and for assault and battery.

Plaintiff testified that he boarded a car of the defendant about 3:45 p. m., and the conductor gave him a transfer punched 3:50; that he rode several squares to the transfer point and waited ten or fifteen minutes for a car, and took the first car that came; but that when he presented the transfer it was after 4 o'clock The transfer read that it was "not good after the hour punched in the margin," and had, therefore, expired.

Judge Harlan ruled that the transfer was conclusive evidence between the passenger and the conductor as to the passenger's right to ride, and that inasmuch as the transfer was bad on its face the conductor had the right to demand that the passenger pay his fare or get off the car, and in the event of his refusal that he then had the right to use all reasonable and necessay force to expel him.

Counsel for defendant argued that the transfer was conclusive evidence as between the passenger and the conductor to whom the transfer was presented, and that if there had been any error by any agent of the company by which plaintiff had been injuriously affected, the latter's rights were in action for breach of contract; that it was the duty of the passenger, under the circumstances, in the interest of public policy to pay his fare, postpone his claim, and not compel the conductor to eject him. Any other ruling, it was argued, would either compel a conductor to accept the word of every passenger who had a transfer that was bad upon its face, and thus open the door to continuous frauds, or else he would be obliged to eject every passenger who had a bad transfer and refused either to pay or leave the car. In other words such a ruling would present only a choice between extensive frauds or breaches of the peace upon the car, which alternative, in the interest of public policy, should not be presented to the defendant.

In support of these contentions counsel for defendant cited many authorities and decisions, including the following: P. W. & B. R. R. vs. McLure, 34 Md., 532; P. W. & B. R. R. vs. Pennington, 62 Md., 95; W. M. R. R., vs. Stocksdale, 83 Md., 245; U. Ry. & E. Co. vs. Hardesty, 94 Md., 661; Wakefield vs. South Boston R. R. Co., 117 Mass., 544; Bradshaw vs. South Boston R. R. Co., 135 Mass., 407; Brown vs. R. Ry. Co., 90 N. W. Rep., 290; C. B. & Q. vs. Griffin, 68 Ill., 499; 37 Mich., 346; 54 Wis., 234; 56 N. Y., 295; 9 Am. Neg. Ry., 476; 38 La. Ann., 930; Riley vs. Chicago Ry. Co., 186, Ill.; Deen vs. Detroit Ry. Co., 123, Mich.

Counsel for plaintiff cited the act of 1900, ch. 313, compelling the defendant to give free transfers in the city which should "be good for a continuous ride," but it was contended and so ruled that this did not prevent the company from making reasonable regulations for its own protection, compelling passengers to produce proper evidence of their rights so to ride.

Plaintiff also testified that after the car had gone seven or eight squares from the place where the conductor demanded that he pay his fare or get off, the car was stopped, and the conductor called a policeman; thereupon, one of the plaintiff's friends with whom he was riding offered to pay his fare, which the conductor refused and attempted to eject him.

Another prayer granted by Judge Harlan was to the effect that if, after the demand by the conductor for payment of fare, a reasonable time had been given by him to comply therewith, and the car had been stopped for the purpose of ejecting the passenger, the conductor was not at that time obliged to accept a tender of fare by the passenger, but still had the right to eject him.

Plaintiff further testified that after he had offered to get off and while so doing, he claimed, the conductor pushed him from behind against the controller of the car, and thus injured his arm. This evidence was contradicted by witnesses, but the case went to the jury on the question of whether unnecessary or excessive force had been used upon the plaintiff.

The jury returned a verdict for the defendant, thus sustaining the company in its position throughout. It is believed that the case will be carried to the Court of Appeals.

New Open Cars for the Brooklyn Elevated

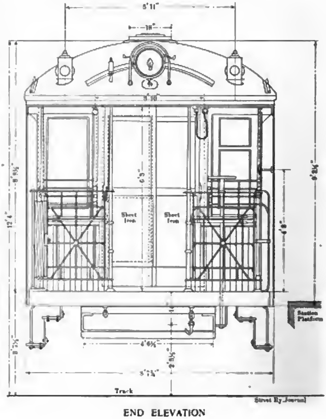
The Brooklyn Rapid Transit Company has operated on its elevated system during the last few years a number of open cars. These cars have been of a somewhat peculiar type, having open sides and cross seats, entrance being made at the ends, and rails being placed at the sides of the seats to prevent passengers from falling out. The cars which have been operated were all trailers, however, and the need of running complete trains of open cars has induced the company to order 120 cars of the type shown in the accompanying drawings. While these cars follow, in some measure, the lines of the older style, there is a great improvement both in appearance and strength in the new cars.

MODEL OF OPEN ELEVATED RAILWAY CAR, WITH AND WITHOUT CONVERTING PANEL

Before it was decided to adopt the plans, a model was constructed in the shops of the railway company, photographs of which are reproduced herewith. This model gave the officers, car-builders and the supply houses a chance to thoroughly investigate the requirements of the new type of car, and resulted in making several improvements in the original ideas. It is thought that possibly a panel will be placed in the window openings, converting the car into a closed one, but nothing has been definitely decided upon this subject. One of the illustrations shows a panel so placed between the center side posts of the model. This panel contains a fixed glass window, and can be readily screwed into place when it is desired to change the car from summer to winter service. The panel shown is, of course, only a suggestion, and if the idea is ever carried out the window opening will probably be somewhat larger than that shown in the cut.

The length of the car over platforms is 48 ft. 11 ins., the car body being 40 ft. 5 ins. This gives a platform of 4 ft. 3 ins. The width over side sills is 8 ft. 5¾ ins., and the car's width at the drip rails is 8 ft. 9¼ ins. From bottom of sills to top of roof the height is 9 ft. 2½ ins., and from top of rail to top of roof it is 12 ft. 4 ins. The trucks are to have a wheel base of 6 ft., the distance from center to center of trucks being 33 ft. 6 ins. and the diameter of wheels 33 ins. The roof, which extends over the platform in a

MODEL OF OPEN CAR—INTERIOR

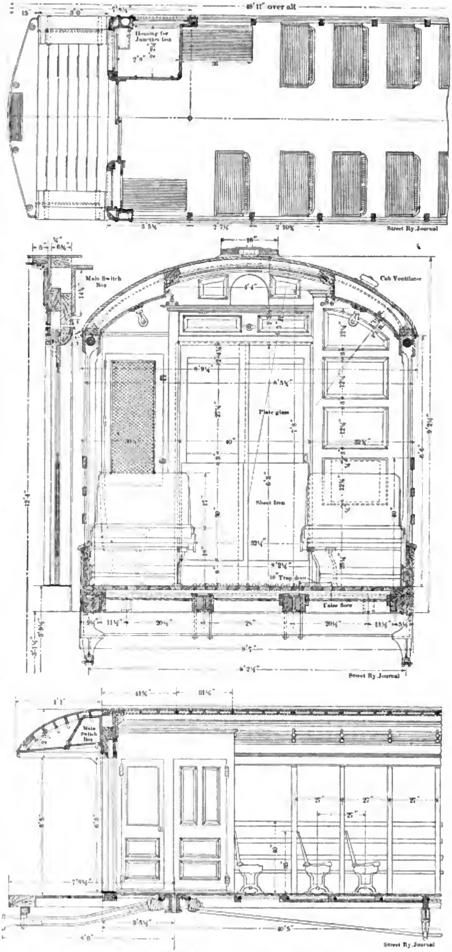


END ELEVATION

hood continuous with the main roof frame, is of the single-deck type without clere-story, but has an imitation clere-story inside, as seen in the cross-section view. Ventilators in the roof are provided for the motorman's cab, and if it is decided to adopt the panel for the winter service, additional ventilators may be necessary for supplying the interior of the car with fresh air. The cars are to be wired for four circuits of lights, the lights being placed along the sides of the roof. The sills, which are four in number, are made of 5-in. 12¼-lb. standard I-beams, the two outside sills having a wood filling flush with the inside edge of I-beam and an outside filler, making a width of 6½ ins. The platform is to be supported by two intermediate sills, running to the outer edge of the end stick, and two platform knees formed of two 4-in. 5¼-lb. channels with wood filler running from the end stick to the bolster. All the moldings, sash, doors, etc., are to be of ash, natural color, including the wooden strips which run along the open sides of the car. In order to obtain a wide door opening, without using a door sliding so as to obstruct the motorman's view, a double door, which opens to one side, was designed. The doors contain sash ⅝ of an inch thick in the upper part, which drop into the space between the sheet-iron panels in the lower part, and have spring latches to hold them in place. The doors are hung by brass sheaves from tracks of flat iron, with rollers both above and below the track. The details of the equipment are to be the same as that of the Brooklyn Rapid Transit Company's standard closed car equipment. Nearly all have been decided upon and include W. T. Van Dorn Company's couplings, Universal safety tread, Christensen air-brake equipment, and Westinghouse motor equipment. The contract for 120 of these cars was given last week to the John Stephenson Company, of Elizabeth, N. J., and work will be immediately commenced in order that the cars may be put in operation the coming summer.

Syracuse Rapid Transit Gets Control of the Oswego Traction Company

W. P. Gannon, president, and E. G. Connette, general manager of the Syracuse Rapid Transit Railway Company, announced on Wednesday that they had closed a deal with C. S. Shepard for the street railway system of Oswego, operated by the Oswego Traction Company. The deal is important because of its bearing on the fight between the Syracuse Rapid Transit Company and the Syracuse, Lakeside & Baldwinsville Railway for franchise right between Syracuse and Oswego, both companies desiring to build a road between the two cities. It is reported that the purchase includes all of the first-mortgage bonds of the Oswego Traction Company, and all but 10 per cent of the capital stock and second-mortgage bonds. The company's capital stock amounts to $300,000, the first-mortgage bonds to $100,000 authorized and $97,000 issued, and the second-mortgage bonds to $200,000 authorized and $191,000 issued. The company operates 11½ miles of railway, including all in Oswego, with lines running out to Beach Oswego and Minetta.



PLAN, CROSS-SECTION AND LONGITUDINAL SECTION

Steam Turbines with Special Reference to the De Laval Type of Turbine*

BY KONRAD ANDERSON

The present construction of the De Laval Turbine is founded on the action principle. The steam is blown from stationary nozzles against vanes or buckets fixed in the circumference of a wheel, and the stem thus impinging on the vanes drives the wheel round. There is only one row of buckets on the wheel, the steam in passing this row delivers most of its energy and is afterwards exhausted either to the atmosphere or to a condenser in the ordinary way. The principle of the machine is very similar to the action turbine for water as constructed by Girard. As is the case with all action turbines, the working of the machine depends on the kinetic energy of the medium which drives it, and the higher the kinetic energy the more power is obtained. It is therefore important that the driving medium, which in this case is steam, should have a high kinetic energy, or (which is the same) that every pound of steam used should enter the turbine wheel at as high a speed as can be obtained, and further, that as much as possible of this speed should be utilized by the buckets of the turbine wheel.

A high speed of the driving steam is obtained by expanding the

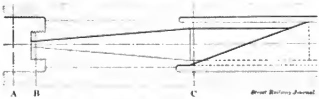


FIG. 1.—SECTION OF STEAM NOZZLE

admission steam in conical nozzles, specially adapted and constructed for this purpose. The steam is expanded adiabatically from its original pressure down to the pressure which prevails in the chamber where the turbine wheel revolves. If, for instance, the turbine works with 200 lbs. admission pressure and 28 ins. vacuum, corresponding to 0.93 lb. absolute pressure, the steam is expanded in the nozzles from 200 lbs. per square inch above the atmosphere down to 0.93 lb. per square inch absolute pressure. This expansion gives the steam, which leaves the nozzle in a jet, a very high velocity of outflow. Professor Zeuner has made extensive tests on the outflow of steam, and has shown theoretically and also proved by numerous experiments, that if the steam is expanded adiabatically in the nozzle, all the potential energy of the steam is transformed into kinetic energy, and that the kinetic energy of steam thus expanded is absolutely identical to the amount of work which the same steam would have done had it been expanded in the same proportion in the cylinder of an engine. Table I. gives the velocity of outflow of steam at different admission pressures, expanded in nozzles down to 1 atmosphere, 25 ins. vacuum and 28 ins. vacuum respectively.

TABLE I

The velocity of outflow and the working capacity of dry saturated steam

Initial Steam Pressure, lbs. per Square Inch	Counter-pressure 1 Atm.			Counter-pressure 2.4 lbs. per Square Inch Absolute Corresponding to 25 in. Vacuum			Counter-pressure 0.93 lbs. per Square Inch Absolute Corresponding to 28 in. Vacuum		
	Velocity of Outflow of Steam, Feet per Second	Kinetic Energy, ft.-lb. per Second	H. P. of 550 ft.-lb per Second	Velocity of Outflow of Steam, Feet per Second	Kinetic Energy, ft.-lb. per Second	H. P. of 550 ft.-lb. per Second	Velocity of Outflow of Steam, Feet per Second	Kinetic Energy, ft.-lb. per Second	H. P. of 550 ft.-lb per Second
		Per lb. of Steam per Hour			Per lb. of Steam per Hour			Per lb of Steam per Hour	
60	2,421	25.29	0.046	3,320	47.57	0.087	3,680	58.44	0.106
80	2,595	29.06	0.053	3,428	50.56	0.092	3,759	62.08	0.113
100	2,717	31.80	0.058	3,530	53.47	0.097	3,861	61.66	0.118
120	2,802	34.47	0.062	3,596	55.80	0.101	3,940	66.59	0.122
140	2,913	36.02	0.066	3,661	57.84	0.105	3,980	69.01	0.125
160	2,962	38.61	0.070	3,718	59.65	0.108	4,015	70.61	0.128
180	3,058	40.45	0.073	3,764	61.14	0.111	4,091	72.92	0.131
200	3,115	41.87	0.076	3,810	62.64	0.114	4,127	73.50	0.134
250	3,166	43.26	0.079	3,872	64.03	0.116	4,159	74.64	0.136
280	3,294	46.84	0.085	3,962	67.14	0.123	4,229	77.18	0.140

As will be seen from this table, the velocity of outflow of steam expanded adiabatically in suitable nozzles to the proper ratio is very high. Steam expanded in a nozzle from 280 lbs. pressure above the atmosphere down to 28 ins. vacuum leaves the nozzle with a velocity of 4229 ft. per second, or over 48 miles per minute. This steam jet would pass round the earth in eight hours and thirty-seven minutes.

The expansion of the steam in the nozzle is obtained by making the passage conical, the steam traveling from a smaller section in the nozzle to a larger one.

In order to illustrate the properties of a steam nozzle, we may take, for instance, one for 200 lbs. steam pressure and 28 ins. vacuum.

Supposing that the admission steam is dry, *i. e.*, that it does not contain any moisture, then at different sections, Fig. 1, the pressures, etc., will be as follows:

Section A—

Pressure 200 lbs. per square inch above the atmosphere.
Percentage of moisture, 0.
Specific quantity of steam, 1.

Section B—(the smallest section of the nozzle).

Pressure 110 lbs. per square inch above the atmosphere.
Specific quantity of steam, 0.96.
Velocity of the steam, 1500 ft. per second.
Specific volume of the steam, 3.5 cu. ft. per lb.

Section C—(the largest section of the nozzle).

Pressure (28 ins. of vacuum) 2 ins of mercury absolute pressure.
Percentage of moisture in the steam, 24 per cent.
Specific quantity of steam, 0.76.
Velocity of the steam, 4127 ft. per second.
Specific volume of the steam, 256.8 cu. ft. per lb.

The proportion between the areas of the large and small section of this nozzle should be as 27.2345 to 1, or the proportion between the diameters of these two sections as 5.2187 to 1. If, for instance, the diameter of the small section is 6 mm, or very nearly ¼ of an inch, the diameter of the large section should be 31.31 mm, or nearly 1¼ ins. Through such a nozzle there passes 479 lbs. of dry saturated steam of 200 lbs. pressure per hour, neither more nor less. This fact of the nozzle passing only a certain amount of steam per hour is often used to ascertain the steam consumption of the turbines.

As mentioned previously it is important that as much as possible of the kinetic energy of the steam jet issuing from the nozzle should be taken up by the turbine wheel, and thus transformed into mechanical energy. The angle between the nozzle and the plane of rotation of the wheel is 20 degs., and in order to obtain the maximum efficiency, the peripheral speed of the turbine wheel, *i. e.*, the linear velocity of the buckets, should be 47 per cent of the velocity of the steam. The absolute velocity of the steam leaving the buckets is then 74 per cent of the initial velocity, and the energy absorbed by the turbine wheel is 88 per cent of the kinetic energy of the steam.

If, for instance, the speed of the steam entering the buckets of the turbine wheel is 4000 ft. per second, the speed of the steam leaving the buckets should be 1360 ft. per second, and the number of horse-power per lb of steam—

$$\frac{4000^2 - 1360^2}{2g \times 550 \times 3600} = 0.11$$

and the steam consumption per theoretical horse power:

$$\frac{2g \times 550 \times 3600}{4000^2 - 1360^2} = 9.1 \text{ lbs.}$$

The steam nozzles are placed in very close proximity to the buckets of the turbine wheel, in fact the distance is only 2 mm, of about 1-16 of an inch, and consequently there is practically no loss of velocity between the steam jet leaving the nozzle and entering the buckets of the turbine wheel.

The speed of the turbine wheel, which for a velocity of the steam jet of 4000 ft. per second ought to be about 1880 ft. per second, or about 21 miles per minute, is however much lower for several practical reasons. At the present time the peripheral speed of the De Laval turbine wheel does not exceed 1380 ft. per scond, which should make a steam consumption of 9.8 lbs. per theoretical horse-power. The following table gives the speed of some types of turbine wheels:

TABLE II

Speeds of Turbine Wheels

Size of turbine	Middle diameter of wheel	Revolutions per minute	Peripheral speed feet per sec.
100 hp	500 mm, 19¾ ins.	13,000	1,115
5 hp	100 mm, 4 ins.	30,000	515
15 hp	150 mm, 6 ins.	24,000	617
30 hp	225 mm, 8⅞ ins.	20,000	774
50 hp	300 mm, 11¾ ins.	16,400	846
300 hp	760 mm, 30 ins.	10,600	1,378

* Abstract of paper read Oct. 31, 1902, before the Institution of Engineers and Shipbuilders in Scotland.

As may be seen from the foregoing table, the peripheral speed increases with the size of the wheel, and the larger the diameter the higher also is the peripheral speed. The 300-hp turbine wheel runs with a peripheral speed of 1378 ft. per second in the middle of the buckets; the outside diameter of this wheel is 800 mm, or 31½ ins., and the circumferential velocity of the wheel is 1450 ft. per second, or more than 16 miles per minute. At this speed the wheel would travel round the equator of the earth in twenty-five hours.

On account of the pheripheral speed of the turbine wheel not being so high as it theoretically ought to be, there is, particularly at high admission pressure and good vacuum, a slight impact when the steam enters the buckets. This is, however, allowed for practical reasons, and the energy due to the loss of speed by this impact is not entirely lost by the turbine, as will be seen later.

One advantage of the action principle of the turbine is that the turbine wheel can revolve quite freely in the casing. This is an essential feature of the machine, and moreover it would not be possible to run at the speed required should a tightening be necessary round the turbine wheel. The wheel does not touch anywhere, and all the steam on emerging from the nozzles must pass the buckets of the wheel, as the radial length of the buckets is always larger than the diameter of the steam jet. There is consequently no possibility of any steam leaking through the turbine, but it must of necessity pass the buckets and deliver its energy to the turbine wheel.

The high peripheral speed which, as previously seen, is necessary in order to obtain a good efficiency, has been obtained by allowing the turbine wheel to run at a very high velocity. A reference to Table II. will also show that the number of revolutions is much higher than the speeds formerly used in practical engineering.

The turbine wheel must be strong enough to stand the speed at which it is required to work, and the design and construction of this wheel are, therefore, of considerable importance. The stresses in the material of the wheel must, throughout the whole section of the wheel, be kept within the limits permitted for the material.

The wheel is made as a solid disc, on the circumference of which the buckets are dovetailed in, each bucket being made and fixed separately to the wheel. The buckets consequently load the circumference of the wheel with a radial force when the wheel is revolving. The amount of this force may be understood when it is mentioned that the centrifugal force on the bucket of a 300-hp turbine wheel, which bucket weighs 250 grains, is 15 cwts. when the wheel is running at its standard speed.

The stresses in the wheel are tangential and radial, and if we call the radial stress P and the tangential stresses S, it is evident that both P and S vary with the radius R. Further, these stresses depend on the axial thickness of the wheel in each place, and they also affect one another.

Fig. 2 shows the stresses in a wheel for a 50-hp steam turbine.

FIG. 2.—STRESSES IN MATERIAL OF TURBINE WHEEL

As may be seen by this diagram the wheel is so constructed that both P and S have their largest value at the circumference of the wheel, just where the buckets are fixed. Consequently the wheel is not made of uniform strength, but is strongest at the heaviest part, that is, in the center.

It will be seen from Fig. 2 that the tangential stresses S in the boss of the wheel increase as they approach the hole in the center of the wheel. These stresses would be still greater on the larger sizes of wheels, and in order to avoid these greater stresses the larger wheels are made without any hole through the center, but the shaft is made in two pieces fixed to the wheel by flanges and screws.

The part of the turbine which makes it possible to run the turbine wheel at its enormous speed, is the "flexible shaft." The shaft on which the turbine wheel is mounted has bearings on each side of the wheel at a good distance from it, and the shaft is consequently flexible and can allow the wheel to swing a little in its plane of rotation. No matter with what nicety the turbine wheel may be turned and balanced, it is practically impossible to bring the center of gravity of the wheel exactly into the geometrical center round which the wheel revolves. The fault causes vibrations, which, if a firm shaft were used, would increase with the speed to such an extent that the bearings would instantly be ruined. With the employment of a flexible shaft there are also vibrations, increasing with the number of revolutions of the wheel. At a certain speed, however, the phenomenon arises that the vibrations suddenly disappear, and the shaft runs smoothly in its bearings.

The speed of the wheel at which this phenomenon arises is called "the critical speed of the wheel," and the phenomenon itself is termed "the settling of the wheel." The explanation is that the wheel at the critical speed takes a new center of rotation, very near the center of gravity, the shaft springing out and allowing this to happen. The reason for this phenomenon cannot be scientifically explained, but assuming, as is very probable, that the settling of the wheel occurs when the number of revolutions is equal to the number of vibrations which the shaft makes with the wheel mounted upon it, the critical speed can be calculated, and it is found to be:

$$n = C\sqrt{\frac{P}{Q}}$$

Where P = the force required to bend the shaft a certain distance
Q = the weight of the turbine wheel,
C = constant.

This formula seems to correspond very closely with the results obtained at actual tests.

The flexible shaft and the turbine wheel are so proportioned that the settling of the wheel takes place very quickly, and the critical speed is from one-fifth to one-eighth of the standard number of revolutions of the wheel. Of course the turbine wheels are very finely balanced and the settling of the wheel is, therefore, scarcely perceptible. It is the flexible shaft that serves to transmit the power of the turbine.

The diameter of the shaft is, on account of the high speed, very small, and it is therefore easy to make it flexible. The shaft of the 300-hp turbine wheel has a diameter of 34 mm, or 1 5-16 ins., and that of the 150-hp wheel 25 mm, or 1 in.; no larger diameter is required.

The normal speed of the turbine wheel is too high for direct driving of ordinary machinery, and it is, therefore, reduced by means of gearing. This gearing is made on the double helical system, and machined with the greatest care and accuracy, as is necessary on account of the high speed. The speed of the gearing, that is the linear velocity of the teeth, is about 1000 ft. per second. The pinion is made of hard steel (in one piece with the shaft) and the teeth of the gearing wheels are cut in a somewhat softer steel than the pinion.

All the revolving parts of the turbine are most carefully balanced, and the parts mounted on the shafts are centered by tapers. The bearings of the slow speed shafts are lubricated by rings, as is usual in this class of machinery. The journals of the flexible shaft are oiled by sight feed lubricators. The bearings, which are all made as interchangeable bushes, are lined with white metal and there is practically no wear on them if the machine is well lined up and properly mounted from the beginning.

The turbines are generally fitted with more than one steam nozzle and these are arranged at intervals in a ring in close proximity to the turbine wheel, receiving the steam from a steam chest in the turbine case. Each nozzle is usually provided with a shutting-off valve so that any nozzle can be closed or opened at any time. This arrangement is of considerable advantage, as when the turbine is working at reduced load, some of the nozzles may be closed and a high efficiency of the machine maintained, even although it is not working at full load. This will be more plainly understood from the tests of steam consumption which will be noticed subsequently.

Before the admission steam can enter the steam chest and pass from thence to the nozzles, it is regulated by the governor valve, which, in its turn, is controlled by the centrifugal governor of the machine. The governor valve is a balanced double-seated valve, connected with a link motion to the centrifugal governor.

The speed of the turbine is regulated by a very sensitive centrifugal governor, mounted horizontally on the end of the gear wheel shaft. The moving parts of the governor work practically without friction, and it is, therefore, very quick and powerful. This governor is very simple, although the construction may seem peculiar, and its dimensions are very small on account of the comparatively high speed at which it works. The variation of

speed between full load and no load is nearly one per cent, the variation is from 2 or 3 per cent generally.

The standard sizes of steam turbines can work with any steam pressure between 50 and 200 lbs. per square inch, and either with or without vacuum. The only parts of the machine which have to be arranged to suit the admission pressure and the pressnre in the exhaust are the steam nozzles, which have to be shaped according to the amount of expansion of the steam. The nozzles are made interchangeable—all other parts do not alter with the pressure—and the machine can consequently work with any pressure between the above limits if only the turbine case is provided with suitable nozzles. The turbine can also be arranged with nozzles for running both condensing and non-condensing. This is often very handy and convenient, particularly if the turbine drives its own condensing machinery, direct or electrically.

TABLE III

Results of tests with De Laval Steam Turbine Pumps

Type of Turbine Pump	Revolutions per minute	Height of Suction in Feet	Height of Delivery in Feet	Quantity of Water Delivered per Sec. Gallons	Water H. P.	Brake H. P.	Efficiency
50 hp duplex pump coupled in parallel	1,500	16.4	16.4	63.5	37.87	50.3	0.753
50 hp duplex pump coupled in parallel. Constructed for larger head of water than the previous.	1,500	16.4	39.53	46.8	38.66	48.0	0.805
50 hp duplex pump coupled in series	2,300	19.7	137.8	12.3	35.22	50.3	0.700
20 hp duplex pump coupled in series	2,315	9.84	85.3	62.5	14.27	20.0	0.713

The general opinion among engineers has been that steam turbines must necessarily use a considerable amount of steam, as the mass of the steam jet was considered too small to give a good impulse. In order to repudiate this opinion, attention is drawn to Table I. It is proved that the expansion of steam in nozzles gives the same amount of energy, ihp, per lb. of steam, as expansion in the cylinder of an engine, the problem being to transmit as much energy as possible to the principal moving part of the turbine. There is, as previously mentioned, no leakage of steam and no appreciable loss by friction in the buckets of the turbine wheel, the only loss, and one which it is impossible to avoid, is the kinetic energy of the steam leaving the wheel. This loss may, perhaps, correspond to the imperfect expansion in the cylinder of an engine, but there is in the turbine no loss of steam from cylinder condensation, as the expansion takes place continuously and the cooling surfaces are small.

With respect to the resistances in the machine, these may be divided between pure friction losses in the bearings and gearing, and the resistance of the turbine wheel. The friction losses are very small indeed, and the resistance of the turbine wheel depends on the pressure of the medium in which the wheel revolves, and also on the medium itself. If this medium is very thin, the resistance is considerably decreased, and it is, therefore, of importance that the turbines should work condensing and with a good vacuum. At 28 ins. vacuum the total resistances in the machine are about 7½ per cent for the larger sizes of turbines.

It is evident that superheating is advantageous to the turbine, as it gives the steam jet a higher velocity and thus increases the kinetic energy of the steam, and it also diminishes the resistance of the turbine wheel.

The use of superheated steam in connection with turbines has become more general in recent years Practically, any degree of superheating can be used, as the highly heated steam does not come into contact with the moving parts of the machinery; by the time the steam reaches the chamber in which the turbine wheel revolves, it has already the pressure and temperature of the exhaust steam. In order to give some idea as to the steam consumption of the turbine when driven with highly superheated steam, I give in Table IV. some results obtained with the 30-hp steam turbine at the Polytechnical College, Dresden.

From the results of these trials, it is obvious that not only the steam consumption but also the heat consumption (in heat units per horse-power per hour), sinks with increased superheating. With constant peripheral speed of the turbine wheel and increasing superheating, the impact is increased on account of the higher velocity of the steam, but this loss is instantly transformed into heat, which raises the temperature of the exhaust steam, and thus diminishes the resistance of the turbine wheel.

The figures of the trial in Table IV. are taken from the report in the German Engineering Society's paper of Nov. 30, 1901. The turbine was run non-condensing only. Had the machine been worked condensing with, say 28 ins. vacuum, the figures obtained would have been about 50 per cent less.

TABLE IV

Tests with a 30-hp steam turbine working with saturated and superheated steam respectively.

NON-CONDENSING

Steam pressure: 7 atmospheres absolute = 88.2 lbs.
Speed of driving shaft: 2000 r. p. m.
Speed of turbine wheel: 20,000 r. p. m.

		Half Load		Full Load	
		Saturated Steam	Superheated Steam	Saturated Steam	Superheated Steam
Temperature of the steam	Centigrade	164	460	164	500
	Fahrenheit	327	860	327	932
Power developed	Metrical b. h. p	21.4	24.5	44.1	51.9
	English b. h. p	21.1	24.2	43.5	51.2
Steam consumption per b. h. p per hour	Kilogrammes per metrical b. h. p	21.6	14.1	17.7	11.5
	Lbs. in English b. h. p	48.3	31.5	39.6	25.7
Heat consumption per metrical b. h. p. per hour in metrical heat units		14,160	11,270	11,610	9,300
Temperature of exhaust steam	Centigrade	100	309	100	343
	Fahrenheit	212	588	212	649

Blackwell's Island Bridge Plans

Plans for the Blackwell's Island bridge will be proposed by Bridge Commissioner Lindenthal along the lines indicated in the report of the commission of experts composed of Professors Burr and Ricketts and Henry W. Hodge, and it is expected that all the details will be finally determined by July 1, 1903, which is the earliest date upon which bonds for this improvement can be issued. The commission proposes that a bridge 91 ft. wide be designed to take the place of the original plan and of the plans suggested by Commissioner Lindenthal. This is 29 ft. narrower than the original plan, and 11 ft. wider than the bridge commissioner's plan. The general arrangements of the new bridge will resemble in the main those of the commissioner, but they will be like those of the original plan, in giving to all the trolley tracks lanes of their own, instead of laying one pair of tracks on the main roadway. The feature of a wide free roadway, undivided by columns, suggested by the bridge commissioner, is, however, retained. The bridge is to be widened from 80 ft. to 91 ft. in order to permit the good features of both plans to be secured as to the arrangement of trolley tracks and roadway.

The entire subject of design and construction of the Blackwell's Island bridge, together with all the suggestions that had been received by the city administration, had been referred to the commission by Mayor Low for examination, and the report submitted last week is the result of this investigation. In answer to the query of how the capacity of the bridge proposed by Mr. Lindenthal compares with the capacity of the bridge as originally planned, whether it is larger or smaller, or substantially the same, the commission reports that the total aggregate capacity of the original plan is greater than that of the proposed one. It is explained that the two remaining trolley tracks in the original design are entirely separated from the roadway traffic, hence the capacity of the trolley service in the original design is greater, as no lines can be delayed or detained by the wagon traffic.

In comparing the efficiency of the designs the commission considered the following characteristics: Superiority in handling traffic; the facility with which passengers may take other means of transportation in cases of accident; the possibility of accident due to any arrangement of the passageways for different kinds of traffic; the attractiveness of the various lines of traffic for the purposes for which they are intended; the general arrangement of the members of the bridge trusses and floor system to insure the greatest rigidity and durability.

In concluding, the commission recommends that "two sidewalks, each not less than 11 ft. in clear width, be placed on the upper deck inside of the trusses and adjacent to them; that the two lines of elevated railway be placed on the upper deck, one on each side of the center line and as close as possible to the sidewalk; that the lower deck be arranged with two trolley lines in overhanging brackets, one outside of each truss, and with two additional trolley lines inside of the trusses, one line being adjacent to each truss, and that a roadway be placed in the middle of the lower deck, with complete separation between it and the trolley lines on either side."

It is further the judgment of the commission that the capacity afforded by this plan is not beyond reasonable provision for the future requirements of the locality served by the bridge.

Efficient Discipline

In the Street Railway Journal for Nov. 29, three papers on the subject of discipline for railroad employees, read at the Nov. 21 meeting of the New York Railroad Club by Messrs. Wheatly, Slingerland and Ketcham, were published. A fourth paper on the same subject read at the same meeting of the club by T. E. Mitten, general manager of the International Traction Company, of Buffalo, was published in the issue of Dec. 6. Remarks were also made on the subject by Prof. Hibbard, of Cornell University; C. W. Bradley, of the New York Central Car Service Association, and George W. West, superintendent of motive power of the New York, Ontario & Western Railroad Company. Abstracts of these remarks follows:

REMARKS BY PROF. HIBBARD

These remarks have special reference to the details in the training of subordinate officers in shops.

Always have someone in mind who would fill each man's place if necessary. Gang leaders, and especially foremen, should be selected with the utmost care. Outsiders (new blood and methods) are occasionally preferable to promotions; but as a rule they should not be brought in unless absolutely necessary. Watch out for and promote good men. Keep your eye on the man who does far more and better than he is paid for or is expected to do. The natural leader may show his qualities in his development, in his desire to do his work in newer, better ways, keeping ahead of the others and showing them the way. A good foreman must not only be able to systematize work, laying it out and so keeping his men busy, but also be able to "manage" men. Find from subordinate officers whom they consider their best men, and watch them. But favoritism, jealousy, or personal dislike may bias subordinate officers. If it be decided, finally, to promote a man contrary to his foreman's judgment, put him in a different department until he has proved his worth. Always stand by those selections which have been justified by observation and experience. Uphold authority of all your subordinate officers when in the right. Train them not to make important decisions which will become precedents, without first consulting you. Never, under any circumstances, reprove them in presence of their men; there may be some criticism or request for explanation regarding work on the spot, though not to be heard by the men; but reserve all severe criticism for the private office. Never disparage one foreman when talking to another.

Have outlined a proper channel for complaints; complaints against a gang leader to be made to a foreman as a rule, not to the master mechanic—but let it be thoroughly understood that there is always the right of appeal to a higher officer. Be willing to revise a subordinate officer's overzealous, hasty or wrong decision, but with great tact and caution. A good plan, at least in small disputes where a workman feels himself unjustly treated, is to get the foreman and man together and then with careful study of the question you can show one or both where they have been too hasty; there should result voluntary acknowledgment of the mistake. If men's complaints are upheld by the master mechanic, foremen should understand that they should have removed the causes before the men reached the complaint stage. A subordinate officer will be more likely to refrain from unjust acts if he knows that the man will get a fair hearing on appeal to the master mechanic. Subordinate officers should be given to understand distinctly that no man shall be persecuted for having appealed.

Keep in close touch with all subordinate officers. They should all understand your desires thoroughly and be absolutely loyal in carrying out the spirit of your laws. Assemble regularly the foremen of all departments, with the storekeeper and general foreman, into the office of the master mechanic, with a stenographer. Occasionally take probable future foremen into the meetings, which not only gives them some training, but results in the leading workmen having more insight into the problems of official management. After the general and detailed statements of conditions of work, stock, delays, etc., have been discussed, take up the subject of complaints, dissatisfaction and discipline of the men. In order to save time, it is well to have your secretary notify each one as to the disciplinary topics to be considered, so that all may come prepared. Avoid any personal naming of a weak disciplinarian in meeting. Talk to such an officer alone.

Hold subordinate officers responsible for what their men do. Hold foremen responsible for what their own subordinate officers do. Under most circumstances, if an officer is held responsible for "results" of his subordinates he should be given subordinates satisfactory to himself. Under officers should be encouraged to ask advice from superior officers without such asking giving the impression that they lack decision or have a desire to shirk responsibility for their later action. It will need some tact for the superior officer to prevent his advice from being considered mandatory.

Foremen never should be late; the master mechanic should be on hand early, occasionally, at the spot where a foreman should be. Officers should transact shop business with the proper subordinate officers, not with the men under them. All officers must sustain cordial shop relations with each other. It is the duty of a superior to correct the first sign of discord among inferior officers. Unfailing courtesy at all times by officers towards men is demanded; this does not prevent severe language when possibly needed. A foreman should analyze the discipline failures and successes of himself and other officers. Avoid that undue "familiarity" with the men outside which " breeds contempt" and lessens their respect, though having sufficiently rugged personality to permit judicious mingling with them without harm, getting their good will and keeping on good terms with them and being yourself approachable. It is easy to invite or repel familiarity by one's manner. In the shop avoid any familiarity with any "pets."

Get out of an officer's head the idea that he is any better than his men. Possibly only the accident of opportunity has placed him above them in control; a number of them might do better than he if in his position. All officers should be neat and clean in person. Often it is necessary for them to get dirty, but they should not stay dirty. A small monthly prize, and, of course, verbal commendation, will stimulate foremen to try to have the cleanest department without increased labor cost.

New foremen should not be too quick to institute needed changes by wholesale and prompt overturning of customs. First let him get quietly and thoroughly acquainted with all sides of the situation and the men. If the methods of work need to be speeded up all around, let him do it gradually, possibly with only one workman at a time, thus avoiding united opposition. Keep close watch of the shop, inspect daily and oftener. Know in a general way about how much work each man, gang and department ought to do, with close enough knowledge to be able to keep the foremen up to limits; the details must, of course, lie with them.

An officer should have the ability to unload work and responsibility upon his subordinates instead of trying himself to do things in detail and routine work, training his subordinates to be increasingly efficient, and thus to set free more of his time for attention to further and new matters pressing for solution. Proper arrangement of work to each subordinate will enable that subordinate to get his work thoroughly in hand and to present such reports to his superior as to enable the latter to understand difficulties at once and solve them without waste of time. An officer is judged by the assistants he gathers around him. Later on, these "understudies" will be ready to take up his work if he is laid aside.

Have a manly, unpatronizing, unpaternal, yet sympathetic application of the Golden Rule, "Do unto others as you would have them do unto you."

REMARKS OF MR. BRADLEY

I must take exception to Mr. Ketcham's idea that a man once discharged should never be re-employed. I am not a believer in the theory that "the King can do no wrong," nor in the divine right of the railroad official to brand a man for life for an error he may have committed, or a mistake he may have or may not have made. All of the papers referred to tell us what discipline is, what to do and what should be done. They do not, however, tell us how to do it. They have stuck to the text literally—"Efficient Discipline."

I will try, with your permission, to enlarge the scope of the inquiry and deal with the broad question of railroad discipline—for how to do it. First, however, let us consider the discipline in the regular army.

The regulations for the army of the United States, Article 1, is headed "Military Discipline," and reads:

1. "All persons in the military service are required to obey strictly and to execute promptly all lawful orders of their superiors."

2. "Military authority will be exercised with firmness, kindness and justice. Punishments must conform to law and follow offenses as promptly as circumstances will permit."

3. "Superiors are forbidden to injure those under their authority by tyrannical or capricious conduct or abusive language."

4. "Courtesy among military men is indispensable to discipline. Respect to superiors will not be confined to obedience on duty, but will extend on all occasions."

[Note: Courtesy is extended so far that an officer, no matter how high his rank, returns the salute of the private.]

Article XXV. of the regulations for the army of the United States is headed, "Medals of Honor and Certificates of Merit," and reads:

177. "Medal of Honor will be awarded to officers and enlisted men who distinguish themselves in action."

178. "When an enlisted man of the army shall distinguish himself in the

service, the President may grant him a certificate of merit on the recommendation of the commanding officer of the regiment, or chief of corps to which the man belongs."

180. "Extra pay from the date of the distinguished service is allowed each enlisted man to whom a certificate of merit is granted."

How is it in the railroad service? Is there that comradeship and courtesy between the railroad officials and their subordinates, as a rule, that there is in the army? Courtesy begets courtesy. Discipline grows with what it is fed on. Fair dealing begets good, loyal service, and the test of efficiency is results.

General Sherman in his memoirs says: "No man can properly command an army from the rear. He must be at its front, and when a detachment is made, the commander thereof should be informed of the object to be accomplished and left as free as possible to execute it in his own way; when an army is divided up into several parts, the superior should always attend that one which he regards as most important. Some men think that modern armies may be so regulated that a general can sit in an office and play on his several columns as on the keys of a piano. This is a fearful mistake. The directing mind must be at the very head of the army, must be seen there, and the effect of his mind and personal energy must be felt by every officer and man present with it to secure the best results."

The railroad officer who sits in his office and plays on his men as on the "Harp of a Thousand Strings," with long, windy, typewritten, nagging letters and telegrams to his subordinates, does not encourage good service or produce the best results. He may have efficient discipline, but he will not secure the loyal, earnest support of his men. At the present time, when every yard east of the Rocky Mountains is congested, how many of you—you operating officers—have spent a whole day or two whole nights on the ground to know, actually know, for yourselves just the condition, and by your presence in the field assisted in raising the blockades? Don't some of you play golf days and work the telephone nights? Would not a little of the discipline you are giving your men, applied to yourselves, help the situation?

To my mind an officer who is always on deck, who is fair and square in dealing with his subordinates, one who strikes from the shoulder, never "below the belt," one who makes good every promise to his men, whose word is as good as his bond, gets the best results. He never has any trouble in getting his orders, rules, instructions and wishes carried out; but the officer, no matter what his position, who is not a manly man and who does not treat his men like men, will not get good service, discipline as much as he may, by fine, suspension or discharge. They will hate him. They can't help it, and will "best him" when they can. The average railroad man knows about as much about the service as the average railroad officer does.

I must again quote old Sherman. He says: "I have many a time crept forward to the skirmish line to avail myself of the cover of the pickets' 'Little Fort' to observe more closely some expected result, and always talked familiarly with the men and was astonished to see how well they comprehended the general object and how accurately they were informed of the state of facts existing miles away from their particular corps. Soldiers are very quick to catch the general drift and purpose of a campaign, and are always sensible when they are well commanded or well cared for."

Is not this condition General Sherman speaks of in the army absolutely true in the railroad service? Do we in the railroad service get that recognition for a meritorious act, or acts, as is the case in the army? If we do, it is so infrequent that we seldom hear of it. On the contrary, let anything go wrong, any failure to live up to or to carry out some of the many rules that cannot, never have been nor ever will be carried out, made to shield the inefficiency and incapacity of the officer, and it is instantly heralded from one end of the road to the other. The man is discharged, discipline enforced. The officer's conscience is clear. He has done what the rules prescribe. He has done his duty as he sees it.

Take an instance like this: A freight conductor gets a telegram which reads something like this:

"To JOHN DOE:

Report at my office at ten o'clock sharp to-morrow morning.

(Signed) SUPT."

This message is received, say at 6.00 p. m. "J. D." takes a night train, sits up all night, rides 100 or 150 miles and calls on Mr. Superintendent at ten o'clock sharp. This is what occurs:

SUPERINTENDENT: "You were conductor of the way-freight yesterday?"

JOHN DOE: "Yes."

SUPERINTENDENT: "You know I issued an order that the doors of freight cars should be closed and kept closed?"

JOHN DOE: "Yes, sir."

SUPERINTENDENT: "Well, sir, I noticed a box car in your train yesterday with a door open at ——— station. Don't let this occur again. Go back and take your train, sir, but this must never occur again. Never! Do you understand? Not another word, sir."

John bows himself out, indulges in more or less silent profanity, goes back home, takes his run, having lost his pay for one round trip and is hot under the collar for the next two weeks. Mr. Superintendent says to himself: "Mr. Doe now knows that orders are orders. 'Efficient Discipline.'"

Take another similar case: A different type of a superintendent, who notices an infraction of the rules or orders and makes a note of it, and the first time he sees John he calls him to one side, perhaps it is in the yard or out on the road, and says, "John, you are as much interested, or should be as much interested, in the success of this road as I am. We are both servants of the company and in our respective positions are responsible for our acts. This rule is for the best interests of the service, and I want you to help me enforce it."

What is the result? John is pleased, his manhood has not been attacked. He feels he is a man, a man among men. He tells all "the boys," his comrades in the service, what has been said and done, what rule he violated, and says to his comrades: "The old man is just right. I did not lose any time as Bill Jones did on the Pee Wee road, and you bet your bottom dollar I am going to do my very level best to enforce the rules of the old man in future, and I am going to see that you do it, too." This picture is not overdrawn. Now, which is the better plan? The first or the second?

You all perhaps recollect the incident that occurred at Montauk Point one Sunday on the return of our brave boys from Cuba at the close of the late war with Spain, when President Roosevelt was asked how he felt leading his men in the charge on San Juan Hill. The Colonel, after apologizing for what he was about to say, made this reply: "I did not lead; I had to run like hell to prevent being run over by my men." If "Teddy" had been made up on the lines of the first superintendent, just referred to, or had he remained in camp and "played on his men as on the keys of a piano," would his men have done this? Not much! You would have had to drive them in this charge, and don't you forget it.

The point I make is this: To produce the best results, begin your efficient discipline, like charity, at home. Discipline yourselves and give your men the same loyal, earnest support you expect from them. Go to the front yourselves. West Point does not make the successful commander unless the man has the stuff in him to command, and this faculty of command over men comes from a higher power than the cadet gets during his four years' tuition on the banks of the Hudson.

There is another phase of this question of "Efficient Discipline" in the railroad service, and that is, the uncertainty of the tenure of office. How many of you who are present here this evening know, know absolutely, that you will not find a blue envelope on your desk in the morning, the contents of which may read somewhat like this: "Dear Sir—Regretting the necessity, but duty compels me, for the good of the service, to ask for your resignation to take effect ———, Respectfully, etc." How many of you have been there? And how often have you seen a change in the executive at the head of a road or a system followed almost immediately by a change of every subordinate official in every department? No reasons stated, nor any explanations given.

Do the men who are thus "bounced" get off the earth? Do they sink out of sight? Are they lost to the railroad world? Not much! In many cases they are re-employed elsewhere with increased responsibility. Some of the older men, however, I regret to say, are turned out like an old army mule—to eke out his last days as best he can. I am glad to say, however, that there is not as much of this wholesale slaughtering to-day as has been the practice in the past. Cannot the tenure of office in the railroad service be made more permanent? The same kind of executive tact, skill, energy and ability is required in the railroad service as we demand in the army. How long would your army last, and what kind of efficiency would be shown in the army, or in the navy, if it were possible with a change in the administration at Washington to be able to discharge every officer above the rank of a corporal? The railroad man devotes his best years to the service.

REMARKS OF MR. WEST

I agree with Mr. Bradley in the stand he has taken in regard to discharged employees and think this ruling is one of the worst enemies to good discipline that can be adopted. My reasons are as follows:

In the first place, the only object of punishment for any offense should be to better the man and the service. I do not think anyone would care to say they had any other object. My experience

in handling men for twenty-five years has convinced me that there are three classes of men in railroad service that produce bad results, or need what is commonly called disciplining.

First, a class that get into all departments the same as they get into churches, lodges and clubs that never belonged there and should never have been taken in. This is the hardest class to handle. The best way to do it is by giving the man in charge of the men he works with, authority to dismiss men, subject to what I may say hereafter.

Second, the class of men that is best expressed in the slang phrase, "playing in hard luck." I am fully aware we have a lot of men holding positions in railroad work that will not admit there is anything in luck, but let these same men hold a position at a card table where they are winners and ask them to change seats and see if they will do it; or in any game of chance, if they find a number with which they are successful, how they will hang to it as "lucky!" I have known a lot of well-meaning men in my life that for a time were unfortunate; an unfortunate man must be treated the same as an incompetent one, for the results are the same to any company, but the chances are that if these same men went on another road and gave satisfactory service, they could come back to their home road and make good men. I have known several men treated in that way that could not be beaten.

I have spoken of two classes of men as I find them in railroading, and have mentioned three. The other class are they that know how, but will not, and I am sorry to say this class is growing in numbers.

On some men one blow has as much effect as one hundred, and a trip or two, or a week's suspension, would be better than a month; for if the man was worth holding, a short suspension would humiliate him, while a long one would make him ugly, and this is my prime reason for saying a discharge that carries with it "never to be taken back" is wrong.

Men do things in all branches of business that demand more severe measure than a suspension of one week or even two, on a hook full of demerit marks, and something more severe than demerit marks, or light suspensions, will have to be dealt out to such a man. When a man from any cause had his records filled with demerit marks or suspensions, I would call him to the office, tell him his record had been bad, and the best interest of us all demanded his discharge; but I would never lock the door securely against an erring child or a man whether I wanted him back or not. I would have him feel the latch string held out for him and that he was sent away to better fit him for his work. Let him have this to encourage him to be a good man for someone else if he could not for us, but if he merited it he could have the same chance some day same as a new man to return to his home road. There are some roads and some officers that discharge men that I do not believe ever have any discharged employees asking for re-employment. They find better and more congenial people to work with.

We ought to encourage men to build homes and take an interest in building up the towns and layover places along the road. Make it an object for them to remain with the company. Do this and there will be little use for the rod. Nothing, in my opinion, helps more to keep in line the men that remain with the company than to receive letters from discharged employees that have found a position elsewhere, saying it is not as good as the one they left, and that they would gladly come back to their old road and among the old employees if they were permitted to do so. This one influence alone is, in my opinion, sufficient to leave the gate unlocked that was closed to them when dismissed from the service.

Insurance and High Voltage Circuits

The National Board of Fire Underwriters last week discussed the subject of increasing the rate of insurance on property along streets through which high-tension transmission lines were carried, and where overhead trolley feeders were run in close proximity to the buildings. It was suggested that all insurance on this class of property be cancelled, but this measure was not received with approval by the conservative element. One member pointed out that a denial of insurance to such risks would be almost revolutionary in the insurance business, and that property usually of the highest value on principal streets, where there are overhead trolleys, would be without insurance. The property values so affected amounted to hundreds of millions of dollars. In Greater New York all the boroughs with the exception of Manhattan would be affected, and Brooklyn most heavily, because of the overhead trolley wires. Another advocate of stricter measures suggested that the rule might be applied to narrow streets only; that when the roadway was broad and there were lawns in front of the buildings, such severe measures would not be required, as there would not be the danger to life and property that existed in narrow and crowded streets.

The matter was referred for consideration to the electrical committee of the Underwriters' National Electrical Association. The report will be printed and sent to the members of the association and its affiliated bodies for consideration, pending action to be taken at a future meeting.

A committee composed of A. E. Kennelly, L. A. Ferguson, O. G. Gossler, F. A. C. Perrine, C. P. Steinmetz, Arthur Williams and C. J. H. Woodbury, has represented the American Institute of Electrical Engineers in several conferences with the insurance interests, and it is now engaged with the Underwriters' National Electrical Association in formulating rules respecting extra high-voltage lines. At a meeting of the board of directors of the Institute Dec. 8 a joint report was considered, but owing to the opposition to the proposed rules in their present form that had developed, it was decided to withhold approval until a further hearing could be given the interests opposed to these regulations. Accordingly, on Dec. 9 President Scott, of the Institute, and Dr. Kennelly, chairman of the committee on national electric code, appeared before the Underwriters' National Electric Association and presented resolutions which had been adopted by the board of directors of the Institute, with an explanation of the position of the latter body. Upon motion of C. M. Goddard, chairman of the conference committee and secretary of the Underwriters' National Electric Association, that body acquiesced in the position taken by the Institute.

The New Washington Street Subway at Boston

The Boston Transit Commission and members of the Massachusetts Railroad Commission held a meeting last week at which preliminary plans for the new Washington Street subway were discussed. The Transit Commission has power to build two separate subways with independent stations, or one subway above another with or without physical connection, and using the same stations. So many problems have arisen in connection with the work that it will probably be some days before the route will be definitely decided. One of the most important questions is the uniting of the new subway or tunnel, or both with the existing subway and elevated lines.

Approximately, the boundaries of the district within which the new subways may be built are from the Pleasant Street terminus of the present subway down Tremont Street to Scollay Square, thence to Bowdoin Square, then straight to the corner of Causeway and Leverett Streets, then along Canseway to Washington Street north, then in a straight line to the corner of State Street and Atlantic Avenue, then up State Street to Broad, thence to the telephone building on Milk Street, thence to the corner of Kingston and Essex Streets, and from this point describing a circle to the point of beginning, making the farthest possible limit the corner of Washington and Florence Streets. This area is much larger than is generally interpreted by the public, who usually consider the subway as under, or neraly under, Washington Street. Under the limits of the act the commission may exercise its own discretion about the connections of the new subway and tunnel, so that it may he decided to build the elevated car subway line from the present Castle Street junction under Washington Street to a connection with the East Boston Tunnel and the Scollay or Adams Square lines, and the subway for surface cars from Castle Street or Harrison Avenue through Chauncey and Arch streets past the Post Office, and thence through the north end to Causeway Street, or vice versa. That the two subways will be separate appears to be the view of the majority of the members of the commission at present. About $1,500 has already been expended in preliminary work. Borings have been made to determine the character of the subsoil under Washington, Arch and other streets where the subway may run, and a field party has been put at work to survey and test the foundations of the buildings in the district which may be affected by the construction of the new subway and tunnel. Each of these new underground thoroughfares will have double tracks, and it is reported as cheap to build them separately as to construct a double-deck subway. The matter of cost will, however, be subordinated to public convenience. Contracts will probably be let as soon as the preliminary work is finished, and construction work actively pushed in the early spring of 1903. Although the commission has an additional year in which to begin the construction of the subway for surface cars, it will probably be started at about the same time as that for elevated trains.

Upon the completion of the new subway there will be three underground rapid transit trunk lines traversing Boston's business district from north to south. The value of these six tracks

can well be apprecited by all railway managers whose traffic is unfortunately concentrated upon a single pair of tracks, and who are thus dependent upon the absence of collisions, fires, breakdowns or other troubles for the maintenance of a uniform and satisfactory schedule.

Electric Railways in Pennsylvania

Isaac B. Brown, superintendent of the State Bureau of Railways of Pennsylvania, has just transmitted to Governor Stone the annual report on the railways of that State. That part of the report devoted to the electric railways deals with capital stock, funded indebtedness, liabilities, assets, cost of construction and operation of the ninety-seven corporations in the State. The total capitalization, as indicated in the report for the year ending June 30, aggregated $00,698,238; the funded indebtedness, $36,773,200; the gross income, $29,001,741; the mileage, 2175. In the report Mr. Brown says:

"It is hardly possible that there is much in the financial development of street railway enterprises that can contribute very much to the financial credit of the State.

"The wildest schemes of capitalization have characterized the proceedings of many street railway corporations in their organization, in their management, in their consolidations, in their mergers and in their reorganization until we have a condition which shows that the capitalization of street railways in Pennsylvania is more than double the reported average cost of road and equipment of the steam railways in the entire United States.

"If that should be questioned, the comparisons of the capital stock outstanding and the bonded indebtedness among street railway corporations in Pennsylvania similarly located will show that one company may have many tines the amount of capital stock and bonded indebtedness outstanding that another corporation has which has been constructed and maintained under similar conditions.

"From a fairly close observation of these transactions in recent years, it must be apparent that the bonded indebtedness outstanding more than equals the cost of these roads and their equipment, from which it follows that, in many cases, at least, there was little, if any, cash actually invested in the stocks.

"In some of the New England States the issuance of bonds and stocks is done under public supervision for a bona fide consideration —actual payment of cash for stocks and bonds, dollar for dollar. The result of such public supervision in the affairs of these States is that when one is offered a bond of a street railway company, or of the corporations subject to public supervision, he may rely upon the bond as a thing of value, and generally as a good investment.

"Should there not be such supervision established in the State of Pennsylvania by our Legislature?

"There can be only one answer to that question: The general good of the Commonwealth demands it. It is fair, it is honorable and reasonable that public corporations, which perform public functions by virtue of their charters, given by the State, should deal fairly with the public, both in their operations and in their financial transactions, to the end that stocks and bonds should not be given away or placed upon the market, or given to corporation officers or to individuals except for value received.

"Sooner or later there will be a consensus of opinion on the lines herein suggested, and the sooner the legislative and executive branches of our State government arrive at a point where on all sides it shall be conceded that public supervision over the financial affairs of at least railway corporations and many other corporations whose functions are purely public, the better it will be for all concerned."

Concerning the dividend feature of electric railway corporations, it said:

"As indicated, the business of operating street railways does not seem from the returns made to result in great dividends to stockholders, and yet, possibly, if the exact amount of cash that has gone into the construction of street railways could be known, it might appear that even the small amount of dividends paid would be a fair sized rate of dividends on the actual cash capital so invested."

Taking up the subject of capitalization the report said that the aggregate capital of the ninety-seven corporations on June 30 was $00,698,238, as against $108,676,774 last year. The discrepancy, it was explained, was due to the fact that several large concerns had been absorbed and had become subsidiary. No reference was made to the Philadelphia Rapid Transit Company, which took control of the Union Traction Company and its leased lines in this city, because the Mack corporation did not formally assume the management until July 1. Operating companies with large amounts of outstanding stock included the Conestoga Traction Company, $4,000,000; the Harrisburg Traction Company, $2,000,000; the Lehigh Valley, $2,654,000; the Pittsburgh Railways Company, $5,000,000; the Scranton Railway Company, $3,000,000; the Wilkesbarre & Wyoming Valley Traction Company, $5,000,000, and the Union Traction Company, of this city, $10,500,000.

Of the total funded debt of $36,773,200 the Lehigh Valley Traction Company had $3,000,000; the Pittsburgh Railways Company, $4,579,000, and the Scranton Railway Company, $3,000,000. The total liabilities aggregate $15,698,575, making a total of capital and liability of $112,770,013.

The cost of road (by construction, purchase and lease) was given as $61,647,864, and the cost of equipment $12,015,828. The stocks owned by the various operating corporations were $21,932,440; bonds, $433,992; cash and current assets, $13,160,552; other assets, $7,013,805. The largest owners of stocks were the Harrisburg, Lehigh Valley, Pittsburgh & Scranton Companies. The Union Traction owned $5,202,412.

Under the income report the gross receipts were $29,001,741. Two of the concerns named were the Pittsburgh Railways Company, $3,711,003 (for a part of the year), and the Union Traction Company, Philadelphia, $14,006,915.

The item of disbursements was an interesting part of the report. The payments, aggregating $28,823,404, included operating expenses, interest, rentals and dividends. The operating expenses were $15,024,899, and $1,574,084 was paid in taxes. This comment was made: "In some cases the amount of taxes paid was very insignificant, considering the value of the property." The heaviest taxpayers were the Union Traction Company, $903,842; the Consolidated, of Pittsburgh, $107,002, and the United, of Pittsburgh, $58,214. The interest paid on funded indebtedness amounted to $3,065,524, of which the Union Traction paid $342,235. The rentals were $7,320,656. The underlying companies leased by the Union Traction absorbed $5,344,550, or more than five-sevenths of the whole sum. The Pittsburgh Railways Company paid $940,487.

The dividends paid by the eighteen operating corporations which declared them amounted to $1,086,440. The companies were: The Altoona & Logan Valley, $41,535; the Chester Traction, $20,000; the City of Altoona, $20,000; the Consolidated, Pittsburgh, $360,000 the Delaware County & Philadelphia, $21,000; the Harrisburg, $100,000; the Holmesburg, Tacony & Frankford, $21,000; the Johnstown, $18,000; the Lebanon Valley, $11,000; the Lehigh Valley, $95,181; the Tamaqua & Lansford, $10,000; the Roxboro, Norristown & Chestnut Hill, $46,624; the United, of Pittsburgh, $75,000; the United, of Reading, $20,000; the Wilkesbarre & Wyoming Valley, $212,500; the York, $7,000; the York & Dallastown, $6,600, and the York & Dover, $1,000.

"From these figures," declared Superintendent Brown, "it would seem that the prodigious amount of money that appears to have been made on street railway construction and operation within the last ten years must have been derived through some other sources than dividends."

MILEAGE OF COMPANIES

The companies with the greatest mileage were the Conestoga, in Lancaster County, 83 miles; the Lehigh Valley, 130; the Pittsburg Railways, 318; the Union Traction, Philadelphia, 334. The cars in use were 7017, of which 1541 were in Pittsburg and 3205 here. The employees numbered 17,788, with a compensation of $10,394,401. The Union Traction Company paid $4,466,848, or $584 to each employee. The passengers carried were 640,076,370—60,000,000 more than in 1901.

Regarding accidents, 34 passengers and 11 employees were killed The accidents to passengers numbered 1406, as against 1050 in 1901; to employees, 234, as against 129. The number of persons not passengers or employees who were killed was 141; injured, 906. It was presumed in the report that the death of persons other than passengers and employees was due largely to carelessness. Reckless operation and high speed were blamed for many accidents, and the report dealt severely with these things.

The "great velocity" at which the cars were run, according to the report, did not apply to Philadelphia, but Mr. Brown declared:

"It is alarming to witness in some instances the speed at which the cars are run, the velocity being almost equal to that of express trains. Such speed is not essential to proper service. It only invites accidents."

It was suggested that high speed, especially down street grades, should be prohibited, and that the "utmost care" should be exercised in handling cars. "If railway managers will not prohibit by most stringent rules and regulations the prevailing recklessnes which is found in some localities," continued the report, "it will not be long before some provision will be made by which the State will exercise a just authority."

The report concluded with a reference to ninety-six subsidiary corporations which made reports to the Department of Internal Affairs. Their capital stock outstanding aggregated $119,801,319, with a funded and unfunded indebtedness of $62,921,719. The income, principally from rentals, was $7,555,102, and dividends of $4,893,020 were paid.

"These figures," said Mr. Brown, "representing the financial and physical conditions of street railway companies, are the result of the rapid transition from conditions that existed a few years ago to those now prevailing, which have been brought about largely through the introduction of electricity as a motor power.

"Probably in the history of financial affairs in this State it would be difficult to find more rapid strides in the financial development and in the introduction of new devices, appliances, means of operation and maintenance than can be found in the history of street railway enterprises in the period of ten or twelve years."

Transit Improvements at Pittsburgh

The report of the committee appointed sometime ago by Recorder Brown, of Pittsburgh, to consider measures of relief for the traction situation, has been made public. The report is presented by William McConway, H. C. Frick, A. W. Mellon, Col. A. J. Logan and Reuben Miller, and, as the Pittsburgh Times says, is rendered to offer suggestions for bettering a service that is wholly inadequate, but for which the operating company is not responsible, as the conditions that now exist are the result of the rapid growth of a prosperous community in a territory where hills preclude the possibility of many wide streets. The commission offers two schemes. One, for immediate relief, suggests the occupation of a number of streets not now traversed, and advises on the change of many of the downtown loops, and the other provides for the permanent relief.

The plan for temporary relief provides for a line on Liberty Avenue as a base line, the north side and west end cars not to pass south of it, and east end cars not to pass north of it. Then there is presented in detail a plan for downtown loops, to prevent the overcrowding of any one street, and then a crosstown line from Sharpsburg, by way of Highland Park to Oakland and Soho and across the South Twenty-Second Street Bridge is proposed. Transfers on all divisions are recommended. For permanent relief an elevated railway along Liberty Avenue to the forks of the road, a high bridge over the Panhandle tracks in Try Street, and the occupancy of all downtown streets by surface lines, including Diamond Street and Virgin Alley, are proposed. Other large plans are left for further consideration. Recorder Brown has offered the following recommendations, which have been accepted by the commission: Elevated line from Lawrenceville to Bellefield; elevated line from Ferry and Water Streets, out Second Avenue, to Glenwood; elevated line from Second Avenue in Soho, through Oakland to Bellefield, to form a crosstown line with the first road.

The Pittsburgh Railways Company, which controls all the lines in the city, did not come into control of the various independent properties until Jan. 1, 1902, so will not complete the first year of its existence until Dec. 31. The various properties that it took over, independent but complete in themselves, were not, of course, laid out so as to operate to best advantage or economically as a whole. And in addition to its work of simplification and readjustment, the company found itself called upon to haul about 20,000,000 more passengers than were earned by the individual companies during the previous year. The unification of the operating forces, readjustment of power distribution, and the myriad of other problems that had to be met at once necessarily made impossible changes in the physical properties such as relocation of lines, etc. Even an increase of over 15 per cent in the carrying capacity of the company afforded but little relief.

Railway Taxes in Connecticut

As a result of the meeting of the State Board of Equalization, at Hartford a few days ago, the accountants in the Treasurer's office have made out and notified the several steam and street railway corporations of the State of the amounts of taxes due by each. The total amount is $1,284,313. Of this large sum $1,032,173 will be paid by the steam roads, and $252,140 by the street railway companies. As usual the New York, New Haven & Hartford Railroad and its leased lines pay nearly all of the steam road tax.

Of the street railways the Connecticut Railway & Lighting Company and its subordinate lines pay the largest tax, $84,522. The Fair Haven & Westville, of New Haven, is the second largest taxpayer, and the Hartford Street Railway Company the third. The smallest taxpayer is the Newington Tramway Company, which is called upon to contribute exactly 8 cents to the State Treasury. The amounts to be paid by the several street railways are as follows:

Branford Light & Water Company, $1,700.14; Connecticut Railway & Lighting, $84,522; Danielson & Norwich Street Railway, $505; Danbury & Bethel Street Railway, $3,041; East Hartford & Glastonbury, $2,000; Fair Haven & Westville, $52,862; Farmington Street Railroad, $781; Greenwich Tramway, $3,324; Hartford & Springfield, $5,400; Hartford Street Railroad, $38,801; Hartford, Manchester & Rockville, $4,209; Manufacturers, of New Haven, $210; Meriden Electric, $6,230; Meriden, Southington & Compounce, $2,335; Middletown Street Railroad, $1,581; Montville Street Railroad, $5,000; New London Street Railroad, $3,365; Norwich Street Railroad, $5,340; Newington Tramway, .08; People's Tramway, Danielson, $5,542; Somers & Enfield, $50; South Manchester Light & Power, $100; Stamford Street Railroad, $2,210; Suffield Street Railroad, $730; Torrington & Winchester, $2,015; West Shore, New Haven, $940; Winchester Avenue, New Haven, $17,154; Worcester & Connecticut Eastern, $507. Total, $252,140.

The Lease of the Indianapolis Street Railway

A report from Indianapolis says that official announcement has been made that the Indianapolis Traction & Terminal Company will, at once, propose to lease the Indianapolis Street Railway Company's lines for thirty years, the length of the franchise of both, and will, if the proposition be accepted, issue $5,000,000 stock and $5,000,000 bonds. Of the stock, $1,500,000 will be distributed to the stockholders of the street railway company as a bonus, and a fixed graduated dividend on the street railway stock will be guaranteed from the date of the signing of the lease. The Terminal Company has a franchise and a contract with all the interurban roads and will erect in a few months a station costing $1,000,000. The stockholders will, it is believed, accept the lease.

Pennsylvania Tunnel Franchise Passed

The New York Board of Aldermen has acted favorably upon the Pennsylvania tunnel franchise, and the improvement is now assured, as the terms of the grant are satisfactory to the company. The plans for the new railroad provide for the building of at least five tubes of 18 ft. 6 ins. in diameter. Three of them will be under the North River and two under the East River. They will rest on pile piers, driven down to solid rock. Each tube will hold a single track. The tunnel system is to converge at the central station in Thirty-Second Street, between Seventh and Ninth Avenues. This station is to be 1500 ft. in length and 500 ft. in width, and will contain twenty-five tracks. The cost of the work is estimated at $50,000,000.

The terms of the franchise provide that in addition to the yearly trackage charges of 50 cents a lineal foot of track, to be doubled after ten years, the company will pay rentals for subsurface stations, for vault privileges, etc., which will bring the total payment to the city for the first twenty-five years to about $2,500,000. The terms are to be readjusted in twenty-five years.

International Congresses at the St. Louis World's Fair

The president of the St. Louis Exposition Company announced last week the organization of a series of world's congresses to be held in St. Louis during 1904. Howard J. Rogers, chief of the department of education, is to be the director of congresses. The advisory board to work in conjunction with him is as follows: Chairman, Nicholas Murray Butler, president of Columbia University, New York city; William R. Harper, president of the University of Chicago; R. H. Jesse, president of the University of Missouri; Henry S. Pritchett, president of the Massachusetts Institute of Technology, and Herbert B. Putnam, librarian of Congress.

The duties of this advisory board will be more exacting than usually fall to the lot of advisory bodies. Upon their recommendations will be determined the number and extent of the congresses, the emphasis to be placed upon special features, the prominent men invited to participate, the character of the programmes and the methods for successfully carrying out the enterprise. No effort will be spared to give the series of congresses at this Exposition unity and connected purpose, and make their published proceedings a valuable contribution to the world's literature.

A series of congresses has been an accompaniment of all recent international congresses, but they have always been disconnected, and rather incident to the Exposition than related to it and supplementary to the exhibits. The work of the director and advisory board will be wholly given to constructing a co-ordinate department of the Exposition which shall have an established scientific value and attract the attention of the practical scholars and experts of the world to St. Louis.

Third Annual Report of the Massachusetts Electric Companies

President Gordon Abbott, of the Massachusetts Electric Companies, in presenting the annual report of the company, said that as the year just finished has been one of the most unfavorable in many years to the operation of street railways in New England, owing to a variety of causes, among which were mentioned a winter of considerable severity, an unusually cold and wet summer, and the coal strikes, the results of the year, which compare favorably with those of previous years, are an evidence, not only of the stability of the business, but also of the devotion and ability of the operating force.

No new consolidations have been effected during the past year, nor have any new properties been acquired, but a large amount of new construction has been done by the companies, shares of which were acquired last year.

The Middleton & Danvers has been extended to Lawrence, and the Haverhill & Andover has built from Haverhill to a junction with the former company, furnishing a new and direct line from both these cities to Salem and Beverly. The Reading, Wakefield & Lynnfield has built several lines with the purpose of connecting an extension built by the Boston & Northern through Tewksbury and Wilmington, with the existing lines of the latter company, and so providing new and direct lines from Lowell, Lawrence, and Haverhill, to Boston. All this work is now finished, and the lines are nearly ready for operation. By this new construction the mileage of the companies has been increased by 41 and now amounts to 860 in twenty-two cities and sixty-six towns. In addition, 25 miles of track have been reconstructed with heavy girder or T-rail, and 55 miles of new feed wire have been strung.

Furthermore, to follow out the policy of improvement outlined in former reports, and to meet the demands of the public for larger and better cars, a large amount of new equipment has been purchased. Two hundred and twenty-eight double-truck closed cars and 100 double-truck open cars have been added, so that, allowing for certain old cars which have been discarded, the increase in seating capacity amounts to 17.69 per cent of the entire equipment as it was a year ago. Five hundred and sixty-six new motors have been added and two new power stations have been built, one at East Woburn and one at Abington. The construction of the plant at East Woburn has resulted in one enabling the closing of two uneconomical existing stations. Besides this, new generators have been installed in Lawrence and Fall River, the total of the new machinery added in all stations amounting to 6900 hp.

To accommodate the increased rolling stock a new car house holding sixty cars has been built in Quincy, and existing car houses in Lawrence, Danvers, Melrose and Fall River have been considerably enlarged.

On the work above enumerated there was expended the sum of $3,083,289, of which $1,671,521 was for construction or betterments of track and buildings, and $1,411,768 for equipment and power.

To meet this expenditure and to provide funds for certain further necessary improvements, permission was obtained in May last for an issue of 55,000 new preferred shares, which have been sold to a syndicate. In accordance with this contract 23,750 of the shares were delivered and paid for prior to Sept. 30. The balance has partly been taken up since that date, and in part will be delivered during the coming winter as funds may be needed by the various companies.

The proceeds of the shares already paid for have been loaned to the sub-companies, it being the desire of the trustees that the floating debt of those companies should be held so far as possible by trustees of the parent company. Thus, since Sept. 30 (for which reason the figures do not appear in the schedules), the companies have been authorized to issue new shares as follows: Boston & Northern Street Railway, 17,073 shares; Old Colony Street Railway, 9487 shares; Lawrence & Reading Street Railway, 1250 shares; while the petitions of the Middleton & Danvers, Haverhill & Andover, and Reading, Wakefield & Lynnfield are still pending.

In the first annual report mention was made of the large number of scattered power stations of the various companies, and of the advantages to be gained by a consolidation into a few large and economical ones. The matter has been carefully studied ever since, but the work has been postponed partly because other improvements seemed more urgent; and partly because it was desirable to take advantage of recent and radical advances in steam engineering.

The time has now arrived when the work can be undertaken, and contracts have been let for 30,000 hp of steam turbines and generators. These will be placed in new stations, and as they will enable the closing of most of the existing ones, we feel confident of very favorable results. The necessary investment will be considerable, but the efficiency of the new machinery as guaranteed by the makers leads the engineers of the companies to calculate that the saving over the present cost of producing power will amount to 8 per cent on the total amount invested in the new power houses, and there will be in addition a large reserve of power for future needs.

The consolidated income account of the operating street railway and electric light companies controlled by the Massachusetts Electric Companies for the year ending Sept. 30, 1902:

Earnings	$6,090,168	$5,778,133
*Expenses	3,827,372	3,915,485
Net earnings	$2,262,796	$1,862,647
Interest, rentals and taxes	1,391,239	937,206
Net divisible income	$871,557	$925,441
Dividends	676,390	779,462
Surplus for the year	$195,167	$145,979

Consolidated surplus account for the year ending Sept. 30, 1902:

Balance Sept. 30, 1901, as per second annual report	$466,286	
Less		
*Newport & Fall River Street Railway surplus Sept. 30, 1901	5,306	
Balance	$460,980	
Surplus for the year ending Sept. 30, 1902	195,167	
Total		$656,147
Deductions:		
Injuries and damages prior to 1899	$50,083	
Reconstruction	120,000	
Sundry net debits	25,220	
Depreciation fund, Hyde Park Electric Light Company	10,000	
Total deductions		205,303
Balance Sept. 30, 1902		$450,844

†Consolidated balance sheet, Sept. 30, 1902:

ASSETS

Property Sept. 30, 1901	$28,210,600	
Net additions to Sept. 30, 1902	2,941,668	
Property Sept. 30, 1902		$31,152,268
Cash		578,051
Accounts receivable		202,690
Coupon deposits		113,435
Sinking and redemption funds		43,867
Prepaid taxes, insurance and rentals		109,142
Material and supplies		609,453
Total assets		$32,808,906

LIABILITIES

Capital stock	$12,632,200
Funded debt	13,181,500
§Notes payable	4,772,150
Vouchers and accounts payable	752,232
State and local taxes	243,714
Coupons outstanding	113,448
Dividends declared, unpaid	328,133
Accrued interest, rentals and excise tax	321,875
Renewal funds	12,810
Surplus	450,844
Total liabilities	$32,808,006

* In the statement for 1901 taxes were included in expenses. The change has been made this year to conform to the system established by the American Street Railways Accountants' Association.

† Interest sold.

‡ As compared with previous year does not include the Newport & Fall River Street Railway Company, leased to and operated by the Old Colony Street Railway Company, as interest has been sold.

§ Of the amount of $4,772,150, $3,988,650 were held by the Massachusetts Electric Companies and the Massachusetts Street Railway Accident Association.

Massachusetts Electric Companies' statement of profit and loss, year ending Sept. 30, 1902:

INCOME		
Dividends on stocks owned	$697,960	
Miscellaneous interest on notes, etc	97,993	
Total income		$795,953
EXPENSES		
Salaries—General officers	$9,000	
Printing and stationery	1,807	
Legal expenses	850	
Miscellaneous expenses	5,310	
Total expense		17,148
Net income for the year		$778,805
CHARGES		
Interest on coupon notes		121,500
		$657,305
Dividends (4 per cent on preferred shares)	$602,296	
Dividends accrued on preferred shares, issued July 1, 1902	22,917	625,213
Surplus for the year		$32,093
Surplus Sept. 30, 1901		172,067
Surplus Sept. 30, 1902		$204,160

Massachusetts Electric Companies' general balance sheet, Sept. 30, 1902:

ASSETS	
Sundry stocks, etc., in treasury	$27,850,820
Stocks deposited under indenture of trust Dec. 31, 1900, to secure issue of coupon notes	2,711,000
Cash	25,368
Notes receivable	3,752,900
Accounts receivable	328,771
Discount on sale of preferred shares	166,250
Cash deposited to pay dividends and coupons	3,201
Total assets	$34,838,310
LIABILITIES	
Preferred shares	$17,432,400
Common shares	14,293,100
Coupon notes	2,700,000
Vouchers and accounts payable	750
Accrued dividend on preferred shares	174,324
Accrued interest on coupon notes	30,375
Dividends and coupons uncalled for	3,201
Profit and loss surplus	204,160
Total liabilities	$34,838,310

New Publications

Ancient and Modern Engineering and Isthmian Canals. By William H. Burr, C. E.; 473 pages. Illustrated. Published by John Wiley & Sons. Cloth, $3.50 net.

Under this somewhat general title Professor Burr, of Columbia University, has included some very interesting discussions of important civil engineering works which have been undertaken in ancient and modern times. Part I is devoted to ancient work of this character, and includes descriptions of the pyramids and their methods of construction, the old Roman roads, cement, bridges, aqueducts, etc. Part II, which contains chapters 6 to 12, treats of bridges, their theory of construction, practice and views of characteristic installations of different types. The subject of waterworks for cities and towns is taken up in Part III. Railroad engineering, which is confined to steam railroad engineering, is discussed in Part IV, while Parts V and VI are devoted to the Nicaragua and Panama ship canals respectively. The book is very thoroughly illustrated, and has been written "with the intention of presenting in an agreeable manner to the engineering profession, including advanced engineering students, a body of interesting technical information of the highest practical value." This object has been accomplished by Professor Burr in a very satisfactory manner.

Report of the Twenty-First Annual Meeting of the American Street Railway Association. Published by the Association; 344 pages.

The annual report of the association this year is more replete than usual with interest, and the papers and discussions at Detroit will well repay a second reading. In addition to the report of the proceedings themselves the report contains a list of the attendants at the convention, and a very good steel engraving of President Vreeland. The lists of names of attendants seem to have been very carefully compiled, and the report, as a whole, both typographically and otherwise, reflects great credit on the secretary of the association, who is responsible for its production.

"Notes on the Plotting of Speed-Time Curves," By C. O. Mailloux; 112 pages, with two insets.

Mr. Mailloux's valuable paper, read before the American Institute of Electrical Engineers, June 19, 1902, and published in the STREET RAILWAY JOURNAL, has been reprinted by the author. The paper is by far the most exhaustive treatise which has been published on the subject, and Mr. Mailloux deserves the thanks of all electrical engineers for giving the results of his investigations in this subject with such completeness.

Satisfactory Settlement of Claims in Easton

Street railway companies in large cities which find their claim departments expensive will be interested in an account of the adjustment of the damage claims resulting from an accident on the line of the Easton & Nazareth Street Railway Company, of Easton, Pa., last spring.

On May 22, 1902, which was circus day in Easton, Pa., a large double-truck car, of latest design, left the circus ground on Thirteenth Street with eighty-seven passengers aboard. The road at that time had a number of curves and bad grades, which have since been overcome. The car was going down a steep hill, and for some unknown reason the motorman lost control of it, and on reaching the foot of the hill the car overturned, killing two passengers and injuring sixty. About twenty-seven escaped without any injury, except to their clothing; the clothes of nearly every person on the car were badly damaged.

At the coroner's inquest the company was exonerated from all blame. I. L. Currier, of New York, a friend of the president, and who happened to be in the city, was engaged to settle all of the claims, eighty-seven in number, which he did for less than $1,200. The largest claim paid was $250, which was a death claim. The other death claim was settled for $129.25. Most of the injury claims were settled on a basis of the value of the victim's time lost while in the hospital; for instance, one man who lost two fingers and whose head was badly cut, requiring more than a dozen stitches, was glad to settle his claim for $20, a suit of clothes and a hundred trip pass over the railway. Mr. Currier attributes the satisfactory outcome of his work to several lines of policy followed in the settlement. One of these was that all damage claims should be proved, even if only a suit of clothes was in question. The second was that the company took up these damage claims promptly and not through a lawyer, but by a layman, who visited each injured person, provided medical attendance where necessary and exhibited a sympathetic interest in the case.

The benefits of the prompt settlement of damage from this unfortunate accident are, of course, not confined to the results of this particular accident. It is needless to say that the company will enjoy the benefit of it for a long time to come, not only as a precedent, but also as showing a readiness to meet its just claims promptly, even where they were the unfortunate result of an accident of this kind.

Opening of the Levis County Railway

On Dec. 6 the first section of the new electric railway at the city of Levis, opposite Quebec, was put in operation. The finished line connects the Grand Trunk station, in South Quebec, with the Levis ferry across the St. Lawrence River to Quebec, and two cars will be kept in operation on this section until the completion of the rest of the line. Power is taken from the power station of the Quebec Electric Light Company.

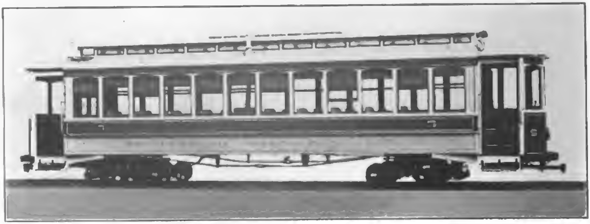
The opening of the line created much enthusiasm in Levis, and the cars were well filled. General Manager Holman received many congratulations on the successful completion of the work, upon which his company has been engaged during the summer.

Grand-Stand Legislation at Oak Park, Ill.

The Village Board, of Oak Park, Ill., a suburb of Chicago, recently repealed the franchises of the street railway lines in Oak Park, owned by the Consolidated Traction Company. To be sure the United States Supreme Court has decided that a franchise given a street railway is in the nature of a contract that cannot be set aside without the consent of both parties thereto, but this made no difference to the Oak Park Board, and it is just as well that they should have their fun repealing franchises, since such action is void under the law.

Semi-Convertible Cars for Stroudsburg

The accompanying photograph shows the style of semi-convertible car recently built for Stroudsburg, Pa., by the J. G. Brill Company, of Philadelphia. The length, 33 ft. 4 ins. over end panels, is somewhat greater than is usual in this type, and affords a seating capacity of forty-eight. The width over the sills is 7 ft. 8½ ins., and over posts at belt 8 ft. This is 2 ins. narrower than customary, but as the roof storage of windows eliminates wall pockets, the interior width is 7 ft. 8 ins. Round-end vestibules are used at either end, and have drop sash and folding doors. The interiors are finished in natural oak with decorated birch ceilings.



SEMI-CONVERTIBLE CAR FOR STROUDSBURG

Brill sand-boxes, angle-iron bumpers, radial draw-bars, ratchet brake-handles and "Dedenda" gongs are furnished. The trucks are "Eureka" maximum traction.

Manila Electric Franchises

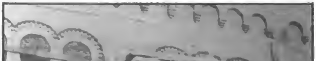
The bureau of insular affairs of the War Department has issued a statement announcing that it is now in a position to furnish intending bidders the full text of the enactment of the Philippine Commission providing for granting franchises for an electric street railway and an electric light, heat and power system in Manila and its suburbs. As previously stated in the Street Railway Journal, the franchises will be awarded after competitive bidding, the bids to be filed in Manila before March 5, 1903, when they will be opened. The route of the proposed system is 35 miles long. The points of competition for bidding are the duration of the franchise, not to exceed fifty years; the rate of fare on the railway not to exceed 7½ cents gold for first-class passengers, and 5 cents gold for second-class passengers, and the compensation to be paid the city of Manila, not less than 1½ per cent of the gross earnings. Construction must begin within six months after awarding the bid, and be completed twenty months thereafter.

Automobile Tower Wagon

The Columbus Railway Company is using an automobile tower wagon in its construction and repair work which contains some features of interest. The accompanying illustration shows the general appearance of the wagon. It will be noticed that the mechanism is carried low to insure stability and firmness when the wagon has a high tower. Power is furnished by a gas engine, similar to those used in stationary service, excepting that the bed-plate is removed and other supports for attaching the machine to the frame are substituted. Special attention was given the design and construction of the running gear. The wheels were especially designed and the axles are of solid steel forging. The frame on which the engine and transmission gear are mounted is forged from angle steel, hot-riveted and reinforced. All bearings are self-aligning and self-lubricating. The speed of the wagon may be regulated by a small hand wheel, and the direction of travel changed by a hand lever. The control is said to be so reliable that no brake is required even in going down a steep hill. An emergency brake is supplied, however.

This wagon has now been in use about two months and linemen have been using it every day with very satisfactory results, just as they would a horse-drawn wagon. The linemen express themselves as being so well satisfied with it that they would rather work on it than on the old tower wagon.

In making a "hurry" run of say a quarter of a mile the horses will make about the same time as the automobile, but after covering that distance the horses begin to lose time; the longer the run the more they slack up, whereas the automobile wagon will hold the same speed regardless of the distance. There is also a great deal of time saved after having made the run, for in doing the work the wagon will often need to be moved forward 15 ft. or 20 ft., either to let a car pass or to get at a different part of the work, and when they wish to return to the original position the horse-drawn wagon frequently has to be driven out and turned around, whereas the automobile will go forward or backward, as may be required, without turning. When working on a span wire or a feeder-tap connected with two trolleys, the automobile



AUTOMOBILE TOWER WAGON

may be run directly across the tracks and it will go forward or back under the cross wire, as may be needed to get in proper location. If a car approaches it needs only to go forward or back a few feet until the car passes, when it immediately returns to its position.

The experience of the Columbus Railway Company has been

that considerable saving is effected in the maintenance of the automobile as compared with the cost of maintaining horses, and an additional advantage is the fact that it is always ready for use however many miles it may have run during the day.

This equipment was built by the Motor Truck & Vehicle Company, of Columbus. It is being placed on the market by J. R. McCardell & Company, of Trenton, N. J.

Chicago Union Traction Appeal Denied

On Dec. 15 the Illinois State Supreme Court handed down its decision in the case of the Union Traction Company's petition asking for a rehearing of the case in which the court had previously decided that universal transfers must be given on all the company's lines. This petition was denied. This ends all litigation on this question as far as Illinois courts are concerned, but the case may be taken by the company to the United States Supreme Court. The decision leaves the situation practically as it stood before the appeal was made.

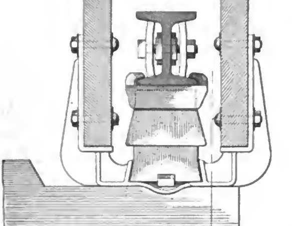
Street Railway Patents

UNITED STATES PATENTS ISSUED DEC. 9, 1902

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

715,286. Street Car Fender; J. Nosek, Prague, Austria-Hungary. App. filed Sept. 3, 1902. The net of the fender is spring-mounted and normally held under the car. When a person is struck, the impact causes the fender to recede, thereby releasing the net, which is pushed forward knocking the feet from under the person and causing him to fall into the net.

715,291. System of Control for Electrically Propelled Vehicles; W. B. Potter, Schenectady, N. Y. App. filed April 8, 1899. Means operated by fluid pressure for actuating the contacts of the controller, step by step, and manually governed electromagnetic means for controlling the application of the fluid pressure.



PATENT NO. 715,329

715,329. Rail Chair and Insulator; W. D. Young, Baltimore, Md. App. filed Oct. 18, 1901. A third-rail chair having a dovetailed opening for the insulator and side arms for supporting the guard rails.

715,341. Brake Shoe; W. O. Belt, Chicago, Ill. App. filed May 26, 1902. A brake-shoe having an expanded metal strengthening strip at or adjacent to the back face thereof.

715,415. Electric Trolley Wire Hanger; A. Palmros, Columbus, Ohio. App. filed Sept. 24, 1897. The wire is gripped by a pair of shear-clamps supported by a bracket.

715,486. Track-Sanding Apparatus for Electric or Similar Cars; J. S. Lang, Boston, Mass. App. filed April 3, 1902. The motorman by depressing a lever, throws gearing into frictional engagement with the car wheel, thereby rotating fingers in the sand-box to stir up the sand, and at the same time opening the sand valve.

715,712. Brake-Shoe; T. E. Twist, Milton, Pa. App. filed Sept. 10, 1902. The face of the shoe is provided with a hard metal insert consisting of a strip cast in the shoe with separated portions arranged in a general transverse direction and other portions joining their opposite ends in alternation.

715,714. Trolley for Electric Railway Cars; L. E. Walkins, Springfield, Mass. App. filed Jan. 9, 1900. The trolley is connected to the car by a ball and socket joint and trails so that it can raise and lower to compensate for inequalities in the conductor.

ENGINEERING SOCIETIES

NEW YORK RAILROAD CLUB.—"The Operation of the Per Diem System of Settlement for Car Hire" was the subject of a paper prepared by W. B. Casey for the regular meeting of the New York Railroad Club Dec. 19.

NEW ENGLAND RAILROAD CLUB.—At the regular meeting of this society at the Pierce Hall, Boston, on Dec. 9, a paper on "Electrically Driven Shops" was presented by Robert L. Warner, Boston sales manager of the Westinghouse Electric & Manufacturing Company. Mr. Warner's paper was illustrated by a large selection of stereopticon views, showing many examples of the application of direct-current and induction motors to the driving of machine shops, tools and other apparatus.

PERSONAL MENTION

MR. R. S. IVES, who recently resigned as superintendent of the Chicago & Milwaukee Electric Railway Company, of Chicago, was pleasantly surprised a few days ago by the employees of the company, who presented him with a beautiful diamond ring as a token of their appreciation of his labors in their behalf.

MR. CHARLES W. WASON, president of the Cleveland, Painesville & Eastern Railway Company, was presented with a magnificent gold watch last week by the members of the Everett-Moore syndicate and his associates in the Cleveland, Painesville & Eastern Railway Company. The presentation was made at this time because Mr. Wason and his wife will leave Cleveland in a few days on a tour around the world.

MR. WILLIAM MANDELICK, who is secretary of the Yerkes interests in London, is spending a few weeks in this country, and will return to London about the first of next year. Mr. Mandelick was formerly connected with the Sprague Electric Railway & Motor Company, of New York, and afterwards with the Interior Conduit & Insulation Company, and has been connected with the Yerkes interests in London for about two years.

MR. E. GONZENBACH, electrical engineer of the Aurora, Elgin & Chicago Railway Company, left the service of that company on Dec. 1 to give his attention to personal matters. He contemplates a trip to Europe next month. His former duties will be divided, Mr. Howard Brooks, who has been with the company for some time, having charge of third-rail and overhead work. Mr. S. Potter, formerly of the Toronto Railway, will look after the other electrical work.

MR. ALBERT C. BARNEY, a member of the firm of Barney & Smith, of Dayton, Ohio, died at Monte Carlo Dec. 6. Mr. Barney had been suffering for months from heart trouble, and made two trips to Nauheim without improvement. He returned to Paris a few weeks ago, was advised to go to a warmer climate, and started for Monte Carlo. He collapsed at the railroad station, and it was feared by his attendants that he would expire there, but he lingered and failed gradually until he died.

MR. F. E. DRAKE, lately general manager of the Union Elektricitats Gesellschaft, of Berlin, has just returned to this country. Mr. Drake has been connected with the Union Company for about two years, during which he has had entire charge of the works of the company, and has reorganized them and introduced a number of American improvements in the methods of manufacture. Previous to his connection with the Union Company Mr. Drake was principal assistant to Mr. Peck, special commissioner of the United States to the Paris Exposition of 1900, and while in this capacity rendered very valuable service to all American manufacturers exhibiting at the Paris Exposition, and to American interests in general. Previous to his European experience, Mr. Drake was connected with the Walker Company, and was also for a long time secretary and general manager of the Sperry Electric Company.

FINANCIAL INTELLIGENCE

THE MARKETS

WALL STREET, Dec. 17, 1902.

The Money Market

The money market has been through another period of considerable strain during the last week, but at length there seems good ground for believing that the worst has been seen, and that the situation henceforth will begin to grow better. Hope for improvement is based mainly on the indications that currency has commenced to flow back in quantity from the interior. For the seven days ending Saturday, the New York banks had gained upward of $2,000,000 from this source. Although doubt still exists in some people's minds whether this may not be only a temporary response of the inland exchanges to the exceedingly high money premiums at this city, the more general impression is that it is really the first of the regular return movement of crop-moving money, which sets in about this time and continues up to the end of February. Of the other influences making for improvement in money conditions, the most important are the heavy liquidation of the last week on the Stock Exchange, and the visible signs of slackening in the absorption of funds by the Treasury. It is certainly reasonable to expect, if precedent counts for anything, that January will be a much more favorable month than either November or December has been in respect to the Treasury's routine operations in the money market. This is mainly because government expenditures, which grow comparatively light toward the end of the year, are apt to become heavy again in the early part of the new year. The chances are altogether that bank reserves will increase during the next few weeks at least. Money rates, especially for call loans, are likely to be relatively high over the period of the first-of-January disbursements, but already some disposition has appeared toward relaxation in time money rates. Confidence in the situation has been strengthened greatly by the concerted action of a number of leading bankers pledging $50,000,000 in a pool to be loaned out freely in case of need. When this action became known on Monday, it helped greatly to allay apprehension over further trouble in the money market.

The Stock Market

The stock market has passed through a period of liquidation during the past week even more severe than any that have preceded it. Ostensibly the cause of the decline has lain in the unfavorable money conditions as reflected in the excessive loaning rates, especially for time money. But keen observers are inclined to doubt whether the money difficulties of themselves would have been sufficient to occasion such a very severe shakedown, had it not been the plan of the banking interests to force liquidation to its furthest extreme. In other words it would seem that money rates have been kept higher than they naturally would have been for the purpose of encouraging the closing out of speculative accounts. At this writing the worst is believed to have been seen so far as the influence of the money stringency is concerned. In the view of bankers and conservative persons generally, the speculative liquidation has gone as far as is necessary to reestablish a sound position in the financial community. There would be no obstacles in the way of immediate and substantial improvement were it not for the danger which lurks on the political horizon in the crisis that has developed in Venezuela. For the moment this is the subject of greatest concern in the mind of everybody interested in any way in the security market. So far nothing has happened to occasion serious alarm, nor has Wall Street come to really fear that anything serious will happen. But it is the vague possibilities which no one can help feeling under the circumstances that provide a source of constant uneasiness and keep the market in an exceedingly nervous condition. It is an open secret that the $50,000,000 money pool, already alluded to, was formed mainly with the idea that it would serve as a protective fund should the course of political events during the next few days threaten a panic. This knowledge in itself is an additional element of disquiet. Predictions, therefore, regarding the immediate future of the market are extremely unsafe. The only definite conclusion that can be drawn is that were the Venezuela imbroglio to be disposed of, the other forces in the situation would act very quickly to bring about a substantial improvement.

The local traction stocks have done nothing more than follow the course of the general market. They have suffered fully as much as any of the other groups, because the speculation which developed at the time of the Manhattan lease placed them all in a pretty vulnerable position. Brooklyn Rapid Transit has been fairly well protected on the decline by the inside party, which has lately become more aggressive in consequence of the turn for the better in the company's earnings. The 15-point drop in Manhattan from its recent high figures has invited considerable investment buying, and those who are in a position to watch the trading assert that the speculative holdings of the stock have been pretty well cleared out.

Philadelphia

The Philadelphia traction issues, moving in sympathy with the general market, have been extremely weak, touching the lowest prices in a long time past. Philadelphia Rapid Transit broke from 15½ to 14, Union Traction from 47 to 44⅝, Philadelphia Traction from 97¾ to 97, American Railways from 52 to 50, and Fairmount Park Transportation from 25 to 24. Railways General sold at 4, Indianapolis Street Railway at 91 and 92, and Consolidated Traction of New Jersey at 67¼. A partial rally has occurred from these low figures, but the market remains in a very nervous condition. There are no new developments of a local nature in the situation, and, as a matter of fact, no interest attaches to specific conditions in individual properties, while everything depends so manifestly upon the course of the general market. The statement was made in this department of our issue of Dec. 13 that the dividend rate on the American Railways stock was not increased at quarterly meeting. This was an error, as at that meeting the dividend rate was raised from 5 per cent to 6 per cent.

Chicago

Prices have declined as a rule in the Chicago market, but on scattering sales rather than on any important liquidation. City Railway, ex-dividend, fell from 210 to 207, Union Traction went as low as 13¾, Lake Street declined from 9 to 8½, North Chicago Street Railway from 162½ to 160, West Chicago from 84 to 83, Metropolitan Elevated common from 36½ to 35, and the preferred from 85 to 84. General market conditions are, of course, the sole reason for this break. Regarding the Chicago traction situation itself, all the lines, both overhead and surface, are reported to be doing a heavy business; the Metropolitan, for instance, will show, according to present expectations, an increase of 25 per cent in this month's traffic over December a year ago. The action of the Aurora, Elgin and Chicago directors in declaring a 3 per cent dividend on the shares, caused a good deal of unfavorable comment. The company's gross earnings for November were only $16,593, which is far short of the rate necessary to pay the declared dividends. It is a fact, however, that the road has suffered through the delay in obtaining its proper car equipment. It has been operating with only 20 per cent of its intended quota of cars, during the few months since the line was opened. Judging by the results obtained with its facilities thus hampered, officials say that the money paid out in dividends from sources other than earnings will be quickly recovered when the additional cars are obtained.

Other Traction Securities

All the leading Boston stocks have made the lowest prices of the year this week, in sympathy with the movement of the general market. Boston Elevated went as low as 149½ on Saturday, Massachusetts Electric common touched 33, and the preferred 94. Partial recoveries have taken place during the last two days. Apart from Massachusetts common, in which there was a good deal of speculative liquidation, the trading was light. In Baltimore prices have also recorded low levels during the past week. United Railways incomes dropped from 66¾ to 65¾, rallying a trifle later. The general 4s went down from 95 to 94¼, and the stock sold freely at 13. Eleswhere business was at a standstill. A single hundred Nashville Railway stock changed hands at 4½, and small sales were reported of Anacostia and Potomac 5s at 99, North Baltimore Traction 5s at 119¼, City Passenger 4½s at 102¼, and City Passenger 5s at 107. The week's transactions on the New York curb include New Orleans Railways 4½s between 78⅞ and 78, Washington Electric preferred at 47½, Brooklyn City Railroad at 246½, New Orleans common at 13¾, San Francisco subscription rights from 46¼ down to 45, and Interborough Rapid Transit 40 per cent paid at 109 and 107, only 100 shares changing hands at each figure. Miami & Erie Canal was the most active stock on the Cleveland exchange last week, 453 shares changed hands at between 30½ and 31½. Lake Shore Electric common sold for 245 shares at 14 and 14½, the lowest mark in some time. A small lot of Elgin, Aurora & Southern sold at 50, Northern Ohio Traction preferred receipts went at 95¼, and Western Ohio receipts dropped to 26 for a small lot. Springfield & Xenia sold at 16¾, a very low figure.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Dec. 9	Closing Bid Dec. 16
American Railways Company	52	61⅜
Aurora, Elgin & Chicago	a39	39
Boston Elevated	153	150
Brooklyn R. T.	64½	61⅝
Chicago City	210	206
Chicago Union Tr. (common)	14	13
Chicago Union Tr. (preferred)	45	45
Cleveland Electric	85	86¼
Columbus (common)	58	60
Columbus (preferred)	105	106½
Consolidated Traction of N. J.	68⅝	68
Consolidated Traction of N. J. 5s	107¾	107¾
Detroit United	—	86½
Electric People's Traction (Philadelphia) 4s	96	96¼
Elgin, Aurora & Southern	45	53
Indianapolis Street Railway 4s	—	86¾
Lake Shore Electric	12½	12¾
Lake Street Elevated	9¼	8¾
Manhattan Railway	147⅞	143⅛
Massachusetts Elec. Cos. (common)	35⅜	34
Massachusetts Elec. Cos. (preferred)	94	—
Metropolitan Elevated, Chicago (common)	36	35⅝
Metropolitan Elevated, Chicago (preferred)	83	85
Metropolitan Street	139¾	136⅞
New Orleans Railways (common)	13⅞	13½
New Orleans Railways (preferred)	45½	44½
North American	115	111⅞
Northern Ohio Traction (common)	—	—
Northern Ohio Traction (preferred)	95	—
North Jersey	30	30⅜
Northwestern Elevated, Chicago (common)	30	—
Philadelphia Rapid Transit	15⅞	15
Philadelphia Traction	97¼	97
St. Louis Transit (common)	27	27½
South Side Elevated (Chicago)	107	109
Syracuse Rapid Transit	30⅜	32
Syracuse Rapid Transit (preferred)	75	79
Third Avenue	—	125
Toledo Railway & Light	a35	35
Twin City, Minneapolis (common)	116½	114
United Railways, St. Louis (preferred)	81	82
United Railways, St. Louis, 4s	84⅝	84½
Union Traction (Philadelphia)	47	45¼
Western Ohio Receipts	27¾	28

a Asked. b Last sale.

Iron and Steel

The output of pig iron, according to the monthly figures of the Iron Age, is again increasing rapidly, and if it were not for the difficulty in obtaining fuel, it would, in the opinion of the same authority, surpass all records. Production is now reckoned at 336,617 tons weekly, an increase of 6500 tons weekly over the outturn of last month. Inability to supply themselves at home has led some of the steel manufacturers to import Bessemer pig from abroad, which, it seems, can be done about as cheaply even with the duty paid as to buy at home. Other features of the iron situation are the heavy trade in sheet steel, in plates and in structural material, and the enormous orders ahead for steel rails. It is said that the rail mills already have on their books orders for 1,800,000 tons of rails for next year's delivery, not counting the surplus of unfinished orders which will be carried over from this year. Quotations are as follows: Bessemer pig iron, $21.75 a $22; Bessemer steel, Pittsburgh delivery, $29; steel rails, $28.

Metals

Following are the quotations for the leading metals: Copper, 11¾ cents, tin 25¼ cents, lead 4⅛ cents, and spelter 4.90 cents.

SAN FRANCISCO, CAL.—The United Railway & Investment Company, of San Francisco, has declared a dividend of 1¼ per cent on the preferred stock, payable Jan. 3 to stock of record of Dec. 20.

FORT WAYNE, IND.—The Fort Wayne Traction Company, embracing all the city transportation lines, the line between the feeder canal and St. Joe River, as well as the Robinson Park summer resort, passed into new hands Dec. 10. The purchasers include Henry C. Paul and Senator S. B. Fleming, of Fort Wayne; James Murdock, Samuel Murdock, Charles Murdock, of Lafayette; George McCullough, who is interested in the Union Traction Company, of Anderson; Colonel J. Levering Jones, of Philadelphia, who represents a syndicate of Eastern bankers.

FRANKFORT, KY.—It is announced that Colonel John J. Webb, of Springfield, Ohio, has just completed the purchase of the Frankfort & Suburban Railway Company, operating 7 miles of track. Colonel Webb is interested in several important interurban railways in Ohio.

FRAMINGHAM, MASS.—The Framingham Union Street Railway Company and the Framingham, Southboro & Marlboro Street Railway Company have each declared an annual dividend of 5 per cent, payable Jan. 1, 1903.

HAVERHILL, MASS.—The Haverhill & Southern New Hampshire Street Railway Company has asked the Railroad Commissioners for permission to increase its capital stock from $60,000 to $80,000.

LOWELL, MASS.—The Lowell & Pelham Street Railway Company has asked the Railroad Commissioners for authority to increase its capital stock from $10,000 to $40,000.

LAWRENCE, MASS.—The Lawrence & Methuen Street Railway Company has asked the Railroad Commissioners for authority to increase its stock from $70,000 to $125,000.

STOUGHTON, MASS.—Judge Colt, in the United States Circuit Court, has denied the petition of William A. Clarke to complete the sale of the Stoughton & Randolph Street Railway by permitting him to pay the balance due ($45,000) on the recent sale. The court will probably order another sale of the property.

DETROIT, MICH.—The earnings of the Detroit United Railway for November were $312,365, a gain of $37,196 over the same month last year.

DETROIT, MICH.—The directors of the Detroit United Railway met in this city last week. The usual quarterly dividend of 1 per cent was declared, and it was voted to spend the extra 3 per cent in improvements, chiefly in improved rolling stock and extensions. It is stated the company is now earning 7 per cent on its capital stock. The Sandwich, Windsor & Amherstburg Railway Company, the majority of whose stock is controlled by the Detroit United, will issue a twenty year 4½ per cent mortgage for $600,000 to provide for the extension of the road to Amherstburg.

ST. LOUIS, MO.—The statement of the St. Louis Transit Company shows the total earnings for November to be $553,577, as against $479,390 in November, 1901, or a total gain of $74,187. The total earnings for the first eleven months of the present year amount to $5,898,276. For the same period last year the earnings were $5,307,597. These figures show a total gain of $591,194 for this year over 1901. An official of the company says that the net earnings will show a gain proportionate to the gross earnings. The percentage of operating expenses and taxes to the gross earnings has been scaled down to a low figure.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has declared a regular semi-annual dividend of 3 per cent, payable Jan. 15, to stock of record Jan. 6.

NEW YORK, N. Y.—The following has been sent out from the office of August Belmont & Co.: The remaining six instalments of 10 per cent each on part-paid stock of the Interborough Rapid Transit Company are hereby called, payable at our office on following dates: Jan. 5, Feb. 2, March 2, April 1, May 1 and June 1. Certificates must be presented for endorsement at time of the respective payments.

TOLEDO, OHIO.—The Maumee Valley Railway & Light Company was organized Dec. 12, with a capital stock of $1,000,000, for the purpose of taking over the Toledo & Maumee Valley Railway and the Toledo, Waterville & Southern Railway.

AKRON, OHIO.—The Northern Ohio Traction Company's railway department earned $62,310 during November, a gain of $13,304 over the same month last year.

SPRINGFIELD, OHIO.—It is announced that ex-Governor Asa A. Bushnell, who, it is said, realized something like $5,000,000 from the sale of his interests in the Warder, Bushnell & Glessner Company, has formed an alliance with Colonel John G. Webb, of Springfield, a prominent electric railway promoter, for the purpose of establishing the largest interurban system in the Central West.

CLEVELAND, OHIO.—The earnings of the Elgin, Aurora & Southern Traction Company for November were $28,607, a gain of $6,008 over the same month last year.

CLEVELAND, OHIO.—Gross earnings of the Aurora, Elgin & Chicago Railway for the month of November were $16,594.

CLEVELAND, OHIO.—The gross earnings of the Cincinnati, Dayton & Toledo Traction Company for November were $38,315, a gain of $6,759 over November, 1901.

COLUMBUS, OHIO.—The Columbus, Buckeye Lake & Newark Traction Company has declared its first dividend on the $500,000 preferred stock, 1½ per cent payable Jan. 1, to stock of record Dec. 20.

CANTON, OHIO.—The Canton-Akron Company has declared a semi-annual dividend of 3 per cent, payable Jan. 1 to stock of record Dec. 20.

ALLENTOWN, PA.—The Allentown & Reading Traction Company has filed a mortgage to secure $750,000 bonds.

GREENSBURG, PA.—A mortgage for $1,100,000 has been placed on record in Westmoreland County by the Pittsburgh & Allegheny Railway Company, which is building from Appollo to Leechburg by way of Vandergrift, with an extension to New Kensington. The mortgage is given in favor of the Public Trust Company, of Pittsburgh.

PHILADELPHIA, PA.—The Interstate Railways Company, mention of whose incorporation was made in the STREET RAILWAY JOURNAL for Dec. 13, has established an office at Reading, Pa., with W. W. Light as treasurer, and a call has been issued for 25 per cent of the subscriptions. Although no authoritative information concerning the plans of the company is available, it is still declared that the purpose of the company is to put through the reported merger of New Jersey, Pennsylvania and Connecticut properties. In fact, there seems to be a growing tendency to magnify the purposes of the company, and recently the United Power & Transportation Company has been mentioned as a party to the operations of the company. That complete secrecy can be much longer maintained concerning the company is improbable.

PHILADELPHIA, PA.—The American Railways Comp ny reports for November gross earnings of $94,590, an increase of $20,784; from July 1 an increase of $124,717 is shown.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. Co.	1 m., Oct. '02	65,627	36,333	29,294	12,604	16,622
	1 " " '01	61,479	29,769	32,710	12,438	19,272
	6 " June '02	318,937	185,362	133,575	77,556	56,019
	6 " " '01	268,967	164,458	104,510	61,494	41,016
	12 " Dec. '01	617,011	*350,845	266,166	135,162	131,004
	12 " " '00	513,732	*317,475	106,919	141,133	55,117
ALBANY, N. Y. United Traction Co.	1 m., Sept. '02	132,606	81,990	50,616	21,866	28,750
	3 " " '02	414,035	251,739	162,897	71,598	91,299
BINGHAMTON, N. Y. Binghamton St. Ry. Co.	1 m., Oct. '02	17,107	10,693	6,414	......	......
	1 " " '01	16,884	9,593	7,291	......	......
	4 " " '02	82,301	44,675	37,626	......	......
	4 " " '01	80,041	40,317	39,727	......	
BOSTON, MASS. Boston Elev. Ry. Co.	12 m., Sept. '02	11,321,030	7,862,571	3,458,459	2,636,941	821,518
	12 " " '01	10,889,496	7,336,507	3,552,989	2,896,550	656,532
Massachusetts Elec. Cos.	12 m., Sept. '02	6,093,166	3,827,372	2,262,794	1,391,239	871,555
	12 " " '01	5,778,143	3,915,496	1,862,645	937,200	925,442
BROOKLYN, N. Y. Brooklyn R. T. Co.	1 m., Oct. '02	1,114,772	644,977	469,795	......	......
	1 " " '01	1,067,131	703,612	363,519	......	
	4 " " '02	4,702,511	2,626,749	2,175,761	......	......
	4 " " '01	4,474,232	2,783,857	1,702,374	......	
	12 " June '02	12,780,705	*8,652,214	3,937,490	......	......
	12 " " '01	12,101,198	*7,970,835	4,130,563		......
BUFFALO, N. Y. International Tr. Co.	1 m., *a*Sept. '02	321,856	161,525	160,331	77,502	82,329
	1 " " '00	255,322	108,954	146,368	81,931	64,457
	3 " " '02	1,019,518	506,664	512,854	235,741	277,113
	3 " " '00	791,470	344,745	446,725	245,753	250,162
CHARLESTON, S. C. Charleston Consol'ted Ry. Gas & El. Co.	1 m., Oct. '02	40,759	27,346	13,494	13,469	25
	1 " " '01	39,038	24,862	14,176	13,482	694
	8 " " '02	428,007	256,064	192,043	108,062	73,981
	8 " " '01	394,190	211,870	112,450	110,042	2,308
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Nov. '02	14,112	6,389	7,723	......	......
	1 " " '01	12,943	6,806	6,257	......	......
	11 " " '02	177,251	72,784	104,467	......	......
	11 " " '01	150,454	68,234	91,878	......	......
CLEVELAND, O. Eastern Ohio Traction Co.	1 m., Oct. '02	17,365	10,142	7,224	6,033	1,190
	10 " " '02	161,071	89,663	71,408	54,674	16,804
Cleveland, Elyria & Western	1 m., Nov. '02	27,924	16,745	11,180	......	......
	1 " " '01	21,125	12,370	8,756	......	......
	11 " " '02	276,135	154,830	121,300		......
	11 " " '01	229,858	125,768	104,085	......	......
	12 " Dec. '01	240,260	126,866	112,394	57,023	55,371
	12 " " '00	179,608	102,373	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Oct. '02	16,218	9,655	6,558	......	......
	1 " " '01	15,630	8,558	7,061	......	......
	10 " " '02	160,677	86,630	74,057	......	......
	10 " " '01	129,824	71,801	68,022	......	......
	12 " Dec. '01	161,971	*87,102	77,809	72,500	5,309
	12 " " '00	141,112	*69,592	71,520	72,500	1,980
COVINGTON, KY. Cincinnati, Newport & Covington Ry. Co.	1 m., Aug. '02	96,119	*53,205	42,923	22,288	20,565
	1 " " '01	74,586	*45,741	28,744	15,807	12,977
	8 " " '02	596,156	*314,125	282,17[illegible]	131,230	150,899
	8 " " '01	585,784	*327,615	268,169	125,328	82,841
DETROIT, MICH. Detroit United Ry	1 m., Nov. '02	290,734	*167,494	123,256	......	
	1 " " '01	254,867	*148,682	106,185		
	11 " " '02	3,177,845	*1793318	1,384,517	......	
	11 " " '01	2,787,730	*1531068	1,256,662		......
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Oct. '02	34,900	21,270	13,600	......	......
	1 " " '01	31,[illegible]	16,74[illegible]	14,261		......
	4 " " '02	172,527	96,176	76,351	......	
	4 " " '01	136,656	81,591	55,065		......
DULUTH, MINN. Duluth-Superior Tr.	1 m., Oct. '02	46,397	26,254	20,533	9,800	10,742
	1 " " '01	38,674	22,525	16,150	9,181	6,975
	10 " " '02	442,845	253,288	189,567	96,419	113,188
	10 " " '01	373,946	204,074	169,872	91,559	78,318
ELGIN, ILL. Elgin, Aurora & Southern Tr.	1 m., Oct. '02	33,648	21,041	12,607	8,333	4,274
	1 " " '01	28,578	16,964	11,614	8,333	3,280
	10 " " '02	341,880	200,145	141,735	83,333	58,391
	10 " " '01	304,144	170,289	133,855	83,333	0,522
FINDLAY, O. Toledo, Bowl'g Green & Southern Traction Co.	1 m., Sept. '02	24,289	13,173	11,116	1,991	9,125
	1 " " '01	15,853	11,067	4,786	645	4,130
	7 " June '02	142,106	76,226	65,880	28,989	36,890
	7 " " '01	105,329	67,679	37,649	20,732	16,898
HAMILTON, O. The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Oct. '02	41,747	22,645	19,099	16,512	2,587
	5 " " '02	226,242	113,854	112,385	81,758	30,642
LONDON, ONT. London St. Ry. Co.	1 m., Nov. '02	12,[illegible]	7,208	5,145	1,850	3,295
	1 " " '01	12,064	6,002	6,062	2,176	3,907
	11 " " '02	139,662	85,428	54,234	24,044	31,189
	11 " " '01	126,898	76,276	50,622	21,976	28,646
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Nov. '02	239,015	105,879	133,137	67,663	65,474
	1 " " '01	206,356	102,296	104,060	63,105	40,908
	11 " " '02	2,494,809	1,167,289	1,326,521	732,289	594,232
	11 " " '01	2,198,416	1,079,875	1,118,541	687,977	430,564
	12 " Dec. '01	2,442,312	1,185,581	1,256,731	755,189	501,609
	12 " " '00	2,290,698	1,199,787	1,090,911	804,063	286,847
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Oct. '02	304,317	140,226	164,091	60,353	103,537
	1 " " '01	270,962	118,054	152,908	58,163	94,734
	10 " " '02	2,971,411	1,331,545	1,639,866	590,967	1,048,899
	10 " " '01	2,611,118	1,166,902	1,444,216	561,437	882,779
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Oct. '02	181,403	96,418	84,986	15,962	68,995
	1 " " '01	166,061	85,210	80,850	15,384	65,466
	12 m., Sept. '02	2,046,329	1,135,136	911,082	......	......
	12 " " '01	1,900,690	1,105,277	795,413	......	......
NEW YORK CITY. Manhattan Ry. Co.	12 m., Sept. '02	11,663,348	5,543,206	6,038,181	2,712,090	3,326,062
	12 " " '01	10,455,872	5,325,649	5,127,223	2,683,122	2,444,091
Metropolitan St. Ry	3 m., Dec. '01	3,867,036	1,723,072	2,143,964	1,151,140	992,824
	3 " " '00	3,766,090	1,699,649	2,066,381	1,138,467	947,914
	12 " June '02	15,918,641	7,865,958	8,050,756	4,815,421	3,235,337
	12 " " '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y. Olean St. Ry. Co	3 m., Sept. '02	18,401	8,135	10,266	4,092	6,208
	3 " " '01	16,372	6,847	9,495	4,200	5,285
	12 m., June '02	56,063	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,758	9,032
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co	1 m., Oct. '02	9,023	5,706	3,317	2,093	1,224
	4 " " '02	37,686	21,580	16,110	8,333	7,777
	12 " June '02	86,795	*56,392	30,403	23,125	7,277
PHILADELPHIA, PA. Union Traction Co.	12 m., June '02	14,115,159	6,401,390	7,713,860	*6632781	1,079,088
	12 " " '01	13,431,061	5,836,166	7,595,494	*6734338	861,156
American Railways	1 m., Nov. '02	94,600	......	......	......	......
	1 " " '01	78,815	......	......	......	......
	5 " " '02	544,059	......	......	......	......
	5 " " '01	418,947	......	......	......	......
	12 " June '02	1,000,546	......	......	......	......
	12 " " '01	841,226	......	......	......	......
ROCHESTER, N. Y. Rochester Ry	1 m., Sept. '02	93,702	46,063	47,690	24,833	22,856
	1 " " '01	82,428	45,854	36,573	24,942	11,632
	9 " " '02	841,852	453,691	388,161	233,361	154,800
	9 " " '01	758,110	449,858	308,258	222,018	86,840
SYRACUSE, N. Y. Syracuse R. T. Co	1 m., Nov. '02	59,590	32,644	26,942	19,025	7,917
	1 " " '01	56,306	30,885	25,441	19,085	6,354
	4 " " '02	243,9[illegible]0	133,808	110,042	76,100	33,932
	4 " " '01	224,574	122,851	102,923	76,046	26,177
TOLEDO, O. Toledo Ry. & Lt. Co.	1 m., Oct. '02	124,498	60,494	64,004	38,833	25,171
	1 " " '01	114,669	54,617	60,050	37,813	22,237
	10 " " '02	1,193,546	607,072	586,474	281,541	304,933
	10 " " '01	1,073,768	515,304	558,264	339,543	218,721
	12 " Dec. '01	1,311,084	*636,407	674,677	415,109	259,568
	12 " " '00	1,102,517	*616,943	565,573	409,061	156,512
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	......	......
	1 " " '01	39,447	21,837	17,610	......	......
	7 " " '02	237,855	158,911	78,944	......	......
	7 " " '01	187,270	133,298	53,972	......	......
NEW BRIGHTON, S. I. Richmond Light & R. R. Co. (formerly Staten Island Elec. Ry)	3 m., Sept. '02	73,687	43,950	29,737	18,930	10,807
	3 " " '01	90,197	41,106	39,094	27,221	10,873
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co.	1 m., Oct. '02	41,494	*23,900	17,594	......	......
	4 " " '02	156,956	*86,940	69,016	......	......
	6 " June '02	198,050	*110,391	87,659	......	......

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Sleet and Third-Rail Operation

The recent experience of the Manhattan Railway in having its entire system practically tied up by a sleet storm has had a disquieting effect upon the community. Through misrepresentations of the sensational press the trouble experienced was magnified and distorted out of all proportion to its actual importance and significance. The real facts were bad enough, and an unfortunate combination of circumstances made them well-nigh intolerable, but a dispassionate review of the situation with a full knowledge of the conditions that obtained cannot fail to be reassuring, inasmuch as it shows that there is every reason to believe that the experience will not be repeated.

In the first place it may as well be frankly stated that the sleet storm found the company wholly unprepared to meet it; this fact admitted, no further explanation of the trouble is required by practical railway men, for it is recognized that to permit a sleet or snowstorm to gain headway generally means complete demoralization of traffic. But in justice to the management it may be stated that there were many extenuating circumstances, although naturally the public was in no mood to listen to explanations or give due consideration to excuses. It is only necessary, however, for the purposes of the present article to mention that the plans of the company for fighting sleet storms, as described in the STREET RAILWAY JOURNAL, Dec. 6, have since been put in operation, and the management is now convinced that no further serious delay or inconvenience will be experienced in the operation of the road from this cause.

It should also be thoroughly understood that the mixed service, which made the time interval between electric trains much longer than it would be if all the steam locomotives had been replaced by motors, permitted the third-rail at many points to become covered with a thin film of ice, and thus to be effectually insulated from the shoe. Just as soon as the motor car reached one of these points on the rail the flow of current was stopped and the train was brought to a standstill. If the shoe retained sufficient heat to melt the sleet from the rail and the motorman had not turned off the current the car would start with a jerk as soon as the shoe touched the rail, only to be brought to another stop when another covered portion of the rail was reached. With the entire road electrically operated and all the motor cars fitted with the track cleaning devices which are now being placed upon them it is believed that a repetition of these troubles will be avoided.

The means employed for removing sleet have been almost as numerous as the number of roads installed, but in the larger city systems, like Chicago and Boston, the companies depend almost entirely upon continuous service and the use of brushes and scrapers on the motor cars. The use of brine and oil have also been recommended as aids to keeping the sleet from adhering tenaciously to the third rail. In New York a solution of chloride of calcium is being used very effectively instead of brine. Both this material and the oil are sprayed on the rails by atomizers carried on cars especially fitted for this service. To be effective, of course, the oil should be used before the sleet gets on the rail, and the brine or chloride of calcium solution is put on to remove the sleet after it is on the rail. Being in an atomic spray there is no danger of its falling in drops on the street below.

One distinct difference between the New York construction and that in other cities is the use of guard timbers on each side of the third rail. These were installed to protect trackmen and others from accidental contact with the rail, and are undoubtedly a safety precaution of considerable advantage. It has been claimed that they add to the difficulty of keeping the third rail clear of snow and ice, and it is possible that this is the case. The present opinion, however, is that with the frequency of trains on the elevated, the detrimental effect of these timbers as regards snow and ice is slight if any. In Chicago, where no attempt is made to protect the rails, there has been no trouble whatever during the last three years from sleet, and none is anticipated. At one time the Lake Street L system in Chicago had protecting strips on

either side of the third rail similar to those employed on the Manhattan, but they were removed, and it is said that less trouble has since been experienced from sleet in the operation of this line.

It has been suggested that the third rail should be covered, or that it should be fastened so as to present a side contact, but numerous objections have been raised to both of these plans. Side contact could only be made by employing a spring to press the shoe against the third rail, and every railroad man knows that this would introduce many complications at switches and crossings, and might seriously impair the efficiency of the system. Protected third rail has been employed experimentally, but never on a large system nor upon an elevated structure, and it is contended that upon the latter in a driving sleet storm very little if any protection to the rail would be afforded by placing a board over it. On isolated sections, however, where the track was laid on the ground, this plan has worked very satisfactorily so far as sleet alone is concerned. But it has been found that snow will still drift and pack around the rail, and the ordinary form of contact-shoe will iron it down solid, and thus effectually insulate the shoe from the rail. To overcome this particular difficulty a special form of shoe has been tried on surface roads with a protected third rail for overcoming this difficulty. It consists of an iron bar about 15 ins. long, 1¼ ins. wide and ½ in. thick. Instead of making contact by crossing the rail at right angles this bar projects diagonally across the rail in the direction of travel, and thus forms a sort of a plow as well as a contact-shoe. Thus far no difficulty has been experienced with this device in operation at switches and crossings as might have been feared.

It seems to be the general consensus of opinion, however, among the men most experienced in third-rail operation that no protection is necessary in elevated systems where reasonable precautions are taken to prevent sleet from forming on the track, and where the interval between trains is as short as on the Manhattan Railway.

The Braking Problem

A pair of very interesting papers on this important topic have just been read before the American Institute of Electrical Engineers, and we earnestly commend them to the study of our readers. The first is a very lucid discussion of the general subject by R. A. Parke, taking up the principles of braking and their application in practice. The second paper, by J. D. Keiley, gives the results of a series of tests on electric cars with brakes of various types, the data being obtained by automatic recording mechanism that eliminated some of the sources of error usually found. Effective braking, as is now well understood, requires the application of power just insufficient to produce skidding of the wheels, and maintained at this point of efficiency as the car slows down. The change in the coefficients of friction forbids a constant brake pressure if the condition just mentioned is to be fulfilled, and the most recent types of air and electric brakes are designed to use a high shoe pressure at first, falling off gradually as the speed comes down. On account of its great facility in application and the ease with which this regulation of pressure may be attained, Mr. Parke strongly favors either the air brake, which can be manually controlled, or else the automatically-controlled magnetic track brake, which, in spite of obvious good qualities, has not yet taken a prominent place in electric railroading. In speaking of feasible brake pressures the interesting point is brought out that, with the use of sand on a slippery track, it is still possible to reach in theory, at least, a negative acceleration of about one-fourth gravity, that is about 5½ miles per hour per second. As this implies a corresponding thrust of one-fourth gravity on the passengers, it is safe to say that emergency stops at such a rate would never become popular. This possible figure of brake efficiency is considerably above safe practice, and it is, perhaps, fortunate that every-day brakes are far from attaining it. Mr. Parke does a good service in calling attention to the common fault of brakes in producing any unequal pressures on the front and rear wheels and in causing unpleasant vibration of the trucks. The common and simple forms of brake seem especially at fault in this matter, and it is safe to say that even hand brakes could be greatly improved by proper equalizing gear, suited to the special structure of the truck used. The track-brake Mr. Parke has little use for, unless in the electromagnetic form, and we think most practical street railway men will be inclined to concur.

On the working side of the electric-car braking question Mr. Keiley's paper is full of suggestive points. He worked with six different forms of brake, one being a late model of hand brake, the others power brakes of various sorts. The cars weighed about 18 tons, and were operated at speeds up to nearly 20 miles per hour. A large number of emergency stops were made and automatically recorded, and from the data thus determined Mr. Keiley has constructed a set of curves showing the characteristics of the various brakes employed. The most striking fact which appeared was, as might well have been expected, the great inferiority of hand brakes at anything above the most moderate speeds. For instance, at 15 miles per hour the car ran 152 ft. under hand braking, while the least effective of the power brakes stopped it in about 108 ft., and the most effective in 74 ft. At 20 miles per hour the hand-brake car ran 205 ft., and the best power brake brought it to a stop in 101 ft. In the rough, one would not go far wrong in saying that a first-class power brake will stop the car in about half the space required by the hand brake. But even among power brakes Mr. Keiley found considerable differences, and also found that redistribution of the pressure as between the front and rear wheels resulted in a very material improvement. Comparing Mr. Keiley's result with Mr. Parke's data it is interesting to note that the former's most effective power brake stopped the car in just about twice the space that would have been required by Mr. Parke's estimate of the best efficiency fairly attainable. This means a negative acceleration of 2½ miles to 3 miles per hour per second, which seems quite as great as is advisable in a passenger car, and greater than should be used except in an extreme emergency. One then reaches the interesting result, which current practice tends to confirm, that the best modern brakes will stop a car as quickly as it is safe to stop it under any ordinary conditions. If greater braking effect is demanded some means of protecting the live load must be devised. On the other hand, many of the brakes now in use fall far short of the permissible maximum efficiency, and are totally incapable of making a stop within a reasonable distance, save at low speed. With hand brakes the statement must be made still stronger. From Mr. Keiley's curves it is easy to deduce the result that if two cars were approaching each other on a single track, each running at 15 miles per hour, and through fog or curves got within 100 yds. of each other before knowing it, a serious collision must result in spite of all the hand brakes could do. There would really be no question of brakes being in order or not, or as regards their prompt application, for they simply would be inadequate. And it is correspondingly easy to see that even with power brakes a collision must result in a fog of any density. When interurban cars run at speed they must simply see to it that they have a clear track, for there is a limit to the capacity of even the best brakes.

Congested Traffic Conditions in Our Large Cities

The Merchants' Association and certain other public spirited bodies in New York have just commenced an active campaign to improve the condition of street railway traffic in New York, which is admitted by all to have become a very serious question. If taken up in the right way and if given popular support, a movement of this kind should be able to accomplish a great deal of good. We are heartily in sympathy with a campaign of this kind, and only regret that it was not commenced several years ago, in which case some of the conditions of which complaint is now made might possibly have been avoided. The street railway companies have done all that they can do by themselves to ameliorate the condition, but if they are now assisted by popular opinion

there is no doubt but that some improvement can be secured in a problem which is admittedly difficult and which at best is not capable of absolute cure.

The real trouble in New York, as in other large cities, is the fact that our large cities are not growing outward as rapidly as they are growing upward. The modern sky-scraper, besides revolutionizing city architecture, has complicated enormously the city transportation problem. The office building district below Fulton Street, in New York, for instance, contains perhaps four times as many tenants as it did ten years ago, and ten times as many as twenty years ago. Nevertheless, the streets are no wider, and although the railway companies have introduced improved motive power, which will care for some of the increased traffic which results from a twenty-story city, even electricity cannot do everything. The city authorities, on the other hand, have, up to this time, taken no steps to assist in a solution of the problem, and, with the single exception of the subway, whose capacity is limited, have refused to grant any more additional franchises in lower New York than when the average office building was only two or three stories in height. The result is that as most of the tenants of these buildings leave their work at practically the same time, or between 5 o'clock and 6 o'clock, the congestion is terrific.

Practically the same conditions exist, though at present to a somewhat less extent, in many of the residential districts and retail shopping districts in New York, where the modern apartment house or department store is replacing the single dwelling or individual two-story of our forefathers. Could the latter have foreseen the type of structures in which their descendants were to pass their days we trust that they would have made more and broader avenues of communication from one part of the city to another. But if, knowing the conditions, they did not, they would not have been any more unreasonable than our present day critical public, which complains about inadequate traveling facilities while doing its most to hamper those which exist.

Although the rearrangement of the streets of a city to secure more lines of track in each is out of the question, there are certain directions in which improvement can be secured. Whether they are made or not will depend on the public itself, and we sincerely trust that the crusade which is being inaugurated for improved transportation facilities in New York will bring about some reforms, the need for which is long outstanding.

Directions in Which Reforms Can be Secured

One of the most important steps for improving the situation which can be taken is in the direction of permissible speed. It has clearly been shown that placing more cars on the present tracks is simply out of the question, as, during the rush hours, when the greatest congestion exists, the tracks are now worked up to their capacity. Even in the non-rush hours it is very doubtful if additional cars, as suggested by the Mayor, would greatly, if at all, relieve the surface traffic situation. The fact of the matter is that the number of cars run during all business hours is very nearly the same, and the effect of the addition of more cars would be simply to reduce the speed at which those in operation could be passed any junction point. In other words, the "seat-miles per hour" would not be increased, and some other direction of improvement must be followed. There is no difficulty about a maximum speed in cities of 25 miles an hour, provided the tracks are kept comparatively clear of vehicles, and this speed is in regular use in many of the Western cities. But in the East, and particularly in New York, it is not at all uncommon for the trucks and drays habitually to use the part of the street covered by the tracks, and in this way hold back long lines of cars. If public opinion should decide that the tracks must be kept clear they would be kept clear, and it is up to the citizens of every large city where such a state of things exists to say whether rapid transit is of more importance to the business men and women who are on a dozen or more cars which are being delayed or to the case of dry-goods which is on the truck causing the obstruction.

Additional Routes Also a Requisite

Although an increase of speed would accomplish considerable relief in New York, it is not the only step available to improve traffic conditions. Additional routes of transit in the lower part of the city are absolutely indispensable. The new subway will help matters somewhat when it is finished, but its effect will not keep pace with the growth of the population, and more heroic measures are needed in addition. Both of the present New York transportation companies, the Metropolitan and the Manhattan, have been willing for a number of years to build additional routes, but their construction has been opposed by a community which has been particularly blind to its own interests. We hope, now the fact has become evident, that steps of some kind must be taken if people are to be transported between their offices and places of residence in ordinary comfort, to say noth.ng of safety. As long as ten years ago the Manhattan Elevated Railway Company presented to the city a plan for the construction of a number of additional routes, including a line extending the entire length of West Street on the North River front, and with two cross-town connections. But this plan, as well as attempts made by the Metropolitan Street Railway Company to secure additional trackage rights in the lower and other business parts of the city, have been continuously opposed for some inconceivable reason. If they had been granted the relief would long ago have been felt, and there would not now be occasion for the present agitation. We sincerely trust that the bodies interested in the present crusade will agitate the need of more and better transportation facilities, and will make their voices heard in municipal as well as legislative councils, so that New York city will soon have the additional elevated surface and underground tracks which are needed to carry its ever increasing population. The matter has already been delayed too long and action is imperative.

The record being made daily by the transportation companies of New York for their facilities is unparalleled in the world, and only those who are unacquainted with the conditions under which they operate could expect them to do materially better in caring for the traffic under the existing circumstances. A public hearing will be held at the City Hall at 10 o'clock next Tuesday morning, at which we hope the salient facts of the situation will be brought out and public recognition will be given to the efforts which are being made by the companies. When this is done the question of the best possible relief can be taken up in an intelligent manner.

The Mayor's Letter

A good instance of the lack of appreciation of the real condition of affairs was given last week in a letter sent by Mayor Low to the presidents of the Manhattan and Metropolitan Street Railway Companies suggesting certain changes by which it was thought that better service could be secured. In his letter to the Manhattan Company Mr. Low referred to the large traffic carried by that company during "Dewey Day," four years ago, and stated that he did not see why the company could not do as well every day. In reply to this suggestion Mr. Skitt pointed out the fact that the travel on the Manhattan system during the Dewey celebration amounted on the first day to 805,000, and on the second day to 836,000, "under conditions with which everyone in New York at the time is familiar. On Dec. 22 last the company without undue delay or risk of accident in the ordinary course of business transported 931,000 passengers." Other suggestions made by the Mayor were taken up in detail, and some reasons were given why the present operating practice of the company was the most efficient. Mr. Skitt believed, however, that when the present improvements, now under way by the company were completed, there would be a marked increase in the carrying capacity of the company.

Mr. Vreeland stated that the subject matter in the Mayor's questions was too broad to be discussed with the limits of an ordinary letter, but he promised to take the matter up at the meeting on Dec. 30.

Kingston Consolidated Railroad Company

Among the smaller street railway systems of the country, probably none has received the attention which has been directed to those in Kingston. Since the organization of the Kingston City Electric Railway Company, in 1892, the situation has attracted the notice of railway financiers, lawyers and engineers, and after passing through many vicissitudes, a unification has been perfected which places the Kingston system in the front rank of economically-operated roads. The street railways of Kingston date back to 1865, when the Kingston & Rondout road was built. The name of this road was changed in 1879 to the Kingston City Railroad. About 1892 the formation of a new electric system, known as the Kingston City Electric Railway Company, was projected. Steps were then immediately taken to electrify the Kingston City Railroad, which had been operated by horses. In 1894 the name of the new road was changed to the Colonial City Electric Railway Company, and began operation under that name. In 1896 the name was again changed to the Colonial City Traction Company. The two rival lines were constantly involved in legal proceedings, and fought each other with great animosity until 1901, when the Colonial City Traction Company bought out its older rival, the Kingston City Railroad, and the combination which is now in effect was made. The name of the unified system was changed to the Kingston Consolidated Railroad on Dec. 11, 1901, and in the past year remarkable results in operating, both from a financial and service standpoint, have been effected.

GENERAL VIEW OF PARK—ALBANY DAY BOAT AT PIER

A PLEASANT SPOT FOR PICNICKERS

One of the most interesting features of the fight between the rival companies was the litigation resulting from the efforts of the Colonial Company to secure the right of crossing the tracks of the West Shore Railroad Company on the line of its rival, the Kingston City Company. This was carried as high as the Court of Appeals, and was ultimately won by the new company. The important legal questions involved created much interest at the time. It was finally decided, however, by the new company, as the result of a compromise, that, instead of crossing the steam railroad tracks at grade, a subway should be built near the existing crossing. During the time of the litigation and the building of the tunnel the road was under the direction of C. Gordon Reel, as engineer and superintendent, and a reorganization committee, consisting of John I. Waterbury, Charles M. Preston and August Belmont, had the operation in their charge. These same interests now control the entire property, and although after the building of the tunnel Mr. Reel's services were dispensed with for a time, at the final consolidation last year he was recalled and now fills the position of general manager of the consolidated road. It is under his direction, therefore, that the work of improving the property during the last year has been carried out.

The city of Kingston is situated on the west bank of the Hudson River, the town of Rondout, which is part of the municipality, being directly on the water. Between the two sections there is comparatively little population, except along a narrow connecting strip. This makes, from a street railway standpoint, an ideal distribution of traffic. The line is single track throughout, a great advantage during the hard winter season, when a double track would make it almost impossible to keep the road open during the heavy snowstorms. The service is frequent, the turnouts

THE BAND STAND IN THE LAGOON

being arranged so that a possible schedule of ten minutes' headway can be made, and in ordinary operation that headway is maintained. Although a small amount of T-rail is used, by far the greater portion of the track is laid with 80-lb., 7-in. girder-rail made by the Pennsylvania Steel Company. A single trolley wire is, of course, used, the road having been built before it became customary to use two overhead wires, but a peculiarity of the construction is the stringing of a single guard wire about 2 ft. above the trolley line. This guard wire was put up with the original construction and has given good service in preventing telegraph and telephone wires from falling across the trolley wire.

The rolling stock consists of forty cars, fifteen closed, twenty-four open and a combination sprinkler and snowplow, most of which were built by the Pullman Company, and equipped with either Peckham or Diamond trucks. Although these cars are several years old, the careful attention that they have con-

stantly received has kept them in excellent condition. This is one of the principal features of the management's operating policy, great stress being laid upon efficient maintenance. Every year the cars are thoroughly overhauled and varnished, and once a day the brass work, even to the coverings of the controllers, is rubbed up. But little repair work is made necessary by this close attention to the apparatus, and a small shop in the car house is quite sufficient for the master mechanic's needs. A peculiar type of car has been operated for the last two or three years with excellent results. The amount of traffic in the old days, when the two rival roads were exerting every effort to attract passengers to their respective cars, was not sufficient to warrant the introduction of long cars, but the comfort of the cross-seat induced the Colonial Company to place this type of seat, made by the Hale & Kilburn Company, in an 18-ft. car. There are six seats on a side, and the three cars are probably the only ones of this type which are in service.

THE CASINO AND PIER

The power station has recently been greatly enlarged in capacity by the placing of two direct-connected units in the engine room, and the building of an addition to the boiler room. The former equipment consisted of two 150-hp horizontal tubular boilers and two belt driven 150-kw Westinghouse railway generators. These machines were driven by Ball & Wood tandem compound engines of 175-hp capacity, each running at 240 r. p. m., the speeds of the generators being, respectively, 550 r. p. m. and 625 r. p. m. The new direct-connected units which have been installed consist of 300-hp Ball & Wood tandem compound engines running at a speed of 200 r. p. m. This nominally high speed makes a very compact unit, and the 200-kw rating of the generators is very much exceeded in regular service. The engines have cylinders 14½ ins. and 28 ins. x 16 ins. stroke, operating under a steam pressure of 150 lbs. The generators are all rated at 550 volts, being over-compounded 10 per cent, but 575 volts is ordinarily carried on the board. A new switchboard has recently been installed, which is the latest type of Westinghouse design for railway service and is equipped with Westinghouse apparatus and measuring instruments. It is of the simplest construction possible, there being but two feeder circuits, and the four generators being all connected directly to the buses. The two feeder panels each contain one single-pole, quick-break feeder switch and an ammeter. The board is equipped with a Thomson recording wattmeter, which measures the entire output of the stations.

The new boiler equipment consists of two water-tube boilers of 302 hp each, built by the Babcock & Wilcox Company, of New York. These boilers are installed in a brick extension, recently built to the old boiler room, and a new stack has been erected between the new and the old boilers. This is a semi-self-supporting steel stack 6 ft. in diameter and 150 ft. high, and its erection necessitated the construction of new breeching for both old and new boilers. Along the side of the new boiler room a shed has been built about 45 ft. long x 25 ft. wide, with a capacity of 250 tons coal storage, which is sufficient for about forty days.

The feed pumps, condensers, feed-water heaters, etc., are placed under the engine room in a low-studded basement. This basement was originally intended to accommodate the auxiliaries for the two smaller machines, and considerable ingenuity has been shown in placing the entire equipment for the larger plant in the somewhat cramped quarters. Two feed-water heaters, of the American type, made by the Whitlock Coil Pipe Company, of Hartford, Conn., are used to raise the temperature of the water before it passes into the boilers. The distance to the feed pumps from the boilers, and the general lay-out of the plant made the installation of economizers in the flues out of the question, and the feed-water heaters are depended upon for this service. The primary heater takes exhaust steam directly from the engine and heats the water to a temperature of about 130 degs. F. The secondary heater raises the temperature to 216 degs. F. by the exhaust from the auxiliaries. Worthington condensers are used and Worthington pressure-pattern plunger pumps for the feed-water. Water for condensing and boiler purposes is taken from the Hudson River nearby. The steam piping is designed to

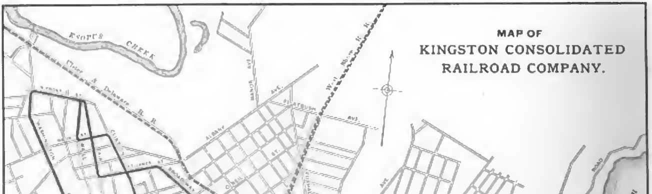
KINGSTON POINT PARK

amply meet all future requirements. It is made up with Van Stone joints, manufactured by the Walworth Manufacturing Company, of Boston.

KINGSTON POWER STATION

Outside of the basement a brick oil house has been constructed, the top of which is level with the engine room floor and forms a convenient landing stage for supplies. A steam railroad siding on the Ulster & Delaware system runs directly behind the power house, so that the facilities for receiving machinery and fuel are excellent. To improve the fire risk the oil house is fitted with solid doors and windows made of wood and covered with tin-plate sheets having lap-joints. A gravity oiling system is used in the engine room, oil being supplied from a tank under the roof. A rotary pump is used for forcing the oil from the filters in the basement to the reservoirs above, and a generous quantity is kept in continual circulation.

The management has given particular attention to the selection of its employees, and as the wages paid are higher than ordinarily found in towns of this size, it has succeeded in retaining on its pay-roll a most efficient force. The economical operation of the road is claimed to be due in a great measure to the co-operation of the men on the platform with the general manager in keeping up the high standard which the road has reached, and in retaining the commendation of the public. The thoroughness with which the equipment is overhauled and maintained, and the strictness with which the men are required to keep the appearance of themselves and the apparatus in condition adds greatly to the feeling of personal interest in the welfare of the road, and the management is sure of the support of its employees in any emergency. As an example of the feeling of esprit de corps among the men may be mentioned the fact that although no benefit association has been thought advisable, yet in case of illness or other trouble generous donations have always been made to those in distress by voluntary contributions. A thorough investigation is immediately made in case of accident, either to passengers or others, and during the past year a most remarkable showing has resulted in consequence. If it is possible to settle a case out of court it is immediately closed, but the company has been very successful in proving in its court cases that any



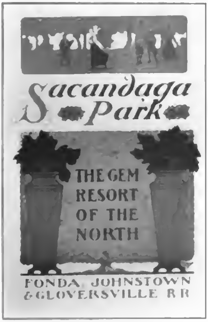
negligence shown has in general been on the part of the injured parties. During the last eleven months the damage account has been $136.

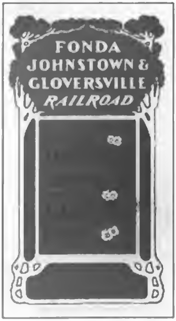
The consolidation has increased the net earnings something over $12,000 in the last eleven months. The percentage of operating expenses to gross earnings has been reduced from 68.11 per cent to 57.53 per cent, the latter figure being unusually low for a small system where satisfactory service is given.

A great source of revenue to the system is the operation of Kingston Point Park, a number of views of which are shown in the accompanying illustrations. This park is situated on a point of land running out into the Hudson River, and is probably one of the handsomest pleasure grounds in the State. Its natural attractions have been materially added to by the construction of appropriate summer houses and pavilions, and the general development of the grounds has resulted in many beautiful examples of landscape architecture. The class of patrons to the park is of the highest order, as it is essentially a resort for Sunday schools, Young Men's Christian Associations, and social societies and organizations. A large convenient hall, which seats 400 people, has been built on the grounds, which makes an ideal place for the holding of meetings of a literary or religious nature, and is largely used by organizations, which thus enjoy pleasant outings as well as instructive sessions at the summer meetings. A pier in the park is the landing-place for the Hudson River Day line as well as excursion boats, and many of the visitors to the park arrive in this manner. No charge is made either for trolley passengers, pedestrians, bicyclists or excursionists who arrive by the water to any part of the park. A handsome bandstand is built on an island in the lagoon formed by the pier, and band concerts are given afternoon and evenings. A large number of boats are owned by the company, and at 25 cents an hour prove a very satisfactory method of hearing the music as well as being extensively used at all times. A carousel and a restaurant where light refreshments are served are features of the park. A handsome station has been built at the end of the trolley track where seats are provided for those waiting to take the cars. Along the side of the track a series of beams, placed end to end, is laid to serve as an additional step to passengers alighting from open cars, which is highly appreciated by the patrons. This step can be seen in the view of the entrance to the park. Summer houses and walks are plentiful throughout the grounds, and in many places rustic tables and benches have been placed for the convenience of picnickers. The policy of the company in welcoming all to the park without restricting that right to trolley riders or direct patrons of the road has resulted in a general friendliness of feeling highly remunerative to the management. As much as $200 a day has been made on the "merry-go-round" alone, while the restaurant privileges bring in a handsome revenue without risk to the railway company. The traffic on special days and nights, when some extra attractions, such as fireworks, etc., are supplied, has been very great, but owing to the short haul and the maintenance of an accurate schedule crowds have been handled with satisfaction to all. On public holidays as many as 40,000 passengers have been carried in a city of 30,000 population. This percentage is surely remarkable. It is, of course, made possible by reason of excursionists coming into the park. The present plans for the coming year include important additions to the amusements in Kingston Point Park as well as improved facilities for handling the traffic, and there is little chance but that these figures will be largely increased during 1903. As an interesting street railway proposition, the Kingston road, as said before, has been observed for a number of years, and it is pleasant to note that at present the only features of interest which are found are the excellent way in which it is managed, and its bright prospects for future development. The present officers of the company are: Charles M. Preston, president; George Hutton, vice-president; C. Gordon Reel, general manager and chief engineer; G. B. T. Bow, superintendent; Augustus J. Phillips, secretary; Abraham Hasbrouck, treasurer; A. M. Day, auditor; C. J. McNellis, chief electrician; M. J. Sullivan, chief engineer of power station, and John Ryan, master mechanic.

Street Railway Traffic Circulars—III.

In the series of park circulars which have been published in this paper attention has been given so far to roads which might be termed of the largest class. These, it may have been thought by many, can afford to advertise and go to a greater extent into the business of publishing circulars than would be warranted in the case of a smaller company. An examination, however, will disclose the fact that probably more of the smaller companies have found it more profitable to issue circulars of this description than those who are operating in large cities. This is especially true of roads which make a specialty of the park business, and some of the circulars advertising parks on the electric railway lines are very artistic.





ARTISTIC COVERS FOR PARK CIRCULARS

The accompanying engravings show the covers only of three circulars of this kind. The first two of these were published by the Fonda, Johnstown & Gloversville Railroad Company, and the third by the Erie Traction Company. The first one of the series illustrated herewith is a small five-leaf circular, containing a time-table of the steam and electric divisions of the company and a map showing the route. The second is a much more pretentious circular, and is descriptive of Sacondaga Park, which is reached by the railroad company. It contains thirty-two pages, with tasteful cover, and is illustrated by small, attractive half-tone views of the park and its attractions. Both covers are printed in colors, in one case red and green, and in the second case red, green and brown, although this would not be indicated in the photographic reproductions.

This circular, entitled "The Edinboro Route," is a sixteen-page pamphlet, of which only the cover is reproduced. It is published

by the Erie Traction Company, of Erie, Pa., and is devoted particularly to describing the charms of Conneauttee Lake, at Edinboro, Pa., which is on the line of the company, and of Cambridge Springs, which is at the southern terminal of the road. The pamphlet also contains two maps of the route, one on a small scale showing the location with relation to neighboring large cities, like Buffalo, Cleveland and Pittsburgh, the other being on a larger scale. This cover, as well as those of the two circulars previously described, were designed by the Matthews-Northup Company, of Buffalo, who make a specialty of this kind of printing. The sizes of the circulars in the order in which they are described are 3¼ ins. wide by 6 ins. high; 4½ ins. wide by 7 ins. high, and 3½ ins. wide by 6¼ ins. high.

Chicago Experience with Sleet on the Third Rail

The Chicago elevated roads, having operated electrically for several years, have had considerable experience with battling with sleet on the third rail. While sleet is probably the worst enemy to the operation of a third-rail electric road that exists, it is not the bugbear to Chicago roads that it was in the early days of third-rail operation. The Metropolitan Elevated was the first to be equipped electrically, and General Manager H. M. Brinckerhoff, who has been connected with the road from the first, and has consequently had a large experience with third-rail operation, reports that his company has experienced no serious difficulty with any sleet storm for three years past. In that time there has been no sleet storm in Chicago which could not be taken care of by the steel brushes, which are carried fore and aft of each contact-shoe. About three years ago there was a very severe sleet storm, necessitating the use of scrapers in addition to the brushes. These scrapers were carried in advance of the brushes to break up the ice, and the brushes finished the job. They now form part of the equipment carried by each motor car.

Mr. Brinckerhoff thinks it possible that heavy sleet storms will be more troublesome in New York than in Chicago, although they are occasionally very severe in Chicago. The use of the protecting trough or guard on each side of the third rail on the Manhattan Railway in New York, which was required by the Board of Health, he considers will be responsible for much trouble in third-rail operation in sleet and snowstorms. The Lake Street Elevated Railroad in Chicago was once equipped with guard boards, but these were not a success.

Superintendent Headley, of the Lake Street and Northwestern Elevated Railroads in Chicago, has devised something for removing sleet which combines some of the features of both a brush and a scraper, and which has been put on all the cars of those companies. It is in reality a number of scraper blades cast into one solid iron back, and bearing on the rail in the same manner as a brush would. This was described in the STREET RAILWAY JOURNAL of Jan. 4, 1902.

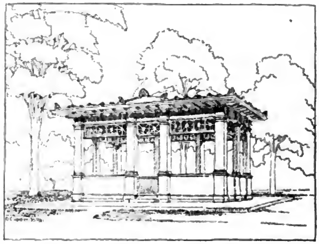
A sleet storm on an elevated road is very much like a snowstorm on a street railway. It must be battled with from the start, or scrapers and brushes are useless. All the elevated cars in Chicago during the winter season are equipped with sleet-fighting devices, which can be let down onto the third rail on short notice.

Interesting New York Traffic Figures

In an interview last week Oren Root, assistant manager of the Interurban Street Railway Company, of New York, made public some interesting figures in regard to the operation of cars on some of the main lines of that system. He stated the well-known fact that the maximum number of cars which could be operated on the longitudinal lines was limited by the number which could be passed the busiest cross street on that particular system. Thus the maximum number of cars on Broadway is the number that can be pushed past the most congested intersection, which is at the corner of Broadway, Sixth Avenue and Thirty-Fourth Street, where two north and south and one cross-town line intersect in a small triangle, and the records show that during the busy hours of the day 1150 cars pass that corner hourly, or an average of 192 cars per minute. The busiest double-track cross section on the system is at the corner of Fourth Avenue and Twenty-Third Street, where 900 cars per hour, or 150 cars per minute, are driven through the intersertion. According to Mr. Root the records are unequaled elsewhere, and the Interurban Street Railway Company has only been able to accomplish as much as it does by the most expert practice secured through years of operating under these conditions.

Unique Design for Shelter and Waiting Room

The Springfield (Mass.) Street Railway Company has adopted a new design for a waiting station for the accommodation of its patrons in West Springfield. A raised concrete walk, 5 ft. wide, surrounds the building, which is 17 ft. x 20 ft., outside measurement. The roof is supported by ten pilasters, and all the space between is occupied by windows and doors in winter, but they can be taken out in warm weather. The interior will be sheathed and



RUSTIC WAITING ROOM IN NEW ENGLAND

finished in North Carolina pine. A tin roof is provided, and there is an overhanging cornice, 3 ft. wide, supported by brackets of an attractive design. The roof is decorated by zinc crestings. The building provides a waiting room 15 ft. x 18 ft. and 10 ft. high, interior measurements. It will be heated by electricity. The estimated cost is $1,000. E. C. & G. C. Gardner, of Springfield, Mass., are the architects.

The accompanying cut, which is a reproduction of the architects' sketch, shows the building with the doors and windows out as it will appear in warm weather.

The Coal Famine in Detroit

Although the scarcity of coal suitable for car heating, and even for other commercial purposes, is being felt somewhat all over the country, Detroit seems to have been one of the worst sufferers in this respect ever since the beginning of the anthracite strike.

The Detroit United Weekly, which is found regularly on all the cars of the Detroit United Railway Company, graphically presents the situation to the patrons of that company in a few words of explanation, which doubtless go far to induce passengers to put up cheerfully with unavoidable discomfort, where otherwise they would be grumbling against poor management on the part of the company. One of the greatest values of a publication of the nature of the Detroit United Weekly is in keeping the public in touch with the efforts of the management to give the best service possible, even if through matters beyond the control of the management the service is not always perfect. Mr. Fry, assistant general passenger agent, who has supervision of this publication, and who many exhibitors at the last American Street Railway Association convention will remember with most cordial feelings, is to be congratulated on his efforts in the direction mentioned. The paragraph spoken of is as follows:

We are all having trouble with coal, or rather, without coal. One is having trouble to get it to sell and someone else to get it to burn. We are all involved, but the degrees of embarrassment vary. The man who needs a scuttlefull to start his fire is not up against it as hard as the man who needs 4 tons to start his fire, for the scuttle is easier to fill than the 4-ton wagon.

The Detroit United Railway needs 10 tons a day to heat its cars alone—300 tons a month. We burn about 1500 tons of coal in our cars between Nov. 15 and April 15. It is coming just as hard for us to get coal as for the man who starts his furnace with a scuttlefull and then goes up stairs to read the papers. It is coming very much harder for us to get coal, in that we need more. The coal dealer fills the scuttle before the wagon. We have fallen upon dinky lots of coal with the avidity of the hungry rooster upon the succulent worm. We have bought odd carloads, odd boatloads, odd pockets-full. We have used soft coal, coke and wandering fragments of anthracite. We are doing our best. That is all.

Railroad Car Braking*

BY R. A. PARKE

The special advantages of compressed air for the transmission of the power throughout trains of considerable length have established the air brake in a pre-eminent position. At first, the compressed air was stored in a reservoir upon the locomotive and, by means of a pipe, extending throughout the length of the train, and an operating valve upon the locomotive, it was conducted to the brake cylinder upon each car, by which the brakes were applied to the wheels, through the intervention of suitable rods and levers. The time required to convey the necessary volume of compressed air from the storage reservoir upon the locomotive to all the brake cylinders of even a comparatively short train, and the total disability resulting from rupture at any point of the air conduit, caused this form of air brake to be supplanted by the automatic air brake, in which an auxiliary storage reservoir, of sufficient capacity to operate a single brake cylinder, was added upon each car. Through the operation of a triple valve device, which connects the train pipe or air conduit, the auxiliary reservoir and the brake cylinder upon each car, admission of compressed air into the train pipe causes each auxiliary reservoir to become charged to operate the brakes, and discharge of air from the train pipe, from any cause, causes communication with the auxiliary reservoir to be transferred from the train pipe to the brake cylinder, whereby a corresponding quantity of compressed air is discharged from the auxiliary reservoir into the brake cylinder. By defining the reduction of pressure of air in the train pipe, the pressure of the brake-shoes upon the wheels may be graduated to any desired degree within the limit established by the ultimate equalization of air pressure in the auxiliary reservoir and the brake cylinder, and accidental rupture of the train pipe instantly operates to stop the train and to prevent further progress without effective repair. In any case restoration of the air pressure in the train pipe actuates the triple valve to re-establish access to the auxiliary reservoir, whereby it is recharged with air pressure, and to transfer communication with the brake cylinder from the auxiliary reservoir to the atmosphere, through which the brakes are released.

THE AUTOMATIC AIR BRAKE

When the automatic air brake became employed upon freight trains it was discovered that, in making a quick stop by venting the train pipe at the locomotive, the interval of time required to cause an operative reduction of the air pressure in the train pipe at the rear end of the train was so considerable that effective application of the brakes upon the rear cars was delayed until sufficient retardation of the forward portion of the train had become effected to cause a collision with the rear cars, which damaged and often disabled the cars and did violence to the lading. To remove this obstacle the automatic air brake became superseded by the quick-action automatic air brake, in which, when a quick stop is desired, each triple valve opens a vent in the train pipe, in addition to the vent upon the locomotive. By this means an operative reduction of the air pressure progresses throughout the train pipe, of the longest trains, with nearly the velocity of sound, and damage from the serial character of the application of brakes by compressed air becomes practically eliminated. Incidentally, also, in the local venting of the train pipe air at each succeeding triple valve, the utilization of this source of power, formerly wasted at the engineer's operating valve, was accomplished by conducting the vented air into the adjacent empty brake cylinder before it receives the ordinary supply provided by the auxiliary reservoir. Thereby the ultimate air pressure in the brake cylinder is augmented about 20 per cent, and the character of the application of the brakes in disaster-threatening emergencies is further distinguished from that in ordinary service, where neither the violence nor the power of the emergency application is desirable or even tolerable.

COEFFICIENT OF BRAKE-SHOE FRICTION

The early Westinghouse-Galton brake tests showed results which may be summarized as follows: The coefficient of brake-shoe friction decreases with increased speeds and, at constant speed, it decreases with the increase of the time that the surfaces are in contact. The coefficient of friction does not appear to increase with increased pressure per square inch. When the wheels roll without sliding upon the rails the rail friction (or adhesion) is unaffected by the speed, but declines greatly with sliding of the wheels when it varies inversely with the speed corresponding with the brake-shoe friction, but is much inferior thereto. The rail friction is very materially affected by the condition of the rail, being greatest when the rail is perfectly dry or very wet (as when washed by a hard rain) and least when the rail is quite moist; but, by the use of sand upon the rails, the effect of moisture is practically eliminated.

The actual variation of the brake-shoe friction with increased speeds is very regular, beginning with the friction of rest (static friction), and declining, very rapidly at first, but with continually decreasing rapidity, up to the highest speeds of the experiments. The undoubted fact that the friction cannot vanish for any finite speed, considered in conjunction with the peculiar character of the decline, suggested to the writer that the results of the experiments might be approximately represented by a portion of an equilateral hyperbola, so far as the maximum and mean values are concerned. The minimum values are too irregular to suggest more than a general inclination to decline as the speed is increased.

The decrease of the coefficient of brake-shoe friction from continued contact apparently follows the same character of law as does that from increase of speed; that is, the fall is rapid at first, but the rate of fall quickly begins to decline. It has been assumed that the decline of the friction is as the increase of the time of contact, but a careful analysis shows that it is a function of the product of the speed and the time, or of the distance through which the shoe rubs upon the wheel. The more recent experiments appear to show that, at the same speed, the friction becomes constant after a time, but it is probable that the coefficient of friction continues to yield to the influence of continued rubbing throughout stops from the highest speeds yet attained in practice.

Recent experiments have also shown very conclusively that, other conditions being the same, the coefficient of friction declines as the pressure increases, and, while insufficient data has yet been presented to determine the character of the decline, there are substantial reasons for believing that it follows the same character of law as do the declines from increased speed and extended rubbing contact.

COEFFICIENT OF RAIL FRICTION

The coefficient rail friction was found to vary for dry rails from .19 to .35, and averaged about .25. Upon wet or greasy rails, without sand, it fell to as low as .15 in one experiment, but averaged .18. With sand upon wet rails it never fell below .20, and rose in some cases as high as .40, so that, with the use of sand, the rail friction of a wet rail is at least equal to that of a dry rail without sand. When the brake-shoe friction overcame the rail friction and caused the wheels to slide upon the rails, the coefficient of rail friction immediately began to decline and then varied inversely as the speed, in much the same way as brake-shoe friction, but is much inferior thereto. This may be readily explained by the greatly reduced area of contact and consequent high pressure per square inch between wheels and rails. It may also, of course, be due in some measure to inferior fractional qualities of the steel wheel upon steel rails, as compared with cast-iron brake-shoes upon steel wheels.

CONDITIONS FOR MAXIMUM RETARDATION

The maximum retardation which may be utilized in stopping railroad vehicles by the customary means of brakes, is therefore that which is realized by so applying brake-shoes to the wheels that the resulting brake-shoe friction shall be uniform, and just insufficient to overcome the constant, static rail friction. If sand be suitably provided whenever the condition of the rail requires it, the coefficient of rail friction always available (unless perhaps in the case of railroads running in streets) is at least .20, and may doubtless be safely regarded, in at least all cases where emergency calls for the highest efficiency, as .25, of the pressure of the wheel upon the rail. A brake system of ideal efficiency in the time of necessity, is thus one in which the brake-shoes are so applied to the wheels that a retarding rail friction equal to one-fourth the weight of the train is instantly realized and continuously maintained throughout the stop. In such a case the retardation (ignoring the resistances of rolling friction and the atmosphere), is one-fourth the acceleration of gravity, or 8.04 ft. per second, which amounts to reducing the speed at the rate of almost $5\frac{1}{2}$ miles an hour per second. Stops would be made in a distance represented by $.1338\ V^2$, where V is the initial speed in miles per hour, or in 482 ft. at 60 miles an hour, 214 ft. at 40 miles an hour, and only $53\frac{1}{2}$ ft. at 20 miles an hour. The obstacles to the realization of a brake of such efficiency are apparent at once when the variable nature of the coefficient of brake-shoe friction is understood, and the difficulties which attend variation of the pressure of the brake-shoe upon the wheel to compensate for the fluctuation of the coefficient of friction, from the simultaneous operation of such complex influences, appear insuperable. But the problem is not entirely hopeless and it is useful to consider what has been and what may yet be done to increase the efficiency of braking.

* Abstract of a paper read at a meeting of the American Institute of Electrical Engineers, New York, Dec. 19, 1902.

VARIATIONS IN RAIL AND WHEEL FRICTION

In the outset, while at first glance the coefficient of static rail friction, which measures the maximum retardation, appears to be inflexibly established, such is not altogether the case. The inferiority of the coefficient of friction between the wheel and the rail to that of the brake-shoe upon the wheel must be attributed chiefly to the very great difference in the areas of the surfaces in contact and the consequent difference in the pressure per unit area. The convenient doctrine of Morin that the friction is independent of the area of the surfaces in contact has been the cause of much misapprehension and of many errors of construction. Mr. P. H. Dudley has clearly demonstrated that broad-headed rails yield a materially greater tractive power to locomotives than narrow heads, and it may be confidently assumed that any means of increasing the surface of contact between wheels and rails adds to the resistance which measures the maximum efficiency of the brakes. The theoretical line of contact between a wheel and rail broadens out practically into a somewhat pear-shaped surface, which differs in form and extent with different materials and pressures. The head of the rail is locally depressed and the circular periphery of the wheel becomes flattened, resulting in a surface of contact, the extent of which depends upon the elasticity of the materials, the diameter of the wheel and the forms of the rail head and wheel tread. It is evident that a greater contact area occurs with a large than with a small diameter of wheel, and it is equally clear that greater elasticity of material of either wheel or rail conduces to the same result. Steel is generally more elastic than chilled cast-iron, and recent observation indicates a higher coefficient of rail friction with steel-tired wheels than with chilled iron. It is true that, while such a result should thus be expected because of a larger area of contact, it may also be that the frictional qualities of the materials in contact constitute a factor of some importance. It has generally been understood that the dynamic friction of cast-iron brake-shoes upon chilled cast-iron wheels exceeds that of the same shoes upon steel-tired wheels. While this conclusion does not appear to have been actually established, yet, even if it be correct, it does not follow that the static friction of steel-tired wheels upon steel rails may not be greater than that of chilled cast-iron wheels. B t, whatever the fact may be in this respect, it is reasonable to expect that the most effective surface of rail contact occurs with large, steel-tired, straight-tread wheels upon broad rails, and, so far as our information yet extends, observation confirms this view sufficiently to warrant the statement that it is a matter of considerable importance.

DESIDERATA FOR EFFECTIVE BRAKING

The utilization of the retarding force available as rail friction, by means of brakes, involves the application of a brake-shoe pressure which shall (*a*) diminish as declining speed causes the coefficient of friction to increase, which shall (*b*) increase as increased distance of frictional contact causes the coefficient of friction to decline, and which shall (*c*), when diminishing or increasing for such purposes, further diminish or increase as reduction or increase of pressure itself causes the coefficient of friction to correspondingly increase or decline. The combined effect of declining speed and increasing distance is far from being uniform in stops from different initial speeds. The friction apparently declines from continued rubbing in about the same proportion, through a given distance—the first 100 feet of the application, for illustration—whether the initial speed is high or low; but the elevation of the coefficient of friction by declining speed during such first 100 ft. of application, is much less proportionally when the initial speed is high than when it is low. The two opposing influences are thus uniformly effective. In stops from low speeds the coefficient of friction increases, slowly at first and rapidly at the close, but continuously from beginning to end. At high speeds the elevating influence is proportionately less effective at first, so that, for a time, the friction remains about stationary, or even declines at first before becoming stationary; but it always subsequently arises with an increasing rapidity that becomes so great as to be almost abrupt at its termination. It is, therefore, a characteristic of all stops that the coefficient of friction is comparatively low during the early portion and much higher toward the close; and, while manipulation of the pressure to compensate for the compound fluctuation of the coefficient of friction appears hopelessly complicated, a partial realization of the efficiency of such an ideal brake system may be accomplished by employing a comparatively high brake-shoe pressure during the early part of the stop, and subsequently so reducing it that the high coefficient of friction near the end of the stop shall not cause the wheels to slide upon the rails. The provision of means by which this partial utilization of the advantage of compensating the pressure is practically realized constitutes the latest and highest progress thus far made in the practical development of the air brake.

In accomplishing the purpose of applying an increased brake-shoe pressure during the early part of the stop, the quick-action automatic brake has been modified by the addition of an automatic pressure-reducing valve to each brake cylinder, by the use of which a high air pressure is utilized in the brake cylinder in emergency applications of the brakes, and is gradually reduced to the level of that which, in earlier forms of the air brake, is maintained continuously throughout the stop without sliding wheels at the close. That material progress in braking is marked by this step will be easily appreciated when it is understood that, with the use of this apparatus, called the "high-speed" brake, stops from the higher speeds are about 30 per cent shorter than those attained by the quick-action brake. By the more prompt application of a greater brake-shoe pressure than immunity from injurious wheel sliding permitted in ordinary applications of the brakes, the "emergency stop" became clearly distinguished by the quick-action air brake, and, in passenger train service it was shortened to about 80 per cent of the shortest stop of the older automatic air brake. By the application of a greater brake-shoe pressure during the early period of stops for utilizing a larger proportion of the retarding force realized at lower speeds the high-speed brake shortens emergency stops from high speeds to about 70 per cent of those of the quick-action brake, or 56 per cent of those of the old automatic brake. The increased brake-shoe pressure is secured by the use of a high air pressure, which, through the operation of the automatic reducing valve, is available only in emergency applications of the brakes, the moderate pressures of the old automatic brake being still preserved in ordinary operation to prevent possible injury of wheels. But the higher storage pressure of the auxiliary reservoir air is equivalent to a correspondingly increased volume of air stored at the pressure of ordinary service, and thus the high-speed brake also provides for repeated brake applications without recharging the auxiliary reservoirs—an incidental advantage greatly increasing the security of trains under conditions of daily occurrence.

DIFFERENCES IN STEAM AND ELECTRIC RAILWAY BRAKING

It is opportune to digress at this point to consider an application of the high-speed brake which concerns conditions to which electric railroad operation is peculiarly adapted. Hitherto, the ordinary stops of railroad trains have generally consisted of a preliminary reduction of speed at a long distance from the stopping point, to bring the train under full control, and then of a gradual reduction of the remaining speed, continuously or in stages, to suit the conditions or the operator's views, until the train comes to a standstill at the stopping point. The stops of express trains have been infrequent, and the speed of way trains has been moderate, so that, in both cases, the time occupied in the stop has not called for careful consideration. But with the rapid growth of suburban traffic in all large cities, particularly since the introduction of electric railroads, the changed operating conditions of suburban trains give great importance to the time consumed in the frequent stops. Both in steam and electric railroad traffic of this kind large expenditures of thought and money have been made to secure high acceleration in starting trains, while almost nothing has been done to secure the equally important high retardation in stopping. Every start is accompanied by a stop, and if economy of time is important in one it is equally important in the other. The neglect which efficiency of stopping has suffered is doubtless due to the fact that, while acceleration in starting has generally been limited to that which may be acquired from the rail friction of a few wheels, the retardation resulting from brakes upon practically all the wheels is so effective in comparison that its inferiority to what it might be is overlooked. Moreover, the character of the train stop of ordinary service has been so firmly established and avoidance of the use of full power—the emergency application—of the brake has been insisted upon for such good reasons that departure from the customary "service" application of the brakes does not readily suggest itself. But the conditions now under consideration are quite different. At low speeds the violence of the emergency application is apt to result in discomfort to passengers, and the brake-shoe pressure is too near the wheel-sliding limit to be desirable. But at the high speeds attained between stations in efficient suburban service the initial coefficient of brake-shoe friction is so low that no perceptible shock or disagreeable effect accompanies an emergency application of even the high-speed brake; and the coefficient of friction near the end of the stop is so much lower, through the effect of continued rubbing through so much longer distance than in a stop from the lower speeds, that the danger of wheel sliding is not troublesome.

There is also another important time-saving feature of the

emergency application for service stops in train service of this character. In making an ordinary service application the personal equation of the operator is an important element. The proper point at which to apply the brake, the force of initial application ano each subsequent increase or reduction of the braking force (to prevent over-running or stopping short of the station) are matters of personal judgment in which men differ materially; the consequence of which is that, to be safe, the brakes are usually applied too early and time is lost in drifting into the station at low speed. In an emergency application the personal element is largely eliminated, as the full application is practically instantaneous, and, where definite speed may always be depended upon, the point at which the brakes should be applied may be designated by a signal post. Thus, full speed might be obtained over much the larger part of the distance traversed during an ordinary service stop, followed by a quick stop of the high-speed brake, and fully half the time occupied by the service stop would be saved.

EFFECT OF BRAKING ON THE PRESSURE OF THE WHEELS ON THE RAILS

In utilizing the rail friction for the retarding force, while it has the proper direction, it is applied at the lowest points of the mass of the car. In consequence the center of inertia of the car body being above the points of application of the retarding force, rotation through the eccentrically applied retarding force is prevented only by the resisting rotative moment of a greater supporting pressure from the forward than from the rear truck. Each truck is subject to the combined rotative moment of the eccentric retarding force at its lower extremity, and the eccentric reacting force from the car body at its upper extremity, and rotation is prevented only by a contrary rotative moment of a greater supporting pressure by the rails upon the forward than upon the rear pair of wheels. Thus the very act of applying the brakes to the wheels produces a new and very different system of wheel pressures upon the rails, and it is the wheel pressures under those conditions which determine the available retarding force. As the total pressure of all the wheels upon the rails cannot vary it is obvious that the existence of a greater rail pressure for the forward than for the rear pair of wheels of the truck implies the virtual transfer of a portion of the normal pressure from one pair of wheels to the other. The brake-shoe pressure upon the rear pair of wbeels must be insufficient to cause the wheels to slide upon the rails, and must, therefore, be cut down in proportion to the transfer of weight from the rear to the forward pair of wheels. But as the forward pair of wheels will become the rear pair when the car moves in the opposite direction, the brake-shoe pressure upon that pair of wheels must also be limited in the same way. Thus, the braking pressure upon each pair of wheels must be restricted to correspond with the minimum pressure of the wheels upou the rails, and wheu it is understood that this minimum rail pressure, which occurs in the maximum application of the brakes, is less than 85 per cent of the uormal, or, iu other words, that the effective wheel pressure, available for braking, of an ordinary eight-wheeled passenger car is but 85 per cent of the weight of the entire car, the importance of an investigation and of the provision of means to compensate for such a serious loss of retarding efficiency becomes clearly manifest. [A solution of this problem, devised by the writer, was submitted, in which a formula was given representing the greatest wheel pressure which can be applied to each wheel of an eight-wheel car without sliding any of them.]

METHOD OF PROPORTIONING BRAKING PRESSURES TO CORRESPOND TO RAIL FRICTIONS

A means of automatically proportioning the brake-shoe pressure upon the forward and rear wheels of the truck so that they should more nearly correspond to the respective rail friction equations is then important. A method of accomplishing this is through the angularity of the hanger link, by which, if the brake-shoes be applied upon the inner face of the wheel—that nearest the center of the truck—and the hanger link supporting the brake-shoe be inclined at a proper angle with the tangent to the wheel at the center of the bearing surface of the brake-shoe, the brake-shoe pressure is proportioned to the wheel pressure. This matter merits very careful consideration.

More as a matter of convenience than for any other apparent reason it has generally been customary in passenger car construction to suspend the brake-shoes from the end timbers of the truck at the outer face of the wheels. It is true that the brake-shoes are thus more accessible for renewals, but the arrangement is inconvenient in other respects, requiring the disconnection and often the removal of the brake beams to remove the wheels. The application of the brake-shoes at the outer face of the wheels results in an upward thrust of the brake hangers, proportioned to the brake-shoe friction, upon the end timber at the rear end of the truck, and a corresponding downward drag upon that at the forward end. It has already been shown that the retardation of the car by the rail friction produces a rotative effect upon the truck, which is greatly augmented by this direct action of the brake-shoe friction through the hanger links, and the result is that a considerable rotation or tilting of the truck frame actually occurs, compressing the forward equalizing bar springs and relaxing those at the rear. The reaction or recoil of these springs is the cause of the frequently observed violent backward surge or shock, so disagreeable to passengers and sometimes throwing unguarded standing persons to the floor at the instant of stopping. If, however, the brake-shoes were suspended at the inner face of the wheels the upward thrust of the hanger links would act upon the forward portion of the truck frame and the downward thrust upon the rear portion, so that the effect would be to counteract and neutralize instead of aggravate the disagfeeable influence of the rail friction.

Another and still more serious objection to this method of suspending the brake-shoes is the evil effect of the angular inclination of the hanger links, which is not only desirable to insure clearance of the shoes from the wheels when the brakes are released, but is usually unavoidable for constructive reasons. This feature will be better understood upon further consideration of the effect of inclining the brake beam hanger links. On the other hand it can be shown mathematically (see paper) that by hanging the brake beams between the wheels, instead of outside, and inclining the hanger links at a proper angle. The increased pressure and consequently the increased friction of the brake-shoes upon the forward pair of wheels and the diminished pressure and frictiou of the brake-shoes upon the rear wheels, due to the effect of the friction itself in causing the shoes to press more or less forcibly upon the wheels through the angularity of the hauger links, are made to correspond with and compensate for the transferred weight from the rear to the forward wheels. In the same manner that running in the opposite direction causes a reversal of the conditions for the transfer of weights; so, too, the rotation of the wheels in the opposite direction causes a reversal of the effect of the inclined hanger links, and the increased brake-shoe pressure is always applied to the wheels carrying the increased weight. The braking force P upon the brake beam must, however, be so reduced that the rear pair of wheels shall not be caused to slide, and the combiued friction of the brake-shoes upon the two pair of wheels be thereby reduced accordingly. The loss of more than 15 per cent in braking efficiency, which has been stated to result from the use of a uniform brake-shoe pressure instead of pressures proportioued to the rail pressures occurs when the hanger links are not inclined, but it will now be understood that, with outside-hung brakes having the ordinary inclinatiou of hanger liuks, the loss is considerably greater, the retardation probably averaging at least 20 per cent below that attainable by the expedient of inside-hung brakes with properly inclined hangers.

In practice the application of this method of inclined hanger links is not without some difficulty. The chief trouble is that no constant angle of the links can be maintained, as the wearing away of the brake-shoes, together with wearing and turning down of the tires of steel-tired wheels, causes constant and considerable variation. Thus, if the angle of inclination and the braking pressure be calculated for the conditions existing when the brake-shoes and wheels are new, the increased angle when the shoes become much worn and the tires have been well turnd off, would probably cause the forward wheels to slide upon the rails. On the other hand, if the calculations be made for turned wheels and worn shoes, the efficiency is too much reduced when the wheels and brake-shoes are new. It is, therefore, necessary to compromise between the extremes, in reference to the angle of inclination of the hanger links. It is obvious that the variation of the angularity of the hanger links, through the allowance necessary for wear (2¼ ins. for steel-tired and 1¾ ins. for chilled cast-iron wheels), is an inverse function of the length of the hanger link itself, which should therefore be as long as practicable. With the use of that form of brake-shoe holder or head in which the hanger link pin is located behind the center of the brake-shoe, the maximum length of hanger is secured. The form of brake head in which the pin is considerably above the center shortens the hanger materially, and its use should be avoided.

The equation deduced (and contained in the original paper) shows that the angle of inclination of the hanger links varies inversely with the wheel base of the truck, which is fortunate, since long wheel base is desirable also in all other respects (ease of riding, minimum wear and tear of wheel flanges and truck frames, etc.), except in cases where curves are so sharp that a long wheel base interferes with curving.

FORMULA FOR MAXIMUM BRAKING FORCE

Examination of the practice in passenger-car construction of ordinary American steam railroads indicate quite general uni-

formity in respect to most of the various features which determine the angle of inclination of the brake hanger link and the braking force. In general, for practical purposes, the average of the conditions existing is sufficiently accurate, and may be taken as follows: The coefficient of rail friction may be regarded as $f_1 = .25$, particularly as the limiting conditions are those of emergency applications. The coefficient of brake-shoe friction most apt to slide wheels is that of low speeds, near the end of the stop, and experience indicates a safe value to $f_2 = 1\text{-}3$. Little error will, in any ordinary case, result from making W_1 (weight of car body) $= 2\text{-}3\ W$ (total weight of car) and W_2 (weight of each truck) $= 1/6\ W$. Generally, h (height of bottom of car body above rails) $= 34$ ins., and $k/l = 1/15$, k = height of center of inertia of car body above truck support; l = distance apart of truck supports. The height of the center of gravity of the truck (d) varies with the diameter of the wheels; for 33-in. wheels, $d = 20$ ins.; for 36-in. wheels, $d = 20.5$; for 38-in. wheels, $d = 21$; for 40-in. wheels, $d = 21.25$, and for 42-in. wheels, $d = 21.5$; the weights of wheels (w) differ both with the diameter and the construction; a fair average appears to make $4.8\ w = .071\ W$ for 33-in. steel-tired wheels, .080 W for 36-in., .089 W for 38-in., .094 W for 40-in., and .098 W for 42-in. With these values (except those depending upon the diameter of the wheels) the maximum braking force, as ordinarily calculated, which may be used without injurious wheel sliding, becomes

$$B = \frac{15\,(1 + 4.8\,w/W)\,(1 - 1/g \tan^2\phi)\cos\phi}{16\left\{\frac{46}{45} - \frac{68 + d}{66} + 1/3\,\frac{(1 + 4.8w)}{W}\tan\phi\right\}\cos(a + \phi)}\,W$$

ϕ = angle which the link hanger makes with the tangent to the wheel at the center of the brake-shoe when the brake-shoe and wheel are fully worn, and a = angle between the radial direction of the brake-shoe pressure and the horizontal with worn shoe and wheel.

BRAKE-SHOE RELEASE SPRINGS

In which it would be a serious oversight to dismiss this subject of truck brake gear construction without mentioning the pernicious break beam release spring. The custom of hanging b ake beams from the end timbers of passenger-car trucks has been attended—in the many cases where the inclination of the ranger links is insufficient to cause the brake beams to fall away from the wheels by gravity—by the necessary use of springs to insure clearance between brake-shoes and wheels when the brakes are not applied.

The loss of brake-shoe pressure from the use of such springs might, of course, be readily compensated by increasing the braking force correspondingly, if such loss could be determined. But these springs vary to such an extent, even when made apparently alike and applied in the same way, that allowance for their influence is well-nigh impossible. Springs, so applied to trucks that they should keep the shoes uniformly away from the wheels, are found to operate so unevenly that—to prevent the brake-shoe at one end of a beam from dragging upon the wheel—that at the other end must be permitted to stand off so far from its wheel that excessive travel of the brake-cylinder piston is necessary to apply the brakes, whereby the air pressure in the brake cylinder is reduced and the efficiency of the brakes correspondingly impaired. Even if these springs were so constructed and applied that they exert a uniform influence upon the brake beams, the inequalities of brake-shoe material cause them to wear unevenly so that a new shoe at one end of the brake beam is often accompanied by a considerably worn shoe at the other end, and adjustment of clearance that will avoid excessive piston travel at the brake cylinder is impossible. The impossibility of adequately measuring and providing braking force for the resistance of these springs, added to the loss of efficiency from excessive piston travel or the alternative trouble from dragging brakes, renders the brake-beam release spring one of the most serious evils of modern brake practice. By the use of inside-hung brake beams, where sufficient inclination of the hanger links insures brake-shoe clearance through the action of gravity, both the expense and trouble due to the release springs is avoided.

THE BRAKING APPARATUS

To enter into the detail of the air-brake apparatus employed to furnish the braking force, in a paper of this character, would unduly extend it and would also be a work of supererogation. The compressed air supply generally implies a suitable compressor upon the car, or, if operated in trains, one or more upon each train. Storage of the compressed air in sufficient quantity has, however, been satisfactorily accomplished in some cases and possesses certain advantages. The air is usually stored at a comparatively high pressure (generally 150 lbs.) in large reservoirs secured beneath the car, or in any other convenient place. It is delivered through a reducing valve into the "main reservoir" of brake operation, at the desired pressure, where it is handled in the ordinary manner. In such a system a single air compressor of large capacity and high efficiency, compresses the air at a station where it is stored and charged into the car storage reservoirs from time to time. The advantages lie in avoiding the cost of installing and maintaining compressors upon all the cars, and in cheapness of operation. The disadvantages consist of the bulkiness of the storage reservoirs and the time reqnired to stop and charge them, and also the limited distance that may be traversed in the intervals. Where the air is compressed upon the car, the compressor must be accessibly constructed and placed upon the car, and supplied with clean, dry air. It may be operated by steam, by a separate electric motor, or by the car motor, through suitable connection with the car axle, as circumstances render it expedient. Its operations should be so controlled by a governor that it shall cease whenever the maximum storage pressure has been attained in the main reservoir, and shall be renewed when operation of the brakes has reduced the storage pressure to the inferior limit.

Upon the motorman's operating valve the satisfactory operation of the brake system in large measure depends. It must not only present the means of accurately gaging the force of brake application and of promptly releasing the brakes, but must also define with precision the pressure of the air with which the auxiliary reservoirs are charged, to insure the full efficiency of braking without exceeding it to the injury of wheels and detriment of efficiency; while at the same time it must provide a superior pressure, that may vary considerably under different conditions, in the main storage reservoir, to insure prompt release of the brakes and restoration of pressure in the auxiliary reservoirs, without any variation of the working pressure in the latter—an exacting combination of conditions not easy of realization but of capital importance.

Of the apparatus for the immediate application of the brakes to the wheels sufficient has already been said, it having been indicated that, in the single case where the unit invariably consists of a single car, simply an air cylinder in communication with the motorman's valve meets all the requirements, while the conditions of every other case justify nothing short of the efficiency of the quick-acting automatic apparatus, and, where characterized by high speeds and frequent stops, the superior efficiency of the high-speed brake is essential to high efficiency of service.

OTHER FORMS OF BRAKE

The application of other forms of power than compressed air to brake service has been practically limited to the vacuum and electricity. The limited pressure and bulky apparatus have restricted the use of the vacuum to comparatively light vehicles, and it is fast becoming a mere historical feature of the development of the art of braking. Electricity has been experimentally applied in various forms of apparatus, but has only recently become recognized as a means of promising utility in practical braking. The simplicity of employing the back torque of the car motors of electric railroads for retarding purposes has appeared very attractive to those unacquainted with the objection to dependence upon that means alone. In combination with other means of retardation, so that excessive heating may be avoided, this means of braking cars has been used with some practical success. But the application of electricity to the purpose of braking that appears to overshadow all others is that of the magnetic brake, which embodies such novel applications of old devices, with results so phenomenal that the use of electricity as the source of braking force in electric railroad service at once occupies an interesting position with a very promising future. [The writer then referred to the magnetic track brake, which has been described in these columns.]

Car License Fees Decisions in New York

The Appellate Division, by Justice Ingraham, holds that the complaint in the action brought by the city against the Third Avenue Railroad Company and the Metropolitan Street Railway Company to recover car license fees aggregating $25,750, due from the former company to the city during the years 1894 to 1899, did not state facts sufficient to constitute a cause of action as against the Metropolitan Company. A judgment of the Supreme Court overruling the Metropolitan Company's separate demurrer to the complaint is therefore reversed. The lease of the Third Avenue Railroad Company to the Metropolitan Street Railway Company turned over all the railroad property "subject to all debts and liabilities" of the lessor, but with no provision imposing upon the lessee an obligation to pay such debts and liabilities.

"The Third Avenue Railroad Company," said Justice Ingraham, "is not dissolved or merged with the Metropolitan Street Railway

Company, but is an existing corporation liable for its debts and obligations. The Metropolitan Street Railway Company did not assume the payment of the debts, but accepted a demise of the property subject to the debts and liabilities of the lessor corporation."

Another car license fee case brought by the city against the Sixth Avenue Railroad Company, the Houston, West Street & Pavonia Ferry Railroad Company and the Metropolitan Railway Company has also been decided adversely to the municipality. In that case it appeared that the Sixth Avenue Company had leased its road to the Houston & Pavonia Ferry Company, and that the latter was subsequently consolidated with the Metropolitan. There the Sixth Avenue Company was to pay a license fee for "each passenger car to be used on the said road." The court decided that when the Sixth Avenue ceased to operate its road, leasing it and its franchises to the Houston, West Street & Pavonia Ferry Railroad Company, it in fact ceased to use cars. The judgment, so far as it overrules the separate demurrer of the Metropolitan, is, however, affirmed.

The Appellate Division has decided that as to the Twenty-Third Street Railway Company no license fees can be collected by the city. The franchise of that road was purchased from the city at auction under authority of a law passed in 1869 for $150,000. No condition as to license fees was incorporated in its charter.

Some Brake Tests and Deductions Therefrom*

BY J. D. KEILEY

In the braking of elevated and light interurban cars or trains, the problem has, of course, been changed from the conditions of locomotive traction to the conditions of electric traction with distributed motors. In the former we have slow acceleration to comparatively low maximum speeds, and the braking of light cars with maximum passenger load equal to 60 per cent or 70 per cent of weight of cars, and in the latter case the motors are carried on the passenger trucks, with armatures geared directly to axles, where we find rapid acceleration to high maximum speeds, and the braking of cars with maximum passenger loads equal to but 45 per cent or 50 per cent of the weight of cars. The rapid acceleration and high maximum speeds with very efficient braking make possible high schedule speeds under conditions of frequent stops. A concurrent condition, in many instances of the first importance, is the relation between effective braking and liability to accident. Notwithstanding these changes in mechanical limitations and operating requirements, many small electric railroad companies, and even many very large systems, have apparently been satisfied with old apparatus and have continued to use the single floating lever (or sway bar) inherited from horse-car practice. Another class of users has, at great expense, equipped the cars with novel and complicated apparatus, to be used in developing greater force for the application of brake-shoes to wheels than could be produced with similar dispatch by human muscular effort when applied to brake wheels or crank handles. A third class of users and a large class of investigators have endeavored to effect the retardation of cars by other means than friction between wheel and rail, set up by the pressure of brake-shoes upon wheels.

A class of braking which is of the first importance on account of the very large number of cars in service and the magnitude of the accident liability affected by them each year, is the emergency braking of cars of from 15 tons to 25 tons weight (including passenger load), from speeds which are under 30 miles per hour. This class of brake service is clearly different from what is commonly known as "high-speed" braking, and requires for its accomplishment a different sort of apparatus. Consider, for instance, the case of a double-truck electric car used in city, suburban or interurban runs, or for all three classes of service collectively. This is a very ordinary case, and perhaps the most exacting requirements on the braking apparatus of such a car are those met with in the city or suburban runs, where cars are operated over public highways and unprotected crossings at comparatively high speeds. Under these conditions emergency stops must often be made, and a braking apparatus is required which is able to stop a car that is moving at a rate varying from 15 miles to 30 miles per hour, and in the shortest possible distance after the motorman receives notice of the necessity to check the speed.

Such cars are frequently equipped with merely a hand brake and a single floating lever (giving anywhere from 25 per cent to 40 per cent excess brake pressure on the rear brake); with a hand brake and some system of equalizing levers; with air or other power brake and equalizing levers; or with some power brake in which, in addition to the friction between wheels and rails, as introduced by a rail-shoe depending for its friction either upon a portion of the weight of the car, an entirely separate frictional force is set up by electromagnetic action between the rail-shoe and the rail. None of this apparatus, except, perhaps, the last mentioned, exhibits any marked advance over the braking of cars used in locomotive traction in city or suburban service.

No attempt will be made in this paper to give a comprehensive summary of the principles and theory, distribution of pressure between trucks or wheels or the design and construction of foundation rigging or truck rigging. It will contain a brief statement of certain methods which have been used in the determining for an electric traction company the relative merits of several types of power brakes.

In designing new or investigating existing brake apparatus the identity and relative importance of the several consecutive events which occur in the stopping of a car under ordinary conditions should be fully considered. It was thought desirable in the brake tests described below to plot accurately a curve sheet, such as is shown in Fig. 1, where the distances in which a car can be

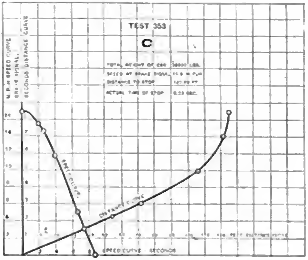


FIG. 1.—TIME AND DISTANCE CURVES FOR EMERGENCY STOPS

brought to a stop from different speeds at brake signal, are shown graphically for the brakes under consideration, as this is the first question usually asked concerning the performance of a brake. A curve sheet was worked up for each braking test, and a specimen of these sheets for individual stops is shown in Fig. 1. A considerable number of individual sheets were worked up for each type of brake tested, and from these sheets were determined coefficients or equations of curves of comparison, as shown on chart, Fig. 2.

Specimen speed-time and distance-time curves for emergency stops (Fig. 1) were made for six different types of brakes. Fig. 3 is a diagram showing the method of obtaining accurate measurements of the distance required for stops. Fig. 2 is a comparison chart showing stops from speeds of 12 miles per hour to 18 miles per hour, with six different brakes. In Figs. 5 and 6 the recording apparatus used in these tests is illustrated.

The following method was adopted to secure the requisite data for plotting these curves:

In all tests the same type of car was used, mounted on similar trucks, and all cars were put in as nearly the same condition as possible and loaded to the same gross weight by an amount equivalent to a heavy passenger load. The cars were run in the same direction over the same section of track on a uniform grade, wind and humidity conditions being as nearly uniform as possible, and great care was taken to determine with accuracy in each case the speed of car at brake signal and the actual distance traversed between brake signal and the stopping of the car. An axle of the car was fitted with a drum carrying a contact plate, which momentarily closed a battery circuit once in each revolution; this circuit energized an electromagnet operating one or two recording pencils, under which a strip of paper was drawn at uniform speed by a very accurately adjusted spring motor. The operating magnet of the other pencil of the two above-mentioned was energized by a circuit which was closed every half second by a contact maker actuated by a carefully adjusted clock movement.

* Read at the 171st meeting of the American Institute of Electrical Engineers, New York, Dec. 19, 1902.

It will be readily seen that with this apparatus a record sheet could be obtained that would contain a clear record of wheel revolutions. From this the number of revolutions during any interval or the duration of any particular wheel revolution could be determined with great accuracy; the method of using this apparatus to obtain the data desired was as follows:

DIAGRAM SHOWING METHOD OF DETERMINING DISTANCE FROM BRAKE SIGNAL TO STOP

When the arrow mark on wheel is in contact with rail, the revolution counter circuit is closed by contact on axle. Each run started with this mark in contact; at stop the point of contact between wheel and rail was marked on rail, and the car rolled on until the arrow mark on wheel again came in contact with rail, giving the final fractional part of a revolution to be used in getting the total length of run by wheel revolutibns, which was subtracted from the length of run by tape measurements to get the distance skidded.

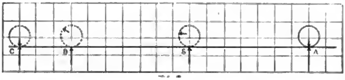


FIG. 3.—METHOD OF OBTAINING ACCURATE MEASUREMENT OF DISTANCE REQUIRED FOR STOPS

A—Position of wheel at start.
B—Position of wheel at stop.
C—Position to which wheel was rolled to get last fractional part of a revolution.
S—Point at which brake signal was given, determined by record of revolution counter.
A B—Tape measurement; total distance run.
A S—Computed from revolution recorder.
A B—A S = Distance to stop = S B.

The car was placed near the starting point and moved backward or forward until the contact on the axle drum was closed, then the point of contact between the wheel and rail was chalk-marked both on wheel and rail. Then the record paper was put in motion, the car started and brought up to speed very gradually to avoid the possibility of slipping of the wheels. When the desired speed was attained an electric bell was rung as a signal for an emergency stop. The circuit of this bell traversed the operating magnet of the chronograph pencil, and by drawing this pencil farther than it was ordinarily drawn by the clock circuit, produced a clearly defined record of the exact time at which the signal bell was rung. When the car was brought to a full stop, the bell was rung again in order to make a record of the time elapsed between brake signal and stop. The position of the point of contact of the front wheel was then carefully marked on the track and the car moved slowly along until the first chalk mark made on the wheel was brought again in contact with the rail, and the rail was marked at this point. A tape measurement was then made between the first and second marks, giving accurately the total length of run, and between the second and third marks to determine the distance traversed in the final fractional part of a wheel revolution. The distance from start to brake signal determined by the wheel revolution record on the chronograph chart was calculated; this distance deducted from the total length of run (a tape measurement), gave an accurate measure of the distance from brake signal to stop. Furthermore, where there was a difference between the total distance run by tape measurement and the total distance indicated by the wheel-revolution chart, such difference only occurred in case of skidding, then the difference was the measure of the distance skidded.

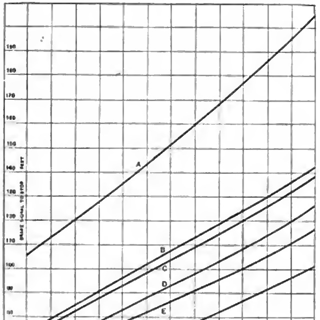


FIG. 2.—COMPARISON CURVES FOR EMERGENCY STOPS

It should be noted that by the use of the methods outlined the measurement of the two quantities whose accurate determination is essential to an accurate brake test—namely, the speed at brake signal and the distance to stop—are obtained with a high degree of accuracy and with apparatus which can be attached to any car in a few minutes. This apparatus is complete in itself, no stops, signals or other special appliances being required on the track or roadbed.

The time elapsing between brake signal and stop, may for the present purpose of tests of emergency stops, be divided into three parts:

1. Duration of time between brake signal and beginning of movement of brake handle or lever by motorman; that is, the personal equation of motorman.

2. Duration of time between beginning of movement of brake handle or lever and setting of the brake-shoes.

3. Duration of time between the setting of the brake-shoes and stopping of the car.

The first interval of time above depends on the motorman, the second on the brake mechanism, and the third on the amount of the frictional resistance which can be developed between the car and the rails for a stop from a given speed. The first and second intervals of time are practically constant for a given motorman and brake apparatus and independent of speed; the third interval will vary with the speed at brake signal.

After being brought up to speed and allowed to run without

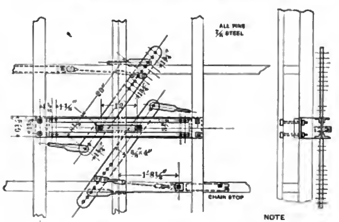


FIG. 4.—DIFFERENTIAL BRAKE RIGGING

power, the speed of cars on the test track was found to fall off at the rate of about 0.16 miles per hour per second. Hence, for a given brake and motorman the distance run by car from time of brake signal to time of full application of brake-shoe would be:

$$\left(S - \frac{0.16 T}{2}\right) 1.467\ T = d \text{ (distance in feet)} \qquad (1)$$

where S = speed at brake signal in miles per hour,

T = time from brake signal to application of brake shoes, and 1.467 = number of feet per second corresponding to 1 mile per hour. S being the speed at brake signal, and 0.16 miles per hour per second the retardation due to friction and windage between brake signal and application of brakes, the total retardation in T seconds will be 0.16 T, and the speed of car at the end of the interval of T seconds, i. e., at the time of application of the brakes will be (S — 0.16 T) miles per hour.

Letting d' = distance from application of brake-shoes to stop

$$\left(S - \frac{0.16\,T}{2}\right) 1.467\,T + (S - 0.16\,T)^2\,\frac{1.467}{2\,R} = D \qquad (4)$$

Equation (4) gives the distance from brake signal to stop in terms of S, T and R. Expanding the expressions and collecting the coefficients of S and S^2 we get

$$L\,S^2 + M\,S + N = D$$

where

$$L = \frac{0.733}{R}$$

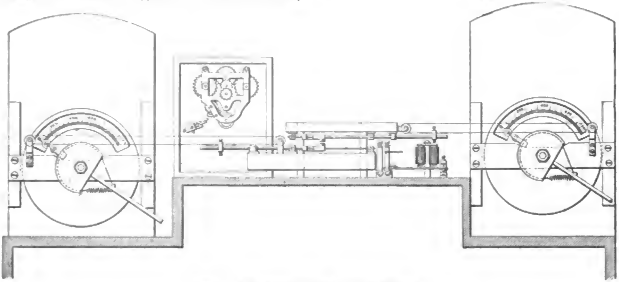


FIG. 5.—RECORDING APPARATUS, ELEVATION

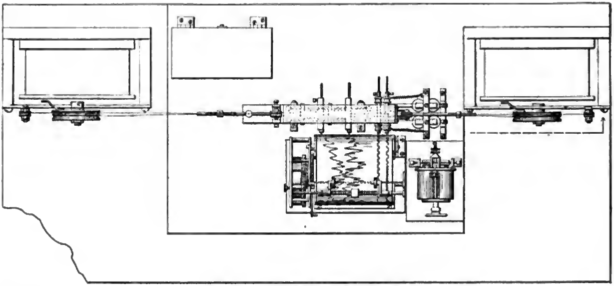


FIG. 6.—RECORDING APPARATUS, PLAN

and T' = time in seconds from application of brake shoes to stop, we have

$$\frac{1}{2}\,(S - 0.16\,T)\;1.467 \times T' = d' \qquad (2)$$

But if R = rate of retardation in miles per hour per second after brakes are set, the time T' may be expressed as follows:

$$T' = \frac{S - 0.16\,T}{R}$$

and substituting this value in equation (2) we have:

$$\frac{(S - 0.16\,T)\;1.467}{2} \times \frac{S - 0.16\,T}{R} = d'$$

or

$$(S - 0.16\,T)^2\,\frac{1.467}{2R} = d' \qquad (3)$$

Let D = total distance from brake signal to stop. Then d + d' = D and substituting from equations (1) and (3) we have:

$$M = \left(1.467 - \frac{0.235}{R}\right) T$$

$$N = \left(\frac{0.0188}{R} - 0.117\right) T^2$$

L, M and N are practically constant for each equipment.

From test stops with each brake curves were plotted showing speed on a time base from the brake signal to time of stop. From these curves may be obtained values for T and R, and from these the values of the coefficients of S^2 and S in the above equation may be computed. From this equation with D and S as variables, we may compute the values of D (distance) corresponding to several values of S (speed), and plot a curve showing for different speeds the distances run from brake signal to stop for each of the equipments tested.

To get the time elapsed from brake signal to stop from different speeds at brake signal, we have the following relations:

T = first and second parts of time above referred to.

$$\frac{S - 0.16\,T}{R} = \text{third part.}$$

Hence, if t = the total time in seconds f om brake signal to stop, from a given speed at brake signal, then

$$t = T + \frac{S - 0.10\,T}{R}$$

The coefficients of this equation for any equipment may be obtained as noted above from the speed curves, and, these coefficients once determined, the values of *t* for several values of *S* may be computed; and from these values a curve may be plotted showing for different speeds at brake signal the time from brake signal to stop for each of the equipments tested. Distance and time curves have been plotted in this way for brakes A, B, C, D, E and F.

These charts show the relative efficiencies of the various brakes for emergency stops; for instance, at 15¾ miles per hour speed at brake signal, the distance from brake signal to stop are:

For brake A, hand brake, 164 ft.; for brake B, power brake, 115 ft.; for brake C, power brake, 112 ft.; for brake D, power brake, 100 ft.; for brake E, power brake B, with differential levers, 93 ft.; for brake F, power brake, 80 ft.

These curves show plainly the relative efficiencies of the several brakes in making emergency stops.

To reduce the liability to accident and to effect economy in the use of motive power it is desirable to secure as high a rate of braking as is consistent with the comfort of passengers. If we assign a total cost per equipment per year to each type of brake considered, then the most desirable brake will be that for which this total is a minimum. The total cost per equipment per year should include the following items:

Cost of maintenance, labor and material.
Cost of power for operating brakes
Interest on investment.
Cost of accidents per equipment per year.

The cost of maintenance and for power must be estimated from the best data at hand. As to the cost of accidents a figure was readily obtained for hand brakes. A figure was also obtained for brake D, for which the record of a number of equipments was accessible. From these amounts, chargeable to hand brakes and brake D, the amounts which should be applied to the other brakes were estimated by a graphical method, taking into consideration the distances in which stops may be made with the respective brakes. Under the item of cost of power in the original comparison a charge was made against the hand brake, which represents the amount of power necessary for operation with hand brakes in excess of what would be required with a power brake, due to the lower rate of braking with hand brakes; as the same schedule speed can be maintained at a smaller expenditure of energy by using a more effective brake, the time of running with power being reduced and cars allowed to coast a greater distance.

Below is given an approximate comparison table for several power brakes:

APPROXIMATE COMPARISON TABLE

	B	C	D	E	F
Maintenance of power brakes and extraordinary repairs, chargeable to brakes	58.80	10.95	36.25	....	29.20
Power	29.20	....	....	25.00	....
Interest	15.00	5.00	6.50	17.50	11.50
Accidents	58.00	53.00	37.00	30.00	15.00
	161.00	68.95	79.75	72.50	55.70

The totals above, which are, of course, only of approximate accuracy, show that under certain conditions a very considerable amount per annum may be saved by the judicious selection of brakes.

One practical result of the tests above described was the application by the writer of differential levers to hand-brakes; one form of construction of this type of foundation rigging being shown at Fig. 4. The levers, as shown, may be varied from 0 per cent to 19 per cent excess pressure on the front truck and may be adjusted to suit different types of car bodies. Another result was the application of differential levers to one type of power brake, the braking characteristic curves *B* and *E*, Fig. 2, showing that the distance required to stop a car with power brake *B* has been reduced by approximately 18 per cent by the use of non-equalizing levers, applying to the front truck a braking pressure exceeding that applied to the rear truck in a certain predetermined ratio

New York Subway Car Contracts

The contracts for 500 of the cars to be used by the Interborough Rapid Transit Company in the New York subway have been let. The general type of car to be adopted was described in the STREET RAILWAY JOURNAL for Sept. 20, 1902, written from the specifications of the cars and illustrated by views taken of two specimen cars then being examined by engineers of the railway company. As it was impossible to obtain satisfactory guarantees of delivery in the specified time from one concern, the 500 cars were divided up into lots, and the orders were given to the following companies: The St. Louis Car Company, of St. Louis, Mo., received 200; the John Stephenson Company, of Elizabeth, N. J., 100; the Jewett Car Company, of Newark, Ohio, 100, and the Wason Manufacturing Company, of Springfield, Mass., 100. The motor trucks for these cars have not yet been contracted for, but orders for 660 trail trucks have been given out and have been equally divided between the Wason and St. Louis companies.

The Popular Double Trolley

The editorial comments of the Chicago Tribune on the St. Paul electrolysis suit reveal a wealth of technical information in the editorial mind that is startling if not refreshing. Here they are:

"That the question of possible damages to city water and gas mains through electrolysis is one that must be reckoned with in all future franchises for new trolley lines or extensions is emphasized once more by recent developments in the city of St. Paul.

"Application has just been made in the District Court of that city in behalf of the Board of Water Commissioners for a permanent injunction against the City Railway Company to restrain it from using the mains of the city water system as a conduit for its return electrical current. It appears that the water mains have been used for the return current since the building of the trolley road, and it is claimed that a rapid disintegration of the pipes has resulted, so much so that the Board of Water Commissioners asks that the railway company be required to make restitution in the sum of $500,000.

"The purpose of the application, of course, is to compel the company to put in the double trolley system, which is now being used successfully in nearly all the larger cities. Electrolysis of water and gas mains through proximity of the return electric currents of trolley systems of street traction is now so thoroughly established that no city would permit for a moment such a practice as the St. Paul Company appears to have been guilty of. Where direct contact is made with the water mains for the return current as was done in St. Paul, the destruction of the pipes is rapid and certain. Where new franchises are granted or extensions allowed nothing short of the double trolley system, in which the return current is sent back through a suspended cable, or some other means adapted specially to that end, should be seriously entertained."

A Massachusetts Paving Suit Goes to United States Supreme Court

The City Council, of Worcester, Mass., has directed the city solicitor to go to the United States Supreme Court to test the constitutionality of the Massachusetts street railway law of 1898. Worcester is the largest city in the State which is affected by this law, Boston being exempted in its provisions. In 1900 the city began action against the Worcester Consolidated Street Railway Company to compel the company to keep in repair the paving between and 18 ins. outside the rails where it had locations. Relying on the law of 1898 the company fought the case, and it was carried to the full bench of the Supreme Court of Massachusetts The Supreme Court handed down a decision supporting the contention of the company that the law is constitutional. The questions that the Supreme Court of the United States will be asked to settle are: Does he act of 1898 impair the validity of a contract? Does the act of 1898 take away a property right without due process of law?

The idea of the street railway law of 1898 is that, in return for an excise tax which the company contributes to cities and towns through which it operates, it shall be relieved of conditions as to repair of the highway and the care of snow on the street. The excise tax provided for by the law is a percentage of the gross receipts of each mile of track in operation, varying with the gross earnings per mile, from 1 per cent for roads earning $4,000 or less, to 3 per cent for roads whose gross receipts per mile of track operated are $28,000 or more. The tax is fixed annually. The excise tax is in addition to other taxes. About $10,000 a year is involved in the case brought by the city of Worcester.

New England Street Railway Club

The December meeting of the New England Street Railway Club was held in Wesleyan Hall, 36 Bromfield Street, Boston, on Thursday, Dec. 18, with President Farrington in the chair. In the unavoidable absence of William Pestell, of the Worcester Consolidated Street Railway, who was to read a paper, the subject of the evening, "Labor-Saving Devices in Car Houses and Shops," was discussed by several members of the club. Charles F. Baker, superintendent of motive power and machinery of the Boston Elevated Railway Company, mentioned numerous labor-saving devices in use on the Boston Elevated, many of which had been designed to meet the manifold varieties of trouble which arise on such a large system. Thus, the improper handling of motors and car equipments by motormen results in many faults in the apparatus. If motormen would tell their car house foremen of the peculiarities and troubles which occur in their own equipments, much work and expense could be saved. "Jerky" cars are often caused by improper controller handling or by defects in the resistance, which, perhaps, is open circuited on the first notch of the controller, resulting in a large excess rush of current when the second notch is reached. This is bad for both motor and passenger. There is a great variety of equipment on the Boston Elevated, which calls for a large supply of spare parts to be kept on hand.

Labor-saving devices may begin in the blacksmith shop. We may have special wrenches, jigs and tools of many kinds which an ingenious mechanic will use to expedite his work. In the car house the pit cradle is perhaps the most useful appliance. Screw and hydraulic jacks also are handy for use in removing wheels and motors from the cars. The company now operates closed cars with 16 ft., 20 ft. and 25-ft. bodies, and the pit cradle, which is built up of chain blocks attached to four rods, two of which are movable, enables a car to be lifted up or the trucks taken out inside of ten minutes by four men.

Mr. Baker then referred to the Conant testing instruments for locating weak fields in motors as valuable adjuncts to a car house and shop equipment. On the Boston Elevated machine shop work is not done to any great extent in the car houses. The company has a very complete stock room, and general repairs are made in shops designed for the purpose. In the armature room compressed air is used for blowing out motors and also for cleaning out cars. There are numerous emery wheels and drill presses in the machine shop. Air hoists are used to some extent. The company does its own armature work, and has its own baking ovens, makes its own field and armature coils, which latter requires many special tools. The motors in use on the surface lines comprise 1500 of the General Electric W. P. type, a number of General Electric 800's, Westinghouse 120's and 68's and General Electric 58's. Special soldering irons, operated by gas flame are in use, and frames for testing armatures over a range of 200 volts to 2000 volts are operated. Heat tests are made by placing two motors in a testing frame and running one as a generator, with the other as a motor, the two machines being connected together by a sleeve coupling, which slips over the pinion. One motor is fastened in a stationary position, and a water rheostat is used for load. There are also lathes, drill presses, hydraulic presses and armature winding machines. In making armature coils a hand bobbin is used for winding tape, and, though home-made, it well answers the company's purpose. The company makes its own mica rings and shells, and does practically all the repair work on its cars as well as that on its generators in the various power houses. Winding stands are used in the armature room, and a 100-lb. Post hammer has recently been added, with another for the elevated repair shops at Sullivan Square, which is run by compressed air.

In answer to a question Mr. Baker said that he had found no trouble from leakage in using air hoists. In the elevated shop a chain hoist with a worm gear is used to advantage.

Roger W. Conant, of Cambridge, Mass., then spoke of some appliances he had seen in car houses throughout the country. At the Detroit United Railway Company's shops was an interesting machine for taping motor field coils. As the cotton insulation is carbonized by baking out, the field is placed in a spindle, the wire unrolls and the end is passed through a set of knives or dies, which scrape off the cotton from the conductor. Usually the cotton is in such frail condition that it strips or falls off, and the knives simply scrape the wire clean. A roll of tape is then revolved spirally around the wire, no attempt being made to weave a layer in the manner of machines in wire manufactories. For insulation the dependence is upon the overlapping of the tape, and if the work is done carefully and with close inspection the results are very satisfactory. Although the tape is not as thick as Grimshaw's it is possible to get the same number of turns upon the spool and have the winding occupy about the same space as the original coil. No reselling of the old copper at a lower price is necessary, and in this matter the company is independent of the fluctuations of the copper market.

In a car house at South Framingham, Mass., Mr. Conant noted a convenient arrangement for quickly removing the motors of a car. The blacksmith shop or repair shop here is at one side of the pits, and the level of the floor is the same as that of the pit floor. The motors can quickly be dropped into a cradle and run over the pit, where the fields or armature can be taken out and inspection quickly made.

The last five or six years of electric railway operation have shown that the final test of service capacity of motors lies in their ability to withstand heavy currents for long periods. This long-continued heating is cumulative, as the resistance of the coils rises with increased temperature and more and more heat is evolved to limit the life and carbonize the insulation of the cotton covering of the coils. This heating is further increased by poor ventilation, conduction and radiation. Gotshall and Mailloux have recently been working on a system of pipes for cooling off motors by air, which may greatly change the operating capacity of equipments.

As more heat is evolved by the increase in resistance of the coils the cotton insulation becomes scorched as if with a hot flat iron, then more baking ensues, and the insulation may be reduced to a black powder thoroughly carbonized. The coil then becomes defective and short circuits more or less completely. Often all the coils are taken out when only one is defective. These troubles weaken the field and cause severe flashing and sparking through the distortion which occurs. Four-field motors spark much more badly with one field gone than do two-field machines, on account of the much greater distortion. Flashing and bucking is very injurious to motors, but if located at the start a great deal of time and money can be saved. Heavy excess currents may be caused by the brakes being set too tightly, by poor judgment of motormen in handling controllers, by defective repairing, such as taping together the wrong leads, by a sandy rail with a groove worn in it filled with dirt, and by low voltage, due to insufficient copper, bad joints or other troubles. The heating which follows low voltage is not due, as many suppose, to larger currents which are required to propel the car, but to the longer time the current is on. This last is a very important factor in the life and maintenance of a motor. Mr. Conant then spoke of his apparatus for detecting a weakened field by a magnetic test, which he said was better than a direct-resistance test, as the latter was often deceptive or of little variation, and sometimes a fault which develops when the motor is hot disappears when it cools down. The magnetic test can be made as easily and satisfactorily when the motor is cold as when it is hot.

William S. Collins, superintendent of motor car repairs of the Boston Elevated, then described more in detail some of his company's appliances for saving labor in the maintenance department. He stated that the pit cradle mentioned by Mr. Baker was a frame, 9 ft. 6 ins. long by 2 ft. 6 ins. wide, made of 6 in. x 8-in. hard pine pieces bolted up, and a section of rail, 4 ft. 8 ins. long, on each side. The rail sections are movable. The cradle is raised or lowered by two sets of chain falls. The car body is first run over the pit cradle and is raised up by two jacks placed at the end of either sill. A bar is placed across the top of the wheels through the spokes, resting on the trucks, the pieces of rail are taken out and tie straps and bar make one suspension of the truck frame with the car body. Sometimes the bottom half of the motor is dropped with the wheels, but usually the cap bolts and axle caps are taken out and the motor suspended by an eye-bolt and bar on top. The wheels are dropped into the pit, and flats, chipped flanges or other troubles are removed. On each side is a chain hoist. In every car house of the company a body hoist is provided for raising car bodies off the trucks. This is made up of 8-in. x 10-in. hard pine timbers, at one end of which are two 1-in. rods, with the ends turned up so that the hoist can be fastened to them. These are some 7 ft. from the floor. The other end has a 10-in. I-beam, 10 ft. long, with traveler for raising the bodies of 7, 8, 9, 10 or 12-bench open cars. These can be raised by means of horse-car T-rails, with rings on the end, through which could be secured the hooks of chain falls. He had recently seen a car put up in less than ten minutes by this arrangement. A Harrington hoist of 2-tons capacity is frequently used.

E. E. Potter, of the New Bedford Street Railway Company, said that his road had about 150 cars to take care of, and it was often necessary to do work in different places. He saw in the shops of the United Traction Company, of Albany, a very handy traveling crane, made up of two rails, on the side of two tracks, from which were suspended two I-beams on rollers, from which run two triplex Western hoists, operated by trolley. Mr. Potter said

that he has two pits, over which ten eight-wheeled cars can be accommodated, and this arrangement of traveling crane can be utilized over any pit. The crane has been found handy in transporting armatures. Table hoists of several kinds are easy and cheap to make, and can readily be moved to different points in the pit. Mr. Potter than spoke of the Conant field testing device, and said that it had proved extremely useful in his car house work. He uses some G. E.-800 motors whose fields are very sensitive, and previous to the employment of the field tester it was often difficult to know when the trouble in the coils was serious, or even if trouble existed then. An almost inexperienced man can use the apparatus, which has the advantage of locating a trouble in the winding at its early stages. In his armature room a boy at $3 per week tapes up coils by a special machine. Many car houses raise up four-wheeled cars with jacks, and a bar across the front of the car, but Mr. Potter criticised this method as dangerous to the men, since the slipping point is indeterminate.

Paul Winsor, assistant to the vice-president of the Boston Elevated Railway Company, then said that the Sullivan Square shops of the elevated division started with very limited equipment to fit up and assemble 100 cars, when the overhead system was being gotten ready for operation, in 1901. Fortunately compressed air was available, as the block and interlocking signal system is operated by that motive power. There was a 14-in. air hoist which would lift 12,000 lbs. Air jacks were also used. Motors are blown out by air, as is the Sprague control. Equipping was started with a little boom derrick with a crab on it. Five men were required to raise a single truck. Then air cylinders were put on and the men soon became used to handling the device in much better time.

President Farrington said that his road used air for blowing out motors and cleaning cushions, and then introduced Mr. John Lindall, foreman of shops on the elevated division of the Boston Elevated.

Mr. Lindall described the shops which are under his supervision, and said that at Sullivan Square the train shed and repair shops are on the structure level. Trucks and motors are usually disconnected in the repair shops. The machine shop is located below the repair shop, and in the latter is the stock room, which is divided into a number of compartments. In one is kept all controller parts, in another motor fittings, in a third car body fittings, in a fourth bolts and nuts, in a fifth tools, and a sixth air brake parts, etc. The check system is nsed in giving out tools, a workman leaving a check always in place of a borrowed tool. The proper laying out of a stock room is an important feature if labor is to be saved. Trucks are carried from car house to machine shop by a hydraulic elevator. Trucks can be lowered from a car in about five minutes, the car body being held by posts on each side of the car. Pneumatic jacks have been found much better than screw jacks. In handling motors and trucks weighing 12 tons the trucks are arranged to be self-propelling, control of the movement being attained by rheostat. The method saves a vast amount of pushing and pulling. The equipment of the shops includes a 300-ton wheel press, a 42-in. lathe, a 36-in. engine lathe, a 20-in. shaper, 36-in. radial drill, pipe cutter, grinders and other tools, all motor driven. Compressed air is used freely in cleaning. A tire heater, designed by C. T. Baker, is in use. This apparatus is operated by gas and compressed air. Old tires are heated in six minutes, so that they fall off from the wheels. New tires can be expanded to slip upon the wheel in ten minutes. A wrecking car is now being equipped with blocking, tools, tackle, jacks, etc., so that in the event of an accident trains can quickly be gotten clear.

The car house floor between tracks is depressed one foot beneath them. This is extremely useful in facilitating the removing of brake-shoes, third-rail shoes, etc. Special labor-saving arrangements often pay for themselves in a single day. Recently 2000 ⅝-in. bolts were to be removed. The foreman made a wrench with a bit stock handle and saved much valuable time by using it in place of a monkey or a T-wrench.

Mr. Baker then said that out of 45,000,000 car miles run by his road last year but 8 or 9 broken axles resulted. Usually in such cases the emergency crew goes out with a two-wheeled car, to which the wrecked car can be chained up, and the outfit is then run into the car house as soon as possible.

Mr. Potter, of New Bedford, described an arrangement for towing in a wrecked car, which has been found very useful on his road, especially on the longer lines of the company. It consists of a pair of small 20-in. wheels from which are run two frames made up of two angle-irons about 5 ins. apart. On one end of the angle-irons is an ordinary journal box. The journals have slotted ends. The box slips over the journal past the thrust key, which holds it in place. At the other end is a U-shaped piece. This outfit is carried in a wrecking car. When the car is reached two sides pieces are slipped on like a wheelbarrow arrangement next to the broken wheel or axle. These pieces will go inside, and by jacking up the frame, dropping the stirrup and attaching to the car, the entire outfit can start for home. He had never seen it get off the track, even on the sharpest curves, and it is possible to go home at a lively pace, regardless of whether it is a four or an eight-wheeled car.

Mr. Miller, of the Boston & Maine Railroad, said that air hoists were very extensively employed in the Concord (N. H.) shops of his company. At one time 300 trucks were stored at this point and a common piston hoist was first used, with a pipe 10 ft. long and 8 ins. in diameter. A great deal of room was lost by this arrangement. Later on a geared air hoist connected with the truck by wire rope or cable was used with great success. This did not depend on the air to hold the truck just where it was wanted. No instance of failure has been recorded, and the apparatus has proved to be far better than the old type of cylinder hoist. Mr. Miller stated that he was planning to support some form of hoist from some 8-in. x 15-in. pieces of timber, spaced 14 ft. to 15 ft. on centers. T-irons will be attached to these timbers by bolts, and the lower webor flange of the T will be used as a track for running the hoist. Probably a 6-ton hoist will be used. Another instance of labor-saving was made by drilling a large number of bolt holes for car hinges with an air drill. The hinges were of malleable iron and the shrinkage was not always the same. A piece of plank was placed against the side of the car and drilled through clear into the iron. A sharp drill was used. In putting the nuts on, an S wrench was first tried, then a T wrench and then a socket wrench, driven by an air drill. This last device worked very rapidly. Some years ago the Boston & Maine found that it was putting the safety chain hook on the wrong side of the car from the Master Car Builders' requirements, and in order to facilitate interchange, especially with Pullmans operating on the Canadian Pacific and Rutland Railroads, all these had to be changed. As there were some 2000 cars affected, and each one required two extra hooks and two extra links, there was a large job on hand for the blacksmiths. After finding that the work was not progressing satisfactorily, Mr. Miller made up some foremen for quicker work on the hooks, and after trying several men he found that about seven times as many hooks could be made per day. It had been his experience that usually workmen felt that the introduction of a new labor-saving device resulted in taking away their bread and butter. This was not so in a railroad shop, as the work there increased with the facilities, and there was always so much to be done that only the most important things could be undertaken.

Mr. Sturgis declared that he had found compressed air very useful in cleaning cushions, and in operating hoists. In small car houses, where facilities were limited, he obtains his air supply by attaching a hose to the air brake compressor.

J. P. Conway, of the Old Colony Street Railway, said that in his opinion the proper instructing of men in handling equipment was entitled to be called a labor-saving device. He was surprised to find how little men sometimes appeared to know about the use of the ordinary series-parallel controller, and had found it to be of great advantage to take a piece of red chalk and mark out on paper in the lobby the various warys in which the current passes through the motors for different positions of the controller handle. It is easy for a motorman seriously to injure a motor by careless or ignorant handling.

Mr. Winsor said that an instruction school for elevated trainmen was maintained at the Sullivan Square terminal, and that a great deal of time was given to the education of the employees for the train service. In the school room were three skeleton cars with everything in the way of actual apparatus mounted upon them, with the exception of the motors. Especially thorough instruction was given in the use of the automatic air brake, which is the most vital safety feature of the system.

Mr. Collins said that motormen on surface lines were first put on with an experienced motorman, after which they were sent to their car house foreman, who instructed them still further in the proper handling of the controller. After this they were examined by Mr. Senter, superintendent of employment.

The Mansfield Technical Society, of Mansfield, Ohio, has been organized among the officers and employees of the Ohio Brass Company, of that city. The object of the society is the promotion of technical knowledge among its members. The regular meetings are held on every third Tuesday, at which time papers pertaining to various branches of technical work are read and discussed. A reading and reference library has been established in connection with the society. Contributions of scientific and trade papers are being thankfully received, and a large amount of good reading matter is already on the files for the use of members.

New York's Transportation Facilities

The complaints from Manhattan regarding the overcrowding of the cars of the surface and elevated roads are to form the subject of a public hearing before the State Railroad Commission. Walter Berg entered a formal complaint regarding the Ninth Avenue elevated road and F. H. Weeks concerning the Third Avenue line, while Secretary Mead, of the Merchants' Association of New York, requested that he be permitted to appear before the Commission in regard to this question. The Commission will meet at the Aldermanic Chamber, City Hall, Manhattan Borough, on Tuesday next at 10 a. m.

These complaints regarding the service in Manahattan has led Mayor Low to appeal to the Metropolitan and Manhattan managements for relief. Regarding surface cars Mayor Low suggests the following points for consideration:

First—It is my own experience, and I think it is the common experience, that it is almost impossible to obtain a continuous seat for a ride on any surface line at any hour of the day or evening. This situation evidently reflects the fact that cars are withdrawn from service, after the rush hours, too rapidly. My first question, therefore, is: Why is it not practicable to run at all hours during the day and evening as many cars as you now operate during the rush hours?

Second—At all hours when the cars are overcrowded it is practically impossible for one conductor to collect the fares and regulate the stopping and starting of the car. My second question, therefore, is: Why is it not practicable to place two conductors on every car during the crowded hours, one of whom shall be required to be always on the rear platform?

Third—In many of the cities of the northern part of the country all street cars are vestibuled so as to protect the driver from the weather. No one would think of sending out a locomotive driver without the protection of a cab. Now that the street cars are operated by power, so that they can be inclosed in front without embarrassment, it seems to me altogether in the public interest that the street cars of New York should be vestibuled for the protection of the motorman. My third question, therefore, is: What objections, if any, are there to this course.

In his communication to the elevated railway company the Mayor declared that the service of that company was open to serious criticism in many respects. He suggested that trains ought to be run as the public convenience demanded, even if it should be necessary to maintain at all hours of the day the same number of trains as were run during the rush hours. The Mayor concludes his letter as follows:

Upon the elevated roads, also where passengers gather at a single station, is it not possible to do something to better conditions by providing for the better handling of them? Is it not practicable, for example, to provide that the passengers shall all leave the cars at one end and enter at the other end, thus avoiding a conflict between crowds moving in opposite directions? Again, why might not the elevated roads adopt the form of car used upon the Bridge, which has a door on the side as well as at the ends?

At such exceptional times as the days of the Dewey celebration, the elevated roads handled almost twice as many people as on ordinary days. Of course, at such times overcrowding is unavoidable. It would seem, however, that if the same number of trains were used and the same effort put forth on ordinary days the public could travel upon the lines with comparative comfort, except during rush hours.

I shall be greatly obliged if you will let me know whether your company will co-operate with the city authorities in meeting the present conditions upon your lines, and in what way you think such improvement may be made. In particular, I should like to know why it is not practicable for your company to operate during all hours of the day and evening as many trains as are operated during the rush hours?

BROOKLYN'S SERVICE CRITICISED

The State Railroad Commission will give a hearing at the old Common Council chamber in the Borough Hall, Brooklyn, Dec. 29, at 10 a. m., on the complaints of the Manufacturers' Association, of New York, with headquarters in Brooklyn, and Edwin F. Clark, E. P. Barnes, R. W. Smith, B. W. Byington, David Morehouse, J. H. Bragdon, C. E. Keator and W. S. Kitchell, residents of Brooklyn, as to the transportation service of Brooklyn.

The complaints against the Brooklyn Rapid Transit Company are couched in general terms and assert that the company runs too few cars, thereby compelling people to stand, and that its service is irregular, and that complaints are disregarded or met with promises which the company fails to fulfil. It is alleged that the company has cars in its barns and refuses to put them in service.

President Greatsinger has been notified of the proposed meeting, and in response has sent the Commissioners a statement of the company's position, in which he says:

We are at present operating, during rush hours, every car for which we can manufacture or buy electric power. The contracts for our new power house called for its completion during the past summer, but, notwithstanding our best efforts, owing to the failure to obtain material, to strikes in the shops of manufacturers and various other unavoidable delays, we will be unable to get any power from this source for six weeks or two months, but expect to obtain power from one of the engines by the middle of February, and from others at succeeding intervals of two weeks to a month.

We have been purchasing for the last year from the Edison Electric Company of Brooklyn all of the power which their plant was able to supply during the rush hours, and have tried without success to obtain power from other sources. When additional power is obtained it will be possible to put on more cars in the suburban districts, but no more cars can be run on Fulton Street or on the Bridge than are now operated.

Contracts for the construction of four additional loops on the New York end of the Bridge at the sole cost of this company have been placed, which we expect will, to a degree, alleviate the conditions at that point.

We have a force of men engaged in counting the passengers upon the different lines at various points along the system, and as fast as their reports indicate that sufficient service is not furnished during non-rush hours we are adding additional service.

The fact that these complaints are made at this time undoubtedly arises from the condition of the streets in Brooklyn during the last two or three weeks. The accumulation of ice upon the sides of the streets throughout the city forced all heavy trucks to drive upon our tracks. Very many of these trucks were overloaded, and as a consequence became stalled upon the tracks, or broke down, and very frequently it was necessary for one of our cars to push a truck for a long distance before it could be induced to leave the track. These delays were universal throughout the city and continued until yesterday.

With regard to the heating of the cars, orders were given out two weeks ago to heat every car thoroughly before it left the barn in the morning and to keep the heat turned on at all hours, except during the two hours in the evening, when, owing to the lack of power for the operation of the cars, it was impossible to furnish power for heating.

We would be very glad to have your Board investigate the question of the number of cars operated during non-rush hours, and would be very glad to adopt any suggestions made by you with reference to an improvement in the service.

We cannot, however, take any action upon complaints such as those sent us by you which do not state the lines where the service is found deficient.

COMMUNICATION

The Front Platform and Crossing Question

Fort Lee, N. J., Dec. 14, 1902.

Editors Street Railway Journal:

Reading in your Dec. 13 issue your comments on the "No seat, no fare! campaign," moves me, having had some experience as a conductor on trolley cars, to put in writing an idea, long in my mind, which I believe would go far toward solving the problem of accommodating the passenger traffic in rush hours. It is particularly applicable to conditions in large cities where short blocks are the rule.

My suggestion is that cars should stop at every other street only; the first car at the first, third and so on, and the second car at the second, fourth, etc., each following car alternating corners.

And then further—though objectionable with non-vestibuled cars in cold weather—I would have all cars stop at the near crossing, and all passengers enter by the front door, and have all alight by the rear door; or the order might be reversed. I am not aware that these suggestions have heretofore been made, but the advantages in time-saving, as well as comfort-giving, must be apparent to those having to do with handling passenger traffic on trolley or other street cars.

A. P. Williams.

An attempt was made to introduce the first plan suggested by you in Philadelphia several years ago, but it was abandoned, and it is very likely that other cities have had the same experience. The latter plan is in use in several cities, and it has also been tried and abandoned in several cities. We have advocated both methods, and there seems to be no theoretical reason why either or both plans should not prove advantageous if the general public could be brought to understand the plan and act in harmony with it. The trouble found has been with the perversity of the ordinary passenger. People have become so used to boarding the car at any corner that it seems almost impossible to teach them any other course, even when it would result in a much better service. Undoubtedly if a company should persist in a plan of this kind the benefits to all concerned would be considerable, but it is a question whether the company would not become so unpopular during the course of instruction that the trouble would be worth the while. Of course there are certain objections to the second proposition, that is that of allowing passengers to use the front as well as the rear platform in entering or leaving the car. They interfere to a certain extent with the motorman, and the conductor cannot watch two platforms as easily as one to see that all passengers are in a safe position for starting the car. There is also the question in a muddy street of providing a dry crossing for the passengers to reach the sidewalk. Nevertheless, we believe that in many cases the advantages of both plans would more than outweigh the disadvantages.

Rates and Methods of Paying Employees

One of the papers presented at the New York meeting of the American Society of Mechancial Engineers last week discussed methods of paying workmen and plans for stimulating them to increase their earning capacity. The author, Frank Richards, of New York, did not approve the practice now in vogue, and he expressed the belief that it was followed because nothing better had been devised that would be generally adopted. As stated by the author the problem that confronts the employer is: How shall the worker, whatever his grade of skill or efficiency, who has hitherto worked only for a fixed daily wage, be so paid hereafter that he shall not only get all that he earns, but that he shall be willing and even desirous to do more, and thus to earn more, up to the limit of his ability? Americans have done much boasting, especially over the excellence of machines and the continuing increase in their efficiencies, and the query is presented: Why have we not been equally exultant over the individual efficiencies of men, and equally diligent and successful in promoting their efficiencies? "It is notorious, and it is absurd that it should be so," says the author, "that the worker finds little satisfaction in his increasing output, and that he takes no pride in it, but rather organizes to retard it as much as he can."

It is pointed out that daily wages, and the same wage for each, offer nothing at all to induce one man to do more than another. In spite of all efforts at equalization there is always an appreciable and often a very great difference in the quality or quantity of work done by different men; and if all are paid alike, then either some are not paid enough or some are paid too much, and pay by the day would never seem to be fair and just to all. The "premium plan" and the "bonus system," both modifications of the "daily wage," are rejected on the ground that they are not just and equitable, and in the end are bound to cause trouble. The essential error in both of these is declared to be in the ignoring of the strictly business relation of employer and employee. The employer of any worker is simply a buyer of what the worker has to sell, ostensibly paying equitably for all that is done. Why, if possible, it is asked, should he not pay in exact proportion to the quantity done, the same as in buying coal or beef or any other merchantable commodity? This would be done, the author claims, if payment were made on the piece plan; but if the general lines of commerce are to be followed in establishing a scale of prices, the workmen must be prepared to receive a smaller proportionate price when the volume of business is great than when there is only a limited demand. This is merely in keeping with the custom that prevails in all markets. Against this view the author contends that in general manufacturing and machine-shop practice, at least, it is greatly to the benefit of the employer to have every man working up to his full capacity. In this way the output can be increased 30 per cent to 50 per cent without requiring additional investment in machinery, leaving labor and power costs the only items of expense that are increased. While the conditions are somewhat different in the case of power house attendants and the general run of labor employed in railway service, the principal holds good that a small but efficient force is much more desirable and of greater value to the employer than a larger one, the capacity of whose numbers is relatively lower.

In work that is paid for by day wages there is always the recognized ability in the man to increase somewhat his output if sufficient inducement is offered. There is a "fair day's work" that is recognized as such and accepted as satisfactory all around, and still it is never assumed to be the extreme limit of a man's possible accomplishment. There are different ways of applying inducements to the men to get them to turn out the possible surplus of work. The author of the paper under consideration believes the best results can be obtained by establishing a piece rate in manufacturing establishments, but he does not suggest any practicable plan for other classes of employees.

Catalogue of the "Four-Track Series"

The New York Central Railroad Company was the pioneer in attractive railroad advertising, and has always managed to keep a little in advance of other railroad companies in this respect. It is safe to say that no other railroad has done as much in the direction of advertising American achievements in machinery and railway equipment, and in giving to the world correct ideas of the facilities for safe, rapid and luxurious travel as the New York Central.

The most popular scheme of advertising devised by Mr. Daniels, general passenger agent of the road, was the establishment of what is termed the "Four-Track Series." This was a series of publications, issued at occasional intervals, describing or illustrating some of the most attractive points reached by the lines. The special feature of the series, however, was the fact that each publication was intrinsically attractive, either for the interest of the contents published therein, or artistically, for several of the series were etchings or photogravures, or for both illustrations and text. The company has recently prepared a catalogue of its publications, which now number thirty-five or more, and which gives in a most impressive way an idea of the enterprise of the company, and of its efforts to aid in building up American institutions. The catalogue also gives a miniature reproduction of each of the eight etchings, which are issued by the New York Central, of scenes along its lines, trains, locomotives, etc., and a list of seventy-six maps printed in the various numbers of "The Four-Track Series."

The illustrated catalogue of "The Four-Track Series," fifty-two pages, will be sent free to any address, on receipt of a two-cent stamp, by George H. Daniels, general passenger agent, Grand Central Station, New York.

Electric Railway Securities

The demand for electric railway securities has increased so rapidly that many large investment houses are now giving especial attention to the subject. One of these has issued a circular letter to its clients cautioning them against plunging in this class of securities, on the ground that while there are many excellent properties, it is quite probable that much less desirable lines would be selected by those not familiar with their respective merits. "Buy on facts and not on faith," is the advice of the experta, who remind sanguine investors that "the history of the transportation enterprises is, that at the start they have heavily over-capitalized the faith of their promoters, and the persons who put in their money have usually either lost all or they have to go through long and drastic reorganizations, in which they have been forced to sacrifice heavily if they hoped to recover any part of their capital."

A careful investigation before investment is recommended. The conditions which would be considered as establishing reasonable probability of success are thus outlined:

A productive region, with a numerous population bound together by important industrial and commercial interests of such a character as to presage steady growth of wealth and increase of general social well-being.

Intimate interdependence of the communities of the region in the exchange of products among themselves.

High civic and personal credit in these communities encouraging an influx of capital and productive labor.

The personal qualities of the managers of the enterprise their responsibility, sagacity, executive ability and grasp of local conditions in the territory of the carrier.

Conservative capitalization, scientific construction and equipment to meet traffic conditions, and judicious economies in operation.

It is pointed out that many of the companies do not provide sufficient capital for operating their roads, merely taking care of the construction and equipment of the lines, and then depending upon influencing additional capital to carry the work on to a successful completion. It is explained that "for many reasons these companies are unable at the outset to borrow on capital issues more than the bare amount of money needed to begin earning revenue, and the first few years of their existence are usually spent in struggling to get fresh capital for necessary extensions of plant and equipment. These years are trying for small investors, who cannot afford to let their money lie dormant and have no way of getting back their capital without heavy sacrifices."

It is not intended to condemn all trolley securities, but to warn investors against unscrupulous and irresponsible promoters, the latter in many cases being the most dangerous, as they have faith in the projects they are pushing, and may, through their enthusiasm, lead others into difficulty. Electric railway properties, whether engaged in city, suburban or interurban service, it is pointed out, invite thorough investigation when organized on substantial basis and established in a territory that can reasonably be expected to support the class of service the company is formed to provide.

Evolution in Street Cars

A street parade was held in Evansville, Ind., on a recent holiday to show the progress made during the last thirty years in street railway transportation. "Old Slick," the veteran mule of the service, with docked tail, appeared pulling one of the first cars used in the city, and as many who witnessed the parade had never seen a mule car, this feature was particularly instructive. The many children who lined the route of march simply gazed on in wonderment. There were five types of cars in the parade. Bringing up in the rear was one of the latest acquisitions of the company—a large winter coach with a seating capacity of 100 persons.

The Davol Oil Engine

Considerable interest is being taken on the Pacific coast in the development of oil engines. It is thought that machines of this kind, if perfected, will have a large field of usefulness on the coast, in view of the fact that oil is now being used as fuel in most of the principal power stations in California; and its direct employment in the engine will have many advantages over its use under the boilers.

The Davol engine, to which considerable attention is being given now in San Francisco, is a distinct departure from the ordinary Otto cycle engine, in that it works on the constant pressure cycle, which is sometimes known as the Brayton cycle. This cycle, however, as carried out in the Davol engine, differs considerably from that employed by Brayton. The construction of the engine is such as to permit the utilization of very high cylinder temperatures, and this feature renders it possible to obtain a much larger percentage of the theoretical possible efficiency. The engine is reversible, and, it is hoped, will be capable of as wide variations in speed and output as a steam engine, and is equally as well under control.

A 200-hp engine is now in process of construction, which will be given thorough and complete tests probably not later than next February. While it is not possible to predict absolutely what the efficiency will be it is expected that a thermal efficiency approximating 50 per cent will be shown.

The capitalists who are engaged in developing this engine are well known. The directors of the company are A. M. Hunt, president; Charles C. Moore, vice-president, both of San Francisco, with Leon Sloss, of San Francisco; L. N. Breed, of Los Angeles, and G. K. Davol, the inventor.

London Letter

(From Our Regular Correspondent.)

The city of Birmingham during the past month has been the center of one of the most determined fights between municipal interests and those of a private company, the British Electric Traction Company having for some time been endeavoring to secure the control of the tramways of that city. The local papers have been filled with arguments for and against the municipalization of the tramways, and as the result of the poll of the electors of Birmingham they have had a large majority approving of the bill proposed by the Corporation to enable the municipality to make and work the tramways for the common good. This fight has served to indicate the state of the public mind in Great Britain on municipal enterprise, and it would seem as if most cities in Great Britain at the present time are clearly in favor of owning and operating their own tramways. The result of the voting was: For the bill, 15,139; against, 8558; giving a clear majority in favor of municipalization of 6581. The situation in Birmingham is somewhat peculiar, most of the tramways in that city being operated and owned by private companies, though the city of Birmingham some three years ago, by a practically unanimous vote, decided to municipalize the whole of the tramways at the expiration of the current leases, some of which expire in 1906, and the others in 1911. There is probably no city of any magnitude in Great Britain at present in which the tramways are in such a backward state as Birmingham. Most of them are operated by the old-fashioned, noisy and dirty steam engines, only one line having as yet been equipped, and that only during the last year, with the electric overhead system, replacing a storage battery system, which had long been a reproach to the city. The British Electric Traction Company has got systems of tramways in several towns round about Birmingham, so that they have been eagerly attracted toward Birmingham for some time, and during the last year secured the control of the City of Birmingham Tramways Company. The result of the vote is in the nature of a defeat for this enterprising company, as the Corporation will now be able to proceed with its own bill in Parliament.

The battle of the tubes still goes on in London, and the entire solution of the question of tramways is now so many sided that it is difficult in a few words to state just in what position it is. Much has been recently written in the press as to the best solution of the underground problem, many of those who have given the subject the most consideration believing that some general commission should be formed to inquire into the whole subject. The scheme promoted by the London United Tramways Company, in conjunction with the Piccadilly & City Railway, for an underground tube which would have paralleled in some portions the tube already being constructed by the Yerkes group, has been withdrawn, and it is now being rumored that the London United Tramways have entered into arrangements with the District Railway. There will, therefore, next session be many schemes promoted and heavy competition in Parliament. The London County Council has unanimously passed a resolution on the question of the tubes, and has decided that a deputation is to wait upon Mr. Gerald Balfour with the idea of a commission being appointed to inquire into the whole subject of underground transportation.

The Blackfriars terminus of the South London Tramways has been long the scene of unseemly fighting for position on the cars during the rush hours in the evening. This fighting has become so serious that it had to receive the attention of the authorities, and it is now announced that the highways committee of the London County Council has decided that another terminus will be constructed in the same vicinity, south of Stamford Street, which would enable it to divide the cars and so provide greater facilities for terminal work. It was also proposed to introduce the Queue system, which has been used very successfully in Sheffield; barricades of "pens" would have to be erected in the street opposite to the place where the cars stopped, and passengers would have to take their place in these pens and so prevent any danger from crowding.

The Huddersfield tramways committee have entered into a contract with Messrs. Martin, Son & Co., Ltd., to convey for seven years the coal required at their works. This is an entirely new step in the direction of municipal trading, though the idea has been on foot for about two years. Specially constructed trucks, to hold about 5 tons each, will have to be used, each of which will be fitted with two electric motors. It is estimated that between 45 tons and 50 tons of coal a day will be required to be conveyed for Messrs. Martin, Sons & Co.'s consumption.

The town clerk of Leeds has received a telegram stating that the Board of Trade has sanctioned the new tramway by-laws. The by-laws will not be put into operation until the tramways committee has decided on the number of excess passengers to be allowed inside the cars. The practice of carrying excess passengers inside the car is legalized, but outside passengers must not exceed the number for which there is seating accommodation. The usual practice of standing outside a car in wet weather is expressly forbidden.

The London County Council has adopted a recommendation from the highways committee that application be made to Parliament for powers for the construction by the Council of new tramways from Battersea Park Road, via Battersea Bridge Road, and Battersea Bridge to Beaufort Street, Chelsea, at a point near King's Road. The estimated cost of the extension is £57,667.

A syndicate has been formed to promote a scheme of electricity supply covering the whole of Cheshire and North Staffordshire and part of Derbyshire, comprising an area of 1770 square miles. The share capital of the undertaking is fixed at a million and a half. Power gas is to be manufactured and distributed, and also used for the production of electricity. Large central power stations will be established at Frodsham, Sutton (near Macclesfield), and at Stone. The syndicate (which is to be styled the Cheshire and North Staffordshire Electrical and Power Syndicate) will promote its bill in the next session of Parliament.

A Manchester syndicate has been formed to apply for Parliamentary powers to erect electric generating stations and lay mains for the supply of electricity and power gas throughout a district comprising the County of Chester, the greater part of the County of Flint, the Wrexham district of Denbighshire, North Staffordshire, etc., a total of some 2000 square miles, with a population of over 1,500,000.

Two schemes for the development of electric traction in the neighborhood of Edinburgh have been submitted to the Town Council as a preliminary to Parliamentary sanction being sought. One proposal is for the formation of a company, and the construction by it of a tramway from the city of Edinburgh to the burgh of Queensferry. The line will be worked by electricity, and probably the promoters will be able to arrange with the city of Edinburgh for a supply of electric power. Messrs. Blyth & Westland, C. E., George Street, Edinburgh, are the engineers. The provost, magistrates and Council of Queensferry unanimously approved of the proposal, and recorded their hope to have the line constructed as speedily as possible. The other scheme is one which has been previously before the Council. The Drake & Gorham Electric Power & Traction (Pioneer) Syndicate, Ltd., London, have written to the Edinburgh Corporation offering to enter into a friendly arrangement with the Corporation by which the gap now existing between the Musselburgh Tramways Order and the Edinburgh Corporation system could be bridged over, and that they would be prepared, if they were to get the support of the Council, to apply for a new tramway order in respect of this intervening gap.

At the formal opening of the electric tramways, established by the British Electric Traction Company for Barnsley and Worsborough, in the presence of officials of the company, the members

of the Town Council, and other gentlemen, the trams were largely patronized.

At a meeting of the New Castle tramways committee, the chairman reported that the number of cars originally contemplated as being necessary to be run was ninety; but, as showing the great increase in the traffic, the number actually in use last Saturday was 140. The energy in reserve at the power house was taxed to the utmost, and, with the prospect of a further increase in the number of cars, it would be necessary to make some immediate arrangements to have additional engine power. Specifications had been sent out by the committee for the building of a new 3000-hp engine, which was sanctioned by the committee some little time ago, and that, it was expected, would be ready next September. In the meantime it would be necessary to have some relief, and Mr. Le Rossignol had been empowered to make inquiries with a view to obtaining a 1000-hp engine at an early date.

A. C. S.

London Locomotion

An interesting series of articles on the traffic facilities of London, which has been appearing for the last few months in "Traction and Transmission" (London), is completed in the December issue. The articles are by the Hon. Robert P. Porter, and give an exhaustive compilation of facts and figures relating to the present conditions, with an expert opinion upon the past successes and failures and the future needs. Through the courtesy of the author and publishers in furnishing to the STREET RAILWAY JOURNAL advance proofs of the final instalment it is possible to give a brief outline of the extremely interesting data and deductions contained in the articles.

Greater London, or the Metropolitan Police District, contains a population of 6,581,077, and the county of London 4,536,524. In studying the traffic problem these two district areas must be kept in mind as well as a constantly growing district extending in every direction on the outskirts, which are all natural outgrowths of the parent city. In some localities the population has increased 175 per cent in twenty years. London presents exceptional difficulties when an attempt is made to estimate, even approximately, the magnitude of its traffic, but the following may be taken as having some elements of probability:

Railways (on basis of Mr Kinnear Clark's estimate, in 1891, of 75 per head of population)	400,000,000
Omnibuses (estimated on basis of number of passengers carried per omnibus by the London General and Road Car Companies)	500,000,000
Tramways (estimated by deducting 10 per cent from the actual total number of passengers carried by the London tramway companies)	300,000,000
Hackney carriages (estimated on basis of 6000 passengers per annum for two-wheeled and four-wheeled vehicles alike)	70,000,000
Steamboats	3,500,000
Total	1,273,500,000

The London passengers are carried in a great variety of ways by a network of steam railways, underground railways, tramways and omnibuses, and each line is treated in detail. There is a total mileage of 228.45 miles, with 273 stations within the 121 square miles comprising the superficial area of the county of London. Within the county lines there are 114.87 miles of tramway, and without 31.89 miles. The average number of omnibuses running must be fully 3200.

At the close of the present session of Parliament the situation is substantially as it was at the opening. Out of over 82 miles of proposed tube railways only 4 miles have been sanctioned. This may have the effect of hastening the electrical equipment of the steam-operated underground roads, and although the unexpected and somewhat sensational withdrawal of part of the London Suburban Railway project by the London United Railway interests, and the subsequent rejection of the entire bill by Parliament, wipes that scheme off the slate for the present, progress is not stopped on the network of tubes now being pushed in various directions by what is known as the Yerkes group, which, when completed, will connect important north and south districts of the city. Although the advisory work of both Board of Trade and County Council has been excellent, and the latter now announces that it has instructed its officers to make a complete scheme of locomotion for London, the author gives a brief review of the work being done by the New York Rapid Transit Commission, the Boston Transit Commission, and points out that it may be possible for Parliament to construct, out of the material now available in England, a body capable of doing similar work in solving the London problems. What is needed is a commission of action, which would take the initiative in deciding routes and providing the best service and lowest fares by offering the franchise to the most advantageous bidder. A policy of this sort would seem more practical than the present system of allowing each promoter to fight for the choice routes and throw the whole business into chaos if he fails to obtain what he wants.

Extensions During 1903

The result of the annual canvass of the street railway companies of the entire country, made by the STREET RAILWAY JOURNAL, for the purpose of obtaining an idea of the amount of new work to be done in the coming year, shows that the work of extending and perfecting the present systems will call for the expenditure of an amount equalling that which has been expended in previous years in this work. Of course, many of the large companies, where unification of the systems has been perfected, do not report on improvements to be made, which though in their way considerable, do not admit of general reference. On the other hand, many companies, their plans not fully matured, are loath to commit themselves because of the uncertainty as to what will be done. A notable feature of the reports is the many references to park and park attractions, showing the increased attention this feature of street railway operation is being given. Below is given an outline of some of the new work proposed:

PARIS TRANSIT COMPANY, of Paris, Tex., will purchase a merry-go-round and theater equipment.

BRISTOL & PLAINVILLE TRAMWAY COMPANY, of Bristol, Conn., will build about 4¼ miles of track.

TWIN CITY GENERAL ELECTRIC COMPANY, of Ironwood, Mich., will purchase four new cars complete.

THE FORT SCOTT CONSOLIDATED SUPPLY COMPANY, of Fort Scott, Kan., will buy one or two open cars.

LOWELL & BOSTON STREET RAILWAY COMPANY, of Boston, Mass., contemplates making a number of extensions.

CHARLESTON CONSOLIDATED RAILWAY, GAS & ELECTRIC COMPANY, of Charleston, S. C., will open a theater.

GREENFIELD & TURNERS FALLS STREET RAILWAY COMPANY, of Greenfield, Mass., will build 3 miles of line in Greenfield.

OCEAN CITY ELECTRIC RAILROAD COMPANY, of Ocean City, N. J., expects to purchase five or six ten to twelve-bench open cars.

NEGAUNEE & ISHPEMING STREET RAILWAY & ELECTRIC COMPANY, of Ishpeming, Mich., will build 2 miles of line next spring.

WICHITA RAILROAD & LIGHT COMPANY, of Wichita, Kan., will buy new cars and power station machinery. Two miles of new track will be built.

DENVER & NORTHWESTERN RAILWAY COMPANY, of Denver, Col., is about to place contracts for a 25-mile extension into the Rocky Mountains.

ROCHESTER, CHARLOTTE & MANITOU RAIROAD COMPANY, of Rochester, N. Y., will build several new switches. Some new cars will be purchased.

PITTSBURGH RAILROAD COMPANY, of Pittsburgh, Kan., contemplates building an extension, and will also extend and increase its power and power station.

METROPOLITAN RAILWAY COMPANY, of Oklahoma City, Okla., will build about 8 miles of new track. Five vestibuled 20-ft. motor closed cars will be purchased.

MOBILE LIGHT & RAILROAD COMPANY, of Mobile, Ala., will build an additional paint shop, car house and carpenter shop, and an extension to track of 3½ miles.

CITIZENS' RAILWAY & LIGHT COMPANY, of Muscatine, Ia., has not yet definitely decided as to extensions to be built. It is possible that a storage house will be built.

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, of Birmingham, Ala., is building a new car house, 140 ft. x 400 ft., and a new machine shop, 140 ft. x 400 ft.

CONCORD, MAYNARD & HUDSON STREET RAILWAY COMPANY, of Maynard, Mass., during the next six months will award contracts for a 7-mile extension.

GAINESVILLE & DAHLONEGA RAILWAY COMPANY, of Dahlonega, Ga., is now building repair shops and a car house in Gainesville. Rails will be required for 15 miles of track.

CLEVELAND CITY RAILWAY COMPANY, of Cleveland, Ohio, will build about 2 miles double track next spring. A new car house will be built, and two sprinklers are to be purchased.

DAYTON & NORTHERN TRACTION COMPANY, of Dayton, Ohio, is building 48 miles from Greenville to Union City, Winchester and Muncie; also power house at Winchester, Ind.

DURHAM TRACTION COMPANY, of Durham, N. C., will build 15 miles of single track and may make other improvements. The company is unable to give further information at this time.

RAPID TRANSIT COMPANY, of Chattanooga, Tenn., will place contracts during the next few months for a 3-mile extension, also addition to car house, and will purchase motor and trailer cars.

BUTLER PASSENGER RAILWAY COMPANY, of Butler, Pa., will build, at once, an addition to car house to accommodate six more cars. Four miles of new track will also be built early in 1903.

PROVIDENCE & DANIELSON RAILWAY COMPANY, of Providence, R. I., will purchase five to eight new passenger cars in the near future.

KITTANNING & LEECHBURG STREET RAILWAY COMPANY, of Kittanning, Pa., will build a power house. The road is to be extended 15 miles. Contracts will be placed during February and March.

COLUMBUS, NEW ALBANY & JOHNSTOWN TRACTION COMPANY, of Columbus, Ohio, within the next ninety days will award contracts for 18 miles of road, and also order four passenger and one baggage car.

FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD, of Gloversville, N. Y., is in the market for a new electric lo omotive. The company expects to build a new frame car house in Gloversville, size 75 ft. x 180 ft.

SARNIA STREET RAILWAY COMPANY, of Sarnia, Ont., expects to build 3 miles of new line. If this work is carried out another generator and three or four large open cars, equipped with trucks, motors, etc., will be required.

GRAND VALLEY RAILWAY COMPANY, of Brantford, Ont., will build as follows: Twenty-mile extension, car house of brick, 66 ft. x 230 ft., theater and merry-go-round. Four motor cars with equipment will be purchased.

KITTANNING & COWANSHANNOCK VALLEY STREET RAILWAY COMPANY, of Allegheny, Pa., will complete the balance of a 6½-mile extension; grading to be finished about March 1, and construction Sept. 1.

MIDDLETOWN STREET RAILWAY COMPANY, of Middletown, Conn., will purchase two open cars, one box-car and one snowplow, each equipped complete. The company will relay 1½ miles of track and build 2 miles of new track.

GRANITE CITY & ST. LOUIS RAILWAY COMPANY, of Venice, Ill., will build between Alton and Granite City to connect with present lines, which will necessitate additional power station apparatus, structures, etc. Ten cars will be bought.

BURLINGTON & HINESBURGH RAILWAY COMPANY, of Burlington, Vt., is in the market for four first-class convertible double-truck passenger cars, each equipped with four motors. A 400-kw 10,000-volt generator is to be purchased.

CANTON-AKRON RAILWAY COMPANY, of Canton, Ohio, contemplates building an extension to East Greenville, and will probably build a new car house at Canton. The company is in the market for a launch, figure 8 toboggan and a merry-go-round.

SHERBROOKE STREET RAILWAY, of Sherbrooke, Que., during the next six months will place contracts for a 1-mile extension of its East Sherbrooke line. The company will buy a dynamo, and two cars equipped with fenders, motors, brakes, etc.

MONROE COUNTY ELECTRIC BELT LINE RAILWAY COMPANY, of Rochester, N. Y., will not begin active construction of it before spring. The Syracuse Railroad Construction Company has the contract for both construction and equipment complete.

HOMESTEAD & MIFFLIN STREET RAILWAY COMPANY, of Homestead, Pa., will place contracts during the next six months for a new extension of 3½ miles, a new power plant and 200 ft. of viaduct. Open or convertible cars and a merry-go-round will be purchased.

MINNEAPOLIS LAND & INVESTMENT COMPANY, of Minneapolis, Minn., had its cars, car house and repair shops destroyed by fire on Oct. 26. The company is building a new car house and repair shops and will have to purchase quite a little new rolling stock and equipment.

DANVILLE, URBAN & CHAMPAIGN RAILWAY COMPANY, Champaign, Ill., will, within the next three months, award contract for a 33-mile interurban road, and orders will be placed for 1000-kw power house machinery. A car house, to be 50 ft. x 100 ft., will be built.

COLUMBIA & MONTOUR ELECTRIC RAILWAY, of Bloomsburg, Pa., will build a car house at Berwick, Pa. The company has added a 30 ft. x 45-ft. building at Bloomsburg, exclusively for repair purposes. A lathe, boring mill, planer, emery wheel and drill press are to be purchased.

BERLIN STREET RAILWAY, of Berlin, N. H., is in the market for a storage battery to use on Berlin end of line, 8 miles from power house, on which there is a 6 per cent grade 300 ft. long and several smaller grades. An electric fountain, merry-go-round and any other park attractions will be purchased.

CAMDEN & SUBURBAN RAILWAY COMPANY, of Camden, N. J., will build as follows: Two and one-half miles double track, Hadclose Heights; 3 miles double track, Riverton extension; 1 mile single track, Moonstown; one bridge, Morris Station; storage battery, sub-station, Moorstown, N. J.

NORTON & TAUNTON STREET RAILWAY COMPANY, of Norton, Mass., during the next six months will award contracts for extension of track and overhead trolley a distance of 5 miles. The company will build a three-track addition to its car house, and purchase six double-truck open cars, with trucks, renders, etc.

LYNCHBURG TRACTION & LIGHT COMPANY, of Lynchburg, Va., during the spring will probably build a new modern car hause and repair shop. The company will also build a new water-power plant with a capacity of 2200 kw. The contract for all electrical apparatus has been given to the General Electric Company.

WARREN & JAMESTOWN ELECTRIC RAILWAY COMPANY, of Warren, Pa., will build 20 miles o. track, a power house and several bridges, and will purchase storage batteries, dynamos, rotary transformers, six interurban cars, with trucks, four motor equipments, air brakes, etc. Contracts will be let during the next six months.

MIDDLESEX & SOMERSET TRACTION COMPANY, of New Brunswick, N. J., within the next few months will award contracts for a 5-mile extension. The company will install the alternating system to operate outlying lines, and will want 400-hp engine and at least 350-kw alternator for sub-station. A summer park is to be opened.

BUFFALO & DEPEW RAILWAY COMPANY, of Depew, N. Y., will build as follows: Sixty miles of track, two new car houses and one central power station with sub-station. Complete equipment for power house and shops is to be built, also rolling stock and rolling stock equipment. Orders are to be placed during the next two months.

NEW ORLEANS & SOUTHWESTERN RAILROAD, of Thibodiaux, La., will begin work in February, 1903, for its road of 120 miles. The company will be in the market for everything in the way of power station apparatus and rolling stock necessary to the complete equipment of the road, including the building of bridges and other structures, etc.

WASHINGTON & CANONSBURG RAILWAY COMPANY, of Washington, Pa., completes grading 7 miles of line. Rails have already been purchased. A car house and power station will be built in the immediate future. Orders have already been placed for power station apparatus, and orders for rolling stock and equipment are about to be placed.

JAMESTOWN STREET RAILWAY COMPANY, of Jamestown, N. Y., expects to place contracts during the next thirty days for the building of 3 miles, 6-in. T-rail; 14 miles, 75-lb. or 80-lb. T-rail; an addition to power house. The company will purchase two 500-kw generators, engines, ten fifty-passenger cars, and ten semi-convertible and combination cars.

INDIANAPOLIS, SHELBYVILLE & SOUTHEASTERN TRACTION COMPANY, of Shelbyville, Ind., will, within the next three months, place contracts for the extension of the road to Batesville, a distance of about 40 miles. The road is now being surveyed. It is not yet determined as to what car houses, power stations and other structures will be built, nor has a decision been reached as to the power station apparatus that will be purchased.

LATROBE STREET RAILWAY COMPANY, of Latrobe, Pa., expects to build 5 miles more of track next summer, contracts to be placed within the next three months. The company is now building a new car house, has contracted for a new power plant, and will purchase three new cars soon. A merry-go-round and some other park attractions will be purchased before spring.

CONESTOGA TRACTION COMPANY, of Lancaster, Pa., during 1903 will complete the Lancaster & Mount Joy Railway, 17 miles; the Lancaster & Rohrstown Railway, 4½ miles, and extend the Lancaster, Mechanicsburg & New Holland Railway from New Holland to Terre Hill, by way of Blue Ball and Churchtown, a distance of about 6 miles. The company expects to open a new park for the 1903 season.

RUTLAND STREET RAILWAY COMPANY, of Rutland, Vt., will award contract within the next three months for a 200-hp power station (water power); a new car house and a repair shop, and will complete a 3-mile extension in the spring. The company expects to purchase dynamos, water-wheels, large open and closed cars and a snowplow, but is undecided as yet as to whether any park attractions will be bought.

FORT SMITH & VAN BUREN LIGHT & TRANSIT COMPANY of Fort Smith, Ark., will award contracts during the next ninety days for an extension of 2½ miles and the building of one bridge across the Arkansas River at Van Buren, 1900 ft. long, as soon as legislation is secured. The company will purchase park attractions in general, also three vestibuled cars, 37 ft. long, equipped with motors, air brakes, arc headlights, etc.

OHIO & INDIANA AIR LINE RAILWAY COMPANY, of Toledo, Ohio, will build 95 miles of track (single) between Fort Wayne, Ind., and Toledo, Ohio, contracts for which are to be let within the next three months. The company will be in the market for everything required for such a road, including the rolling stock and rolling stock equipment, power house and repair shop apparatus, car houses and other structures, etc. Park attractions will be purchased for a pleasure resort which the company plans to open.

TOLEDO, COLUMBUS, SPRINGFIELD & CINCINNATI RAILWAY COMPANY, of Toledo, Ohio, has placed contracts with the United States Construction Company, of Lima, Ohio, for 40 miles of new line, 20 miles to be in operation June 1, 1903, and the other 20 miles within a year. The company will need about 38 miles of equipment about July, 1903. A power station, two substations, one or two car houses, a repair shop and four to six depots and freight houses will be built. Large tiling for bridges and equipment for power house complete will be required. Eight passenger cars and one combination car will be purchased, also trailers.

LONDON, AYLMER & NORTH SHORE ELECTRIC RAILWAY COMPANY, 1036 Majestic Building, Detroit, Mich., will build about 45 miles of track, the necessary car houses, power stations, repair shops, bridges, etc., and will purchase everything needed in the way of rolling stock and rolling stock equipment, dynamos, storage batteries, engines, boilers, conveying machinery and other power station apparatus necessary to equip the line for high speed. Contracts will be awarded in about sixty days. The company does not expect to purchase, at present, anything in the way of park attractions, but would be glad to receive any information about them for future use.

The Interstate Railways Company

Announcement has been made that control of the United Power & Transportation Company has been sold to the Interstate Railways Company at $75 a share, payable in forty-year collateral trust gold coupon bonds, to be issued by the Interstate Railways Company. The bonds will be dated February 1, 1903, and will bear interest at the rate of 3 per cent for the first year, 3½ for the second year, and 4 for the third year and thereafter. The Interstate Railways Company was incorporated recently in New Jersey, with a capital of $10,000,000, for the purpose of operating electric companies and street railways, and sensational announcements as to the magnitude of plans of the company were made at once.

The United Power & Transportation Company is also a New Jersey corporation, chartered in 1899. Its authorized capital was $12,500,000, of which $3,125,000, par $25, full paid, is outstanding. Among the operations controlled by the company are the following: Edison Illuminating Company, of Lebanon; Schuylkill Valley Traction Company, Trenton (N. J.) Street Railway; United Traction Company, of Reading; Wilkesbarre & Wyoming Valley Traction Company, of Wilkesbarre; Dallas & Harvey's Lake Railway, of Wilkesbarre; Wilmington & Chester Traction Company, Wilmington City Electric Company, Citizens' Electric Light & Power Company, of Delaware County; Delaware County & Philadelphia Electric Railway, and several lines in the suburbs of Philadelphia.

Financing the Indianapolis & Northwestern Traction Company

Messrs. Tucker, Anthony & Co., according to the Boston News Bureau, have just concluded arrangements for the financing of the Indianapolis & Northwest Traction Company, which is organized under Indiana laws and will build a high-speed electric interurban railway between Indianapolis and Lafayette, Ind., a distance of 64 miles. The company has an authorized capitalization of $3,000,000 bonds and $3,000,000 stock, but only $2,000,000 of each class of securities will be issued at the present time. The remainder is authorized to provide for a proposed extension later on. The financing of the above has all been underwritten. The road will be equipped with 70-lb. steel rails and regular steam railway construction. It will be built on a private right of way and will be tributary to a population of about 250,000

Subway Talk in Chicago

A sub-committee of the local transportation committee of the Chicago City Council has outlined the terms on which a franchise may be granted to the Washburne-Alexander syndicate, which proposes to build a system of subways in the downtown districts of Chicago for street railway purposes. The plan suggested by the committee is that the promoters build the tunnel and the city own it. To compensate the promoters the full use of the subway is to rest with the promoters, who are to reap the benefits until such time as the city elects to buy it, or until the city's interest amounts to enough to meet the original cost of construction. There seemed to be some question in the minds of the committee as to whether the city could invest any proposed company with the right of eminent domain necessary to remove the existing obstructions in the streets. It was proposed, therefore, that instead of having the company build the tunnel the city should build it with the company's money, the title to remain with the city. Instead of a franchise granting the company the right to build and operate the subway the city would execute with the company a contract giving it entire possession, with full power to operate, and to receive and retain all profits which might be had. It was suggested that a profit of 7 per cent be allowed on the investment, and if the dividends amounted to more than 7 per cent half of all over 7 per cent and up to 10 per cent be credited to the city's account, the company, however, retaining the money. If over 10 per cent is earned two-thirds of all up to 15 per cent to be credited to the city, and over 15 per cent still larger amounts, always, however, leaving the company something as a reward for good management. As these credits accrued to the city the amounts would be deducted from the original amount of the capitalization, the balance fixing the amount the city must pay at any time it might elect to take over the possession as well as the title of the property.

Premiums at Pittsburgh

The Pittsburgh Railway Company, of Pittsburgh, Pa., distributed almost $30,000 to 2400 men Dec. 23. This is the premium money promised six months ago by the company to motormen and conductors as a reward for carefulness in avoiding accidents during the six month ended Nov. 30. About 80 per cent of the motormen and conductors participate in the premium distributions. Some 300 of the 2400 had small accident charges, which aggregated less than the amount of their premiums, and they get the difference. About eight premiums were wiped out by accident charges. The money will be paid in the form of a special check adopted for the purpose. With each check goes a premium certificate, which many of the men will treasure more than the money, as it will at all times be a recommendation for employment elsewhere should the holder need it. The payment of the premium money is practically an advance of wages of 1 cent per hour to all the men participating. This makes the third advance this year.

New Elevated Railway Trucks for Brooklyn

The Peckham Manufacturing Company, of New York, has closed a contract with the Brooklyn Rapid Transit Company for a new type of truck to be used on the new elevated equipment of that road. The order comprises trucks for 480 motor cars. They will be needed at an early date for use on the 240 old steam coaches soon to be remodeled for electric service by the railway company and for the 120 open cars recently ordered. The type of truck selected is a modification of Master Car Builders' designs, containing many features of additional strength and serviceability, controlled by patents owned by the manufacturing company, as well as others specified by the engineers of the railway. The placing of so large a single order at this time may be looked upon as practically standardizing the truck equipment of the Brooklyn elevated roads, and the Peckham company has very satisfactorily proved the merits of its high-speed trucks by securing this contract.

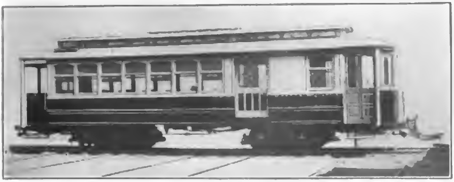
Important Legal Decision in Illinois

On Dec. 22 the Appellate Court of Illinois, in session at Freeport, rendered an important decision, holding that city councils and supervisors have power to grant street railway franchises to corporations only, and not to individuals. This decision may invalidate many existing franchises.

Semi-Convertible Cars for Tyrone, Pa.

A number of fine cars were lately placed in commission on the lines of the Tyrone Electric Railway Company, and were built by the J. G. Brill Company, of Philadelphia. The length over the end panels is 30 ft. 8 ins.; length over crown-pieces, 40 ft. 1 in.; width over sills, 8 ft., and, width, over belt rail, 8 ft. 3½ ins. The weight without motors is 30,000 lbs.

The baggage compartments, which are 10 ft. 10 ins. in length,



NEW CARS FOR TYRONE

are fitted with folding seats for smokers. The passenger compartments are seated for twenty-eight passengers. As the system of roof storage of windows does away with the necessity for wall-pockets, the panel lining is set within the posts and the seat ends brought thereto, increasing the aisle width nearly 7½ ins. Brill angle-iron bumpers, radial draw-bars, "Dedenda" gongs, and ratchet brake-handles are included in the equipment. The trucks are the No. 27-G.

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

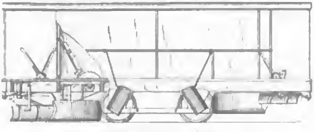
UNITED STATES PATENTS ISSUED DEC. 16, 1902

715,791. Railroad Truck; W. C. Happe, Davenport, Ia. App. filed July 14, 1902. Stub-shafts mounted in the side of the car carry wheels which run against the under side of rails suitably supported by the track structure, whereby the cars will be held against displacement when traveling at high speed.

715,906. Adjustable Brake-Shoe Head; C. F. Uebelacker, Elmira, N. Y. App. filed June 16, 1900. Relates to means for adjusting the brake-shoe so that uneven wearing thereof may be prevented.

715,975. Controller for Electric Motors; E. R. Carichoff, East Orange, N. J. App. filed Aug. 1, 1901. To give the required quick movement, the spring is compressed between each notch and suddenly released.

715,983. Trolley Wheel; L. Chroninger & J. E. Adams, Findlay, Ohio. App. filed May 21, 1902. On each side of the wheel spiral tracks are formed on cones to conduct the wire into the central groove when it becomes displaced.



PATENT NO. 716,283

715,995. Brake Beam; S. A. Crone, New York, N. Y. App. filed June 27, 1902. Comprises a beam member having on its ends the brake-shoe heads, a truss rod member engaging said heads, and a central strut adapted to receive the brake lever.

715,996. Brake Beam; S. A. Crone, New York, N. Y. App. filed Aug. 19, 1902. See preceding invention.

715,997. Brake Beam; S. A. Crone, New York, N. Y. App. filed Sept. 22, 1902. Details.

716,070. Car Fender; G. Linhard and P. Linhard, Sublett, Mo. App. filed July 28, 1902. Consists of a frame, a pair of arms extending forward therefrom, links connected to the arms, angle-levers connected to the links, side and forward buffer springs and a catch basket.

716,101. Electric Railway; W. B. Potter, Schenectady, N. Y. App. filed April 28, 1900. A plurality of sources of current, a supply circuit, a control circuit, and means brought into action through the instrumentality of said control circuit for connecting said supply circuit with any one of said sources of current.

716,113. Driving Mechanism of Motor Cars; A. Schmid, Havre, France. App. filed Jan. 28, 1902. The engine, dynamo, motors and controller are all mounted on the same vehicle.

716,125. Electric Railway; E. A. Sperry, Cleveland, Ohio. App. filed Oct. 20, 1902. A traction rail engaged by suitable spur-wheels, also serves as the "third-rail."

716,145. Trolley Catcher; A. Thode, Hamburg, Germany. App. filed Sept. 25, 1902. The trolley cord is controlled by a spring drum arrangement.

716,189. Motor Control System; F. E. Case, Schenectady, N. Y. App. filed June 3, 1901. A motor controller consisting of a group of independent elements arranged to control both the direction of rotation and the speed of one or more motors, each of said elements comprising a single set of contacts connected to the motor circuit, and means for actuating the same.

716,200. Controlling Electric Motors; M. W. Day, Schenectady, N. Y. App. filed Nov. 2, 1899. A combined magnetic and friction brake for electrically propelled devices, comprising connections for putting the motor on short circuit when the supply circuit is broken, a brake releasing coil in series with the motor, and an auxiliary brake-releasing coil in shunt to the armature.

716,244. Tramway Switch; J. W. Keefer, Voorheesville, N. Y. App. filed Aug. 30, 1902. A bed-plate, a shifting block pivoted thereon, a cross-bar adapted to engage with the shifting block, means for adjustably securing the cross-bar to the shifting block and a guide arranged along the edges of the bed-plate.

716,283. Snow Plow; M. Rounds, Roxbury, Mass. App. filed Aug. 14, 1902. A snow plow for street railways in which the wings or "shares" of the plow are adjustable to throw the snow to the right and left, or all to the right or to the left, and the scope of the plow may be increased or decreased at will.

716,294. Flexible Car Truck; C. S. Schallenberger, Milwaukee, Wis. App. filed July 14, 1902. Consist of the combination with a car truck, of springs inserted between the sides of the bolster and the frame and rollers under the bolster, so as to allow the bolster to move laterally against the tension of the springs, to thus make the truck flexible.

Consolidation in Central New York

A certificate of consolidation of the Fonda, Johnstown & Gloversville Railroad Company, the Amsterdam Street Railroad Company, and the Cayadutta Electric Railroad Company, under the title of the Fonda, Johnstown & Gloversville Railroad Company, was filed for record at Albany on Dec. 23. The capital of the company is $1,950,000, and the officers and directors are: J. L. Hees, of Fonda, president; Gustave Levor, of Gloversville, first vice-president; J. C. Ferris, of Johnstown, second vice-president; G. M. Place, of Gloversville, secretary and treasurer; S. H. Shotwell, Erastus Darling, S. B. Whitney and A. J. Zimmer, of Gloversville; G. F. Moore, of Fonda; J. G. Younglove and James Stewart, of Johnstown; R. T. McKeever, of Houghton, Mich.; J. S. Friedman, of Albany; Chauncey M. Depew, of New York city; W. M. Hardis, of Northville, directors.

Ten Hour Law for Railroad Employees

The act passed by the Rhode Island Legislature last January which limited the time of employment of motormen and conductors employed by electric railroad companies to ten hours of actual labor, performed within twelve consecutive hours, and which was the cause of the railroad strike on the Providence lines several months back, has been under discussion ever since. This legislation resulted in the partial defeat of the Republican party in Rhode Island at the last November election. The subject was

taken up at the adjourned session just ended, and the law passed last January was amended so that nothing contained in the act should prevent an employee working more than ten hours, through written contract, should he see fit to do so. This is a practical repeal of the first act in its original intents and purposes.

PERSONAL MENTION

MR. T. L. LYMAN, manager of the asbestos department of H. W. Johns-Manville Company, New York, sailed on Dec. 20 for Havana, Cuba, where he will remain two weeks for the benefit of his health.

MR. C. O. FITCH, electrician of the Cudahy Packing Company, with headquarters in Omaha, Neb., has resigned from that company, to become connected with the Hudson Valley Railway, of Glens Falls.

MR. ALBERT C. WISWALL, who has been connected with the United Traction Company, of Albany, N. Y., for some time as master mechanic, has resigned from the company, to become master mechanic of the Utica & Mohawk Valley Railway Company, of Utica, N. Y.

MR. L. W. SANBORN, who has sold to Mr. Thomas W. Peterson his interest in the People's Traction Company, of Galesburg, Ill., will retire as president of the company. Mr. E. B. Hardy, the vice-president of the company, will, according to report, succeed Mr. Sanborn temporarily.

MR. E. GONZENBACH, well known through his connection with the Aurora, Elgin & Chicago Railway and other interurban roads, will said for Europe early in the new year for the purpose of inspecting recent interurban railway installations, especially those employing the third-rail and those using alternating-current motors.

MR. JOHN S. BRACKETT has recently been appointed superintendent by the Boston & Northern Street Railway Company of its Nashua, N. H., system, which includes several lines in the city of Nashua, and one for Lowell. He was for about five years superintendent of the North Woburn Division of the Boston & Northern Street Railway.

MR. LEMUEL S. BOGGS has been appointed to the management of the Boston & Great Falls Light & Power Company and the Great Falls Street Railway Company, of Great Falls, Montana. Mr. Boggs has for some time been on the engineering staff of Sargent & Lundy, of Chicago, and his wide engineering experience fits him well for his new duties.

MR. HARNETT J. FULLER, formerly a civil and railroad engineer of England, is now located with offices in the Arcade Building in Seattle, Wash., from which headquarters he is supervising the surveys and preliminary field work of the Pierce County Improvement Company in the development of the Puyallup River electric power transmission, which is being pushed by Messrs. Stone & Webster, of Boston. Mr. D. P. Robinson, of the Seattle Electric Company, is looking after the local interests of the electrical side of the proposition.

MR. F. M. WHYTE, mechanical engineer of the New York Central & Hudson River Railroad, was elected secretary of the New York Railroad Club at a recent meeting of the executive committee. The selection of Mr. Whyte to fill the vacancy made by the resignation of Secretary W. B. Yereance, has placed the affairs of the club in the hands of one who has not only had a large experience in the work as former secretary of the Western Railroad Club, of Chicago, but has a very large acquaintance with the membership. His duties as secretary of the New York Railroad Club commence at once.

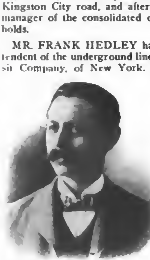
MR. H. F. SWAIN has recently been appointed engineer of way and structure of the Brooklyn Heights Railroad Company. Mr. Swain was connected with the track department of the Brooklyn system from 1893 to 1895, and later for a short time in 1897, so that he is thoroughly familiar with the requirements of his position, and has a large number of friends on the road. During the interval between 1895 and 1897 he was on the engineering staff of the Hazelton Boiler Company, and since 1897 he has been with the Metropolitan Street Railway Company, of New York, where he has superintended much of the new construction recently completed, including the Ninth Avenue line and some of the crosstown lines.

MR. E. C. NOE has just been appointed general superintendent of the Northwestern and Lake Street Elevated Railways, of Chicago, to succeed Mr. Frank Hedley, who has resigned to become connected with the Interborough Railway Company of New York. Mr. Noe has had an extended electrical experience. He began his electrical career with the Chicago Edison Company in 1881, and has been connected with the Edison and General Electric companies ever since. At present he is chief engineer of the Chicago office of the latter company, which position he has occupied for several years past. He is familiar with the elevated properties, and has a high reputation in Chicago. The selection was made quickly after the announcement of Mr. Hedley's resignation.

MR. C. GORDON REEL, general manager of the Kingston Consolidated Railroad Company, has been intimately connected with that property for a number of years, and it is largely owing to his efforts and ability that the railway situation in Kingston is as satisfactory as described in the article appearing elsewhere in this issue. Mr. Reel was graduated in 1893 as a civil engineer from the five-year course at Washington University. In 1895 he built the St. Louis & Meremac Highlands Railroad, and afterwards became chief engineer of the Lindell Railway, of St. Louis, the nucleus of the present St. Louis Transit Company. In 1897 he was made engineer and superintendent of the Colonial City Traction Company, of Kingston, and remained in that position for two years, during which time the bitter litigation between the then separate street railway system of the city was at its height. Leaving Kingston, Mr. Reel became connected with other municipal engineering work, and in 1900 he associated himself as principal assistant to Mr. Charles H. Ledlie, of St. Louis, and devoted himself to consulting engineering until 1901. Last year he was made vice-president of the Kingston City road, and after the consolidation became general manager of the consolidated companies, which position he now holds.


C. GORDON REEL

MR. FRANK HEDLEY has been appointed general superintendent of the underground lines of the Interborough Rapid Transit Company, of New York. This is the company which will operate the new rapid transit subway now under construction. For about ten years past Mr. Hedley has been making a fine record as superintendent of elevated roads in Chicago. When he first came to Chicago, in 1893, it was to start the operation of the Lake Street Elevated Railroad, as superintendent of motive power and transportation. He had full charge of the construction of the cars and locomotives, and operation of the road. In 1894 and 1895 the construction of the Northwestern Elevated Railroad and the Union Loop was begun, and during all the construction Mr. Hedley was on the consulting engineering staff, in addition to his duties as superintendent of the Lake Street Elevated. He has, since their completion, acted as general superintendent of their operation.


FRANK HEDLEY

Mr. Hedley comes from a family of English engineers, prominently connected with the steam railroad and locomotive engineering. His granduncle, William Hedley, was the designer and builder of the first locomotive traction engine ever constructed, the model of which was exhibited in Chicago at the Columbian Exposition in 1893. This model is now in the Metropolitan Museum in Chicago.

Mr. Hedley learned the mechanical engineering profession in England, coming to this country in 1882, and engaging with the Erie Railroad at its Jersey City shops, as a machinist. Later he was machinist and general inspector of the Third Avenue division of the Manhattan Elevated, from which he was promoted to the position of the assistant general foreman in the locomotive department. He remained with the Manhattan Elevated for 5½ years, which company he left to become master mechanic for the Kings County Elevated Railroad in Brooklyn, where he remained 3½ years, before going to Chicago.

Mr. Hedley is not only a broad-minded transportation engineer, but a first-class operating superintendent as well, as can be easily judged from the fact that he has been chosen to fill one of the most important positions the local transportation world has to offer to-day.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Dec. 24, 1902.

The money market has grown decidedly easier in all quarters during the past week. Call money, which loaned as high as 12 per cent ten days ago, is now freely supplied at 6 and under. Time money for sixty and ninety-day contracts, which command at one time 7½ per cent, is now offered at 6. This sudden loosening of the market stringency reflects not so much actual relief to bank reserves as confidence that relief is immediately in sight. The surplus reserve continued its decline even in last Saturday's statement, but in the opinion of all competent observers the low point of the season has probably been reached and the corner has been turned. This view is based chiefly upon the two most important recent developments in the market, one being the increasing return movement of funds from the harvest sections, the other being the diminished absorption of money by the Sub-Treasury. Following the normal course of events the return of crop-moving currency may be expected to continue from now on up to the end of February. January is always a period of heavy government expenditures, and consequently the more favorable turn in the bank exchanges with the Treasury which has been noticed during the past fortnight is not likely to be only a temporary incident. Meanwhile sterling exchange, which, during the early part of the month, hung steadily around the gold-shipping level, has dropped off a full cent in the pound, thus rendering gold exports out of the question, for the time being at least. These various evidences of improvement in the money situation, combined with the extensive liquidation which has gone on among loans upon speculative collateral, are the obvious reasons for the decline in money rates. The chances seem to favor a continuance of the recent relaxation, with possibly easier terms for borrowers, such as is usually witnessed after the first of the new year.

The Stock Market

The recovery which set in a week ago on the Stock Exchange has made further progress, though with greater display of irregularity during the last few days. In part the suspension of activity is due to the holidays, in part to the tighter money, expected over the first of the year, and in part to the belief that some reaction is in order after the very sharp rally which prices have enjoyed from their low points of last Monday week. This expectation has been partially realized during the last day or two, but not to the extent that many people looked for. Consequently the trading element is hesitating whether to think that the immediate course of the market will be lower, or whether to feel that the decline has gone far enough already to put conditions in shape for a further advance. Meanwhile there is no disposition to sell on the part of the more solid class of security holders, which indicates that their attitude is one of hopefulness for the future. The Venezuelan episode has ceased to trouble the market. Reports of earnings for the December quarter, and the semi-annual period are not as encouraging as they might be, the Vanderbilt roads in particular showing that operating expenses have been increasing a good deal faster than gross receipts. But on the other hand the gross earnings reported from week to week at the present time are making an improved exhibit.

The local traction stocks have been favorites of the trading, especially during the last day or two. Insiders and their friends have bought Brooklyn Rapid Transit freely on the remarkably good earnings statements which are now coming to hand. Manhattan and Metropolitan have done little on their own hook, but have merely sympathized with the rise in Brooklyn.

Chicago

All the leading Chicago issues have responded quickly to the general upward tendency in the speculative markets. South Side Elevated, which has held better than anything else during the recent depression, sold early in the week at 108, but the next sale was 109¼, with the dividend off. City Railway has also been notably strong at 208. Officials of the company claim that earnings since last September have shown up at the rate of 18 per cent on the share capital. Union Traction has been quiet but firmer, with some vague intimations that something important concerning the financing of the company's affairs will be made known after the first of January. The common is selling at 14, against 13 a week ago, while the preferred has changed hands in small blocks between 45 and 45½. The recovery carried Metropolitan common back from 34 to 35¾, and the preferred from 85 to 85½. Lake Street, after selling as low as 8, rallied to 8⅞. No attempt will be made, according to good authority, to reorganize the company, at least yet awhile.

Philadelphia

The Philadelphia market for street railway shares has enjoyed a sharp recovery during the week, in common with the markets elsewhere. American Railways, which went as low as 50 during the break, rallied to 53 on sales of a few hundred shares. Philadelphia Traction was dealt in between 97½ and 98, and Union Traction between 45 and 46. In both these stocks the dealings were fairly large. Philadelphia Rapid Transit was comparatively dull but strong, rallying two points or more to 16¾. Consolidated Traction of New Jersey moved up from 67 to 69, reacting later to 68. A hundred shares of Railways General sold at 4, and 200 Reading Traction at 30. There was little or no news or developments of a particular nature. All the stocks mentioned were merely reflecting general market conditions.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid Dec. 16	Closing Bid Dec. 23
American Railways Company	51¾	51¾
Aurora, Elgin & Chicago	39	37
Boston Elevated	150	154½
Brooklyn R. T.	61⅝	65⅝
Chicago City	208	208
Chicago Union Tr. (common)	13	14½
Chicago Union Tr. (preferred)	45	44
Cleveland Electric	86¼	84¾
Columbus (common)	60	60
Columbus (preferred)	106½	106½
Consolidated Traction of N. J.	68	68½
Consolidated Traction of N. J. 5s	107¾	107
Detroit United	86½	84
Electric People's Traction (Philadelphia) 4s	98¾	—
Elgin, Aurora & Southern	53	48
Indianapolis Street Railway 4s	86¾	85½
Lake Shore Electric	13¾	13½
Lake Street Elevated	8¾	8½
Manhattan Railway	143¼	145⅝
Massachusetts Elec. Cos. (common)	34	35½
Massachusetts Elec. Cos. (preferred)	94	94
Metropolitan Elevated, Chicago (common)	35⅝	35
Metropolitan Elevated, Chicago (preferred)	85	84½
Metropolitan Street	126¾	129
New Orleans Railways (common)	13½	—
New Orleans Railways (preferred)	44½	46
North American	111¾	114
Northern Ohio Traction (common)	—	a67¾
Northern Ohio Traction (preferred)	—	a98
North Jersey	30¾	29½
Northwestern Elevated, Chicago (common)	—	—
Philadelphia Rapid Transit	15	16½
Philadelphia Traction	97	97½
St. Louis Transit (common)	27½	26¼
South Side Elevated (Chicago)	109	109¼
Syracuse Rapid Transit	32	31¾
Syracuse Rapid Transit (preferred)	79	76
Third Avenue	125	124
Toledo Railway & Light	35	a35
Twin City, Minneapolis (common)	114	115¾
United Railways, St. Louis (preferred)	82	80½
United Railways, St. Louis, 4s	84½	—
Union Traction (Philadelphia)	45¼	45⅞
Western Ohio Receipts	26	23

a Asked. b Last sale.

Other Traction Securities

In Boston the week has been dull and devoid of feature, but prices have moved back in sympathy with the general market. Boston Elevated recovered five points from the lowest to 154½, Massachusetts Electric rose two points to 35½, the preferred selling ex-dividend, went up to 93½, West End common sold at 94¾ and the preferred ex-dividend at 112. In all these stocks the lots actually changing hands were extremely small. There has been some improvement also in Baltimore during the week. United Railways incomes rallied to 66¼ from 65¼, the recent low point, the stock recovered from 13 to 13¾, and the general 4s from 94 to 94¾. Nashville Railway shares were active at 4½, and sales

of North Baltimore Traction 5s were reported at 110¼. These comprised all the week's business in the traction specialties. On the New York curb some activity was manifested in New Orleans 4½s at an advance to 79, and in United Railways of St. Louis 4s, which sold up from 81. to 84¾. Otherwise business was poor, the only sales reported being New Orleans common, from 13 to 14, the preferred at 45, St. Louis Transit at 26½, and Interborough Rapid Transit 40 per cent paid stock at 107 and 106½. While bank stocks have been quite active on the Cleveland Exchange during the last week, and money seems to be easier, there is little or no interest in tractions, and prices continue to show fractional declines. Lake Shore Electric preferred sold at 57 and the common for 14 in small lots; later a small lot of the latter sold at 13. A number of small sales of Northern Ohio Traction preferred receipts took place at 95¼ to 95½, and the common receipts were held at 70. A small lot of Springfield & Xenia sold at 17½, and a small lot of Western Ohio receipts at 26, both close to low marks. Monday the Northern Ohio preferred receipts dropped to 92½ for small lots.

MACON, GA.—The Macon Railway & Light Company has executed a mortgage for $1,000,000 on all its properties to the North American Trust Company, of New York, as trustee, to secure an issue of fifty-year 5 per cent gold bonds.

CHICAGO, ILL.—New York and Chicago capitalists have joined forces to launch one of the largest traction ventures this city has known, according to *The Daily News*. The scheme is for an underground railroad, combined with a new elevated road, the cost of the entire project to be from $51,000,000 to $56,000,000. The plan includes the construction of a tunnel under the down-town streets, making a loop of the business section and connecting with a new elevated road, which it is proposed to construct parallel with the existing South Side line. The elevated road is to be reached by means of an incline. The scheme is designed largely to benefit the stock-yards district. The Interborough Rapid Transit Company of New York is said to be at the head of the scheme. Eight New York men are interested, it is said, while only six Chicagoans have so far been mentioned in the deal. It is reported that, until it was learned that Mayor Harrison did not approve of the plan, it was intended to introduce the petition in the Council before the spring elections, but when Mayor Harrison's opposition became known, it was decided to wait for the election of his successor

CHICAGO, ILL.—The directors of North Chicago Street Railroad have declared the regular quarterly dividend of 3 per cent, payable Jan. 15.

CHICAGO, ILL.—A "spread" story of one of the local daily papers says that a new move by the street railway companies of Chicago to avoid the renewal of their franchises and to overcome the twenty-year limitation is reported to be on foot. The proposition is said to bring about a gigantic merger of all the street railway lines of the city by lease or otherwise, and operate them under the protecting privileges of the Chicago General Railways Company's charter, which still has forty years to run.

CHICAGO, ILL.—It is announced that the remaining $300,000 of the preferred stock and $1,200,000 of the common stock of the Aurora, Elgin & Chicago Railway will be delivered to receipt holders in the near future. The original agreement provided that the stock should not be delivered until the road was in full operation, but a number of the stockholders are desirous of securing their stock at once. It is probable that the $3,000,000 of bonds in the hands of the Western Reserve Trust Company, as trustees, will be syndicated and sold in a lump, instead of being delivered to the original receipt holders.

NEW ALBANY, IND.—The Jeffersonville, New Albany & Sellersburg Rapid Transit Company has filed for record a deed transferring its property and rights to the Southern Indiana Interurban Railway Company.

COUNCIL BLUFFS, IA.—The entire street railway system of the Omaha & Council Bluffs Railway & Bridge Company, with its Lake Manawa property, has been leased for twenty-five years to the Omaha Street Railway Company, which was recently purchased by the Seligmans, of New York. Both properties are to be consolidated under the name of the Omaha & Council Bluffs Street Railway Company on Jan. 1. The consolidated company is capitalized at about $6,000,000. The capital of the Omaha, Council Bluffs Railway & Bridge Company is $1,500,000. It is stated that Frank Murphy, president of the Omaha Street Railway Company, is to be president of the new corporation, and that W. B. Tarkington, general manager of the Omaha & Council Bluffs Railway & Bridge Company, will be retained by the new company to take charge of its Council Bluffs and Manawa properties. The power house and car houses, located in Council Bluffs will no doubt be used in operating the new system.

LOUISVILLE, KY.—The stockholders of the Louisville, Anchorage & Pewee Valley Electric Railway Company have voted to increase the capital stock of the company from $350,000 to $1,200,000. It is said that a large issue of bonds is to be placed.

BOSTON, MASS.—The trustees of the Boston Suburban Electric Street Railway Companies have declared the quarterly dividend of $1 per share, payable Jan. 15, to stockholders of record Dec. 31.

MINNEAPOLIS, MINN.—Twin City Rapid Transit Company has declared the quarterly dividend, 1¾ per cent, on preferred stock, payable Jan. 2.

MINNEAPOLIS, MINN.—The local papers say that the Twin City Rapid Transit Company has in contemplation the purchase of the railway operated by the Minneapolis Land & Investment Company between Minneapolis and Hopkins, 4 miles distant.

NEW YORK, N. Y.—It is reported that a deal is on for the purchase or lease of the property of the New York & Queens County Electric Railway Company by the Interborough Rapid Transit Company.

ROCHESTER, N. Y.—The Rochester Railway Company has declared the regular quarterly dividend of 1¼ per cent on preferred stock, payable Jan. 1 to stock of record Dec. 20.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

November	1902	1901
Gross earnings	$1,057,665	$996,850
Operating expenses	602,529	661,248
Net earnings	$455,136	$335,602
From July 1 to Nov. 30		
Gross earnings	$5,783,616	$5,498,520
Operating expenses	3,494,532	3,762,359
Net earnings	$2,289,084	$1,736,161

CINCINNATI, OHIO.—The regular quarterly dividend at the rate of 5½ per cent per annum has been declared by the Cincinnati Street Railway Company.

CLEVELAND, OHIO.—The Cleveland City Railway Company has filed a motion to dismiss the injunction against the company secured some time ago by Frank DeHass Robinson, preventing the officials from issuing new stock. The company desires to issue $1,000,000 worth of stock to cover recent improvements. The company maintains that Robinson's claims have been settled.

CLEVELAND, OHIO.—For the first time since President Andrews took charge of the Cleveland Electric Railway Company has an inkling been given as to the earnings of the company. It is stated that for November the receipts were $211,993, a gain of $25,552 over the same month last year. For eleven months the receipts were $2,284,335, as against $2,077,012 for the previous eleven months, an average gain of $10,000 a month.

CLEVELAND, OHIO.—The directors of the Cleveland, Elyria & Western Railway Company and the Cleveland & Southern Company have ratified the consolidation of the properties as the Cleveland & Southwestern Traction Company. The matter will be ratified by the stockholders of both companies at meetings to be held Jan. 15. The new company will also absorb the Norwalk Gas & Electric Light Company.

BATTLE CREEK, MICH.—Spitzer & Company, bankers, of Toledo and New York, who have acquired the control of the Jackson & Battle Creek Traction Company, advise us that the construction of this railway is largely completed and that the line will be in operation by Feb. 1. The company has a capital stock of $1,500,000 and a bond issue of $1,200,000; 200,000 of the bonds are to be put up with the trustee, the Savings & Trust Company, of Cleveland, Ohio, and to be issued only upon a majority vote of the stockholders and a majority vote of the directors, for future extensions or improvements. The securities have been underwritten by the owners of the property. The statement that some of the securities would be put on the market, made in a recent issue of this paper, was erroneous. The system is operated by means of the third rail, and the company owns a private right of way. The track is laid with 70-lb. steel rail and No. 1 ties, laid 2-ft. centers. The construction throughout is substantial, the same as a steam railroad.

TOLEDO, OHIO.—The Toledo & Maumee Valley Railway Company and the Toledo, Waterville & Southern Company have consolidated as the Maumee Valley Railways & Light Company. The roads have been operated as one for some time. The capital stock of the new company is $1,000,000, and bonds to the same amount will be issued. The stockholders of the Toledo & Maumee Company will receive $900,000, or three shares of new stock for one of old, and those of the Toledo, Waterville & Southern Company will receive $100,000, or four shares of new stock for one of old. The officers of the new company are: R. H. Baker, president; E. J. Rechtel, vice-president; William H. McLellan, secretary; Charles T. Munz, treasurer. The property is owned by the Everett-Moore syndicate, and is operated by the same management as the Toledo Railways & Light Company. It is understood that the company is going into the electric lighting business with a view to supplying power for lighting Maumee, Perrysburg, Waterville and other towns in the valley.

ALLENTOWN, PA.—The first consolidated mortgage of the Allentown & Kutztown Traction Company to the Integrity Title & Sale Deposit Company, of Pennsylvania, for $750,000 has been filed for record. The mortgage is given to secure an issue of $750,000 bonds bearing interest at the rate of 6 per cent. The right to cancel the bonds after 1917 is reserved.

LEECHBURG, PA.—The agreement of merger of the Apollo, Vandergrift & Leechburg Electric Street Railway Company, and the Vandergrift & New Kensington, forming the Pittsburgh & Allegheny Valley Railway Company. The capital stock of the company is $1,500,000. The directors of the company are, John S. Cochrane, S. M. Nelson, of Apollo; J. D. Orr, Edward Hill, J. B. Kiler, John P. Kliogensmith, Leechburg; S. B. Cochrane, Kittanning.

PHILADELPHIA, PA.—The directors of the Philadelphia Company have declared a regular quarterly dividend of 1½ per cent on the common stock, payable Feb. 2 to stockholders of record Jan. 2.